Republic of Uzbekistan
JSC Thermal Power Plants

The Project for Establishment of the Combined Cycle Gas Turbine (CCGT) Operation and Maintenance Training Center Project Completion Report

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Japan International Cooperation Agency (JICA)

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Power Engineering and Training Services, Inc.

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Location of the Project Site

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Abbreviations

Initial	Abbreviation	English / Russian etc.	Remarks
A	AC	Alternate Current	
	ACK	Acknowledgement	DWG. No.D4-J2046
	ACS	Accessory Station	DWG. No.D4-J2045
	ADB	Asian Development Bank	
	AI	Analog Input	
	ALR	Automatic Load Regulator	
	ANN	Annunciator	
	AO	Analog Output	
	APC	Automatic Plant Control	
	APR	Automatic Plant Regulator	
	APS	Automatic Plant Start-up/Shut-down	
	AUX	Auxiliary	
	AVR	Automatic Voltage Regulator	
B	BFP	Boiler Feed Water Pump	
	BOP	Balance of Plant	DWG. No. D4-J2050
	BP	Break Point	Synchronize
	B/T	Boiler / Turbine	
C	CB	Circuit Breaker	CB
	C/C	Combined Cycle	C/C
	CCGT	Combined Cycle Gas Turbine	
	CCPP	Combined Cycle Power Plant	
	CCR	Central Control Room	CCR
	CCTV	Closed Circuit Television	CCTV
	CDB	China Development Bank	
	CHPP /CHP	Combined Heat and Power Plant	
	CI	Combustor Inspection	
	C&I	Control & Instrumentation (Engineering)	
	CIRC	Circulating	
	CN	Connector	DWG. No.D4-J2046
	C/N	Confirmation Note	
	CP	Condensate Pump	
		Circuit Protector	DWG. No. D3-J0038
		Counterpart	
	CPFM	Combustion Pressure Fluctuation Monitoring System	
	CPU	Computer	
	CR	Cold Reheat	
	CRT	Cathode Ray Tube	
	CSO	Control Signal Output	
	CV	Control Valve	
	CWP	Circulating Water Pump	
D	DB	Data Base	
	DC	Direct Current	
	DCS	Distributed Control System	
	DE	Drive End	
	DEA	Deaerator	
	DI Interface Module	Digital Input Interface Module	DWG. No. D4-J2046

	DI Circuit	Digital Input Circuit	DWG. No.D4-J2046
	DIFF	Difference	
	DIU	Digital Input Unit	
	DLN	Dry Low NOx	
	DO Circuit	Digital Output Circuit	DWG. No.D4-J2046
	DOR	Division of Responsibility	
	DSCP	Differentiated Service Code Point	DWG. No.D4-J2046
E	ECO	Economizer	ECO TUBU
	EM	Empirical Model Derived from well-established empirical correlation	DWG. No.D4-J2051
	EMS	Engineering & Maintenance Station	DWG. No.D4-J2045
	EMSACS	Engineering & Maintenance Station Accessory Station	Instructor PC
	EOH	Equivalent Operating Hours	
	EPC	Engineering, Procurement and Construction	
	EXH	Exhaust	
	EVA	Evaporator	EVA TUBE
F	FAT	Factory (Witness) Test	DWG. No.D4-J2054
	FCB	Fast Cut Bac	
	FCC	Federal Communications Commission	DWG. No.D4-J2046
	FCV	Flow Control Valve	
	FG	Fuel Gas	
	FG	Frame Ground	DWG. No. D3-J0038
	FGH	Fuel Gas Heater	FGH TUBE
	FW	Feed water	
G	GBCS	Gas Boosting Compressor Station	
	GCP	Generator Control Panel	GCP
	GE	General Electric	
	GEMS	General Equipment Maintenance Service	
	GEN	Generator	GEN
	GES	Hydro Power Plant	
	GINV	Relay Indication G : Generator Protection INV : Inverse Time	46GINV Relay
	GJP	Ground configuration Jumper Switch	DWG. No.D4-J2046
	GMCB	Generator Main Circuit Breaker	GMCB
	GRES	State Regional Power Plant	
	GT (ГТ)	Gas Turbine (Газовая Турбина)	
	GTCC	Gas Turbine Combined Cycle	DWG. No.D4-J2045
	GTS (ГТС)	Gas Turbine Facility	
	GW (ГВ)	Giga Watt	1,000,000kW
	GWh	Giga Watt Hour	1,000,000kWh
H	HDD	Hard Desk Drive	
	HDR	Header	GAS Header
	HMI	Human Machine Interface	
	HP	High Pressure	
	HPCV	High Pressure Control Valve	
	HRSG	Heat Recovery Steam Generator	

	HW	Hardware Wizard	DWG. No.D4-J2046
I	IC	Initial Conditions	DWG. No. D4-J2047
	I&C	Instrumentation & Control	
	ICV	Intercept Valves (ST)	DWG. No. D3-J0038
	IGV	Inlet Guide Vane (GT)	
	INITEC	INITEC Energia S.A.	
	IO Interface Mode	IO Interface Mode	DWG. No. D4-J2046
	IOPS	Instructor Operation Station	
	IP	Intermediate Pressure	IP
	IPB	Isolated Phase Bu	IPB
	ISO	Isolation Operator Station	ISO
J	JCC	Joint Coordinating Committee	
	JET	JICA Expert Team	
	JICA	Japan International Cooperation Agency	
	JSC	Joint Stock Company	
	JSC (ORGRES)	(ОАО Фирма ОРГРЭС)	
K	KVM	Key board Video Machine	
L	LACP	Link Aggregation Control Protocol	DWG. No.D4-J2046
	LAG	Link Aggregation Group	DWG. No.D4-J2045
	LAN	Local Area Network	DWG. No.D4-J2046
	LCD	Liquid Cell Display	LCD Monitor or TV
	LCV	Level Control Valve	Drum LCV
	LED	Light-Emitting Diode	DWG. No.D4-J2046
	LLC	Limited Liability Company	
	LP	Low Pressure	
	LPCV	Low Pressure Control Valve	
	LPSV	Low Pressure Stop Valve	
	LTSA	Long Term Service Agreement	
	LTPA	Long Term Parts Agreement	
	LTPM	Long Term Parts Management	
	LVDT	Linear Variable Differential Transducer	
M	M/C	Metal Clad	M/C Bus
	MCC	Motor Control Center	
	MCB	MAIN Circuit Breaker	DWG. No. D3-J0038
	MF/RF	Malfunction / Remote Function	DWG. No. D4-J2047
	MG	Relay Indication M:Main Transformer protection G:Gas turbine generator	86MG(A/B)
	M/M	Minutes of Meeting	
	MHPS	Mitsubishi Hitachi Power Systems, Ltd.	
	MI	Major overhaul Inspection	
	MOP	Main lube Oil Pump	
	MP	Middle Pressure	
	MSV	Main Stop Valve	
	MPS	Multiple Process Station	DWG. No.D4-J2045
	MV	Middle Voltage	MV SWG
	MW	Mega Watt	1000kW
N	NDA	Non Disclosure Agreement	

	NDE	Non Drive End	
	NDT	Non Destructive Test	
	NEDO	New Energy and Industrial Technology Development Organization	
	NGR	Neutral Grounding Resistor	
	NTC	Navoi Training Center	
	NTPP	Navoi Thermal Power Plant	
O	Off-JT	Off-the-Job Training	
	OJT	On-the-Job Training	
	OMM	Operation and Maintenace Manual	
	OTKC	Tariff and Qualification Handbook of Power and Energy sector	
	O&M	Operation and Maintenance	
	OPS	Operator Station	DWG. No.D4-J2045
	ORCA	Object Relation Control Architecture(Object Database)	DWG. No. DUM-OBE02
	OST	Over Speed Trip	
	OTS	Operation Training Simulator	DWG. No.D4-J2045
P	PB	Push Button Switch	DWG. No. D3-J0038
	PC	Personal Computer	DWG. No. D3-J0038
	Pch	P channel	DWG. No.D4-J2045
	PCM	Project Cycle Management	
	PD	Project Director	
	PDCA Cycle	Plan-Do-Check-Action Cycle	
	PDM	Project Design Matrix	
	PE	Protection Earth	DWG. No. D3-J0038
	PET	Power Engineering and Training Services, Incorporated	
	pH	Potential of hydrogen	
	PI	Periodic Inspection	
	PIU	Project Implementation Unit	
	PLC	Programmable Logic Controller	
	PM	Physical Model Derived from conservation equations	DWG. No.D4-J2051
	P.O.	Purchase Order	
	PO	Plan of Operations	
	P/S	Power Station	
	PVID	Port VLAN ID	DWG. No.D4-J2046
Q	Qch	Q channel	DWG. No.D4-J2045
	QoS	Quality of Service	Link Aggregation
R	RBOT	Rotating Bomb Oxidation Test	
	R/D	Record of Discussions	
	RH	Reheat / Re-heater	
	RSTIN	External Reset Input	DWG. No.D4-J2046
	RSTOUT	Reset Signal Output	DWG. No.D4-J2046
	RSW	Rotary Switch	DWG. No.D4-J2046
	RTS	Ready to Start	
S	SA	Surge Arrestor	
	SAT	Site Acceptance Test	
	SCADA	Supervisory Control And Data Acquisition	
	SFC	Static Frequency Converter/Controller	

	SH	Super Heater	
	SJSC	State Joint Stock Company	
	SM	Simplified Model Provides graphical or logical feedback based on status of appropriate equipment	DWG. No. D4-J2051
	ST(ПТ)	Steam Turbine	
	STB	Strobe	DWG. No. D4-J2046
	STG	Steam Turbine Generator	DWG. No.D4-J2050
	SV	Stop Valve (ST)	
	SWGR	Switch Gear	
T	TA	Technical Adviser	
	TB	Turbine Bypass (ST)	Graphic
	TB[External]	Terminal Block[External]	DWG. No. D3-J0038
	TBM	Tool Box Meeting	
	TCA	Turbine Cooling Air (GT)	Graphic
	TCS	Turbine Control System	
	TE	Relay Indication T : Transformer E : Excitation	87TE Relay
	TI	Turbine Inspection	
	TME (TMO)	Thermal-Mechanical Equipment (ТеплоМеханического Оборудования)	
	TOT	Training of Trainers/ Teachers	
	TP	Thermal Power Plants	
	TS	Relay Indication T:Turbine protection S:Steam turbine generator	86TSA/TSB
	TTC	Tashkent Training Center	
	TX	Terminal Block[Internal]	DWG. No. D3-J0038
U	UE	JSC Uzbekenergo	
	UE HQ	Uzbekenergo Headquarters	
	UPS	Uninterruptible Power Supply	
	USB	Universal Serial Bus	
	USD	United State Dollar	
	UZ	Republic of Uzbekistan	
V	VLAN	Virtual LAN	Instructor P
	VM	Visual Model Status values displayed on DCS screen	
	VNC	Virtual Network Connection	Instructor PC
	VT	Voltage Transformer	
W	WB	World Bank	
	WIS	Welfare Improvement Strategy	
	WRR	Weighted Round-Robin	DWG. No.D4-J2046
	WS	Work Shop	
	WSM	Work Space Manager	DWG.No.DUM-OBE01
X	(XTM)	Staff Training Center	

Chapter 1

1. Project Outlines

1.1 Project Background

With approximately 33,200,000 people, the Republic of Uzbekistan (hereinafter referred to as "Uzbekistan") has the largest population of any country in Central Asia. In recent years, the country has maintained steady economic growth due to government-oriented development and increased exportation of natural resources such as natural gas, gold, and raw cotton; furthermore, the effects of continual public investments have helped the local economy as well. On the other hand, in maintaining its high economic development, the 10 thermal power plants (TPP) which were built in former Soviet Republic are decrepit and only capable of a power supply capacity of no more than 7,800 MW, despite having their rated electrical power plant capacity of 13,409 MW. They are incapable of supplying the maximum power demand of approximately 8,400 MW (all data are as of 2014). Up to 2017, about 1 GW or more has been increased as a new Combined Cycle, but it is also necessary to dispose of aged power generation equipment and it is presumed that the supply and demand balance is still tight.

Moreover, the average thermal efficiency of those plants is as low as approximately 30%. This is also one of the causes of increased environmental load as the level of CO2 emission / GDP is very high in Uzbekistan (1st in 2009 and 5th in 2010 according to World Development Indicators by the World Bank). It is urgently necessary to renew the outdated power facilities and install high efficiency TPP to meet the growing power demand and reduce CO2 emissions.

Considering these, Japanese government will not only support the resolution of the problem in Uzbekistan through the Japanese ODA loans, but also to improve the business environment and bilateral relationship. It is also expected to contribute the further development of economic relation including to secure resources for Japan.

The Government of Uzbekistan formulated the Law on Electric-Power Industry in 2009, in which it decided the basic structure of its power sector and its direction of development. Moreover, the government's priorities, which include the optimization of fuel and electricity use, were made clear. Also in "Welfare Improvement Strategy II" (goal period 2012-2015), as Uzbekistan's National Development Plan, it aims for the modernization of the generation ability as well as the enhancement of credibility in electric power supply through expansion, including installation of Combined Cycle Power Plants (CCPP). Already the Navoi CCPP-1 unit, which was built with domestic funds, has been introduced as the first CCPP. In the Talimarjan TPP Expansion Project, the Navoi TPP Modernization Project, as well as the Turakurgan TPP Construction Project, which are all supported by Japanese ODA loans, five Agreement are implemented now for installing CCPP. Including these five, the Government of Uzbekistan was planning to install around 20 CCPP by 2016.

However, the Joint-Stock Company Uzbekenergo (UE), which is a Public Corporation, is short of experience in running and maintaining CCPP. At Navoi CCPP-1 unit, an output reduction that was thought to be caused by lack of component replacements and inspections has occurred. Mitsubishi Hitachi Power Systems (MHPS), which is the manufacturer of the main engine, has had to assist in order to restore the

situation. So there is an urgent need to increase the ability to run and maintain the CCPP. Although UE does have in-house training at Tashkent Training Center (TTC), which does not have a training program for CCPP. This situation resulted into formulation of the Technical Cooperation Project.

1.2 Project Details

Since 2011, JICA has held Country-Focused Training called "Thermal Power (Gas Turbine) Maintenance Training" in order to improve the ability of Maintenance staff of CCPP. Under this situation, in 2013, the Government of Uzbekistan formally requested that the Government of Japan implement a Technical Cooperation Project to increase the ability of the training centers owned by the Government of Uzbekistan in order to establish a sufficient Operation and Maintenance (O&M) management system and ensure the engineers and technicians have the necessary level of training.

Japan's Country Assistance Policy for Uzbekistan of April 2012 states that "economic infrastructure renovation and improvement (transport and energy)" is one of the priorities. This Project is a part of the "Energy and Infrastructure Improvement Program" and is expected to cooperate and create synergies with related Japanese ODA loan programs.

Additionally, JICA carried out a detailed plan development survey in December 2014 to assess the necessity and the validity of this Project. Based on this survey, a basic agreement was made by R/D (Record Discussion) between two of the governments in 2015, and has resulted in the start of this Project.

In this Project, through providing advice on the O&M system of the CCPP owned by UE, establishing new training subjects and implementing the Training of Trainers (TOT), the needed technical level of O&M staff will be secured, thereby enabling UE to establish an appropriate O&M system.

1.3 Project Objectives

By implementing this Project based on R/D (Record of Discussion), achievement of the Project's purpose "Training system of O&M for CCPP is established" is expected. "Overall Goal", "Project Purpose", "Output", and "Activities" stated in R/D are below.

(1) Overall Goal

Capacity of O&M of CCPP is strengthened.

(2) Project Purpose

Training system of O&M for CCPP is established.

(3) Output

Output 1: Operation and Maintenance Policy of CCPP is developed

Output 2: Human resource development plan, training plan, and accreditation system of CCPP O&M are

developed
Output 3: Training curricula, materials and equipment of CCPP O&M are developed
Output 4: Instructor of CCPP O&M are trained and secured

(4) Activities
1-1 To identify the current status and issues on O&M of CCPP.
1-2 To confirm the installation plan and O&M of CCPP in Uzbekistan
1-3 To confirm the current status on internal regulation of UE related to O&M (safety control, etc.)
1-4 To propose a policy for O&M system of CCPP, including scope of service agreement with manufacturers
1-5 To support institutionalization of the policy for O&M system of CCPP

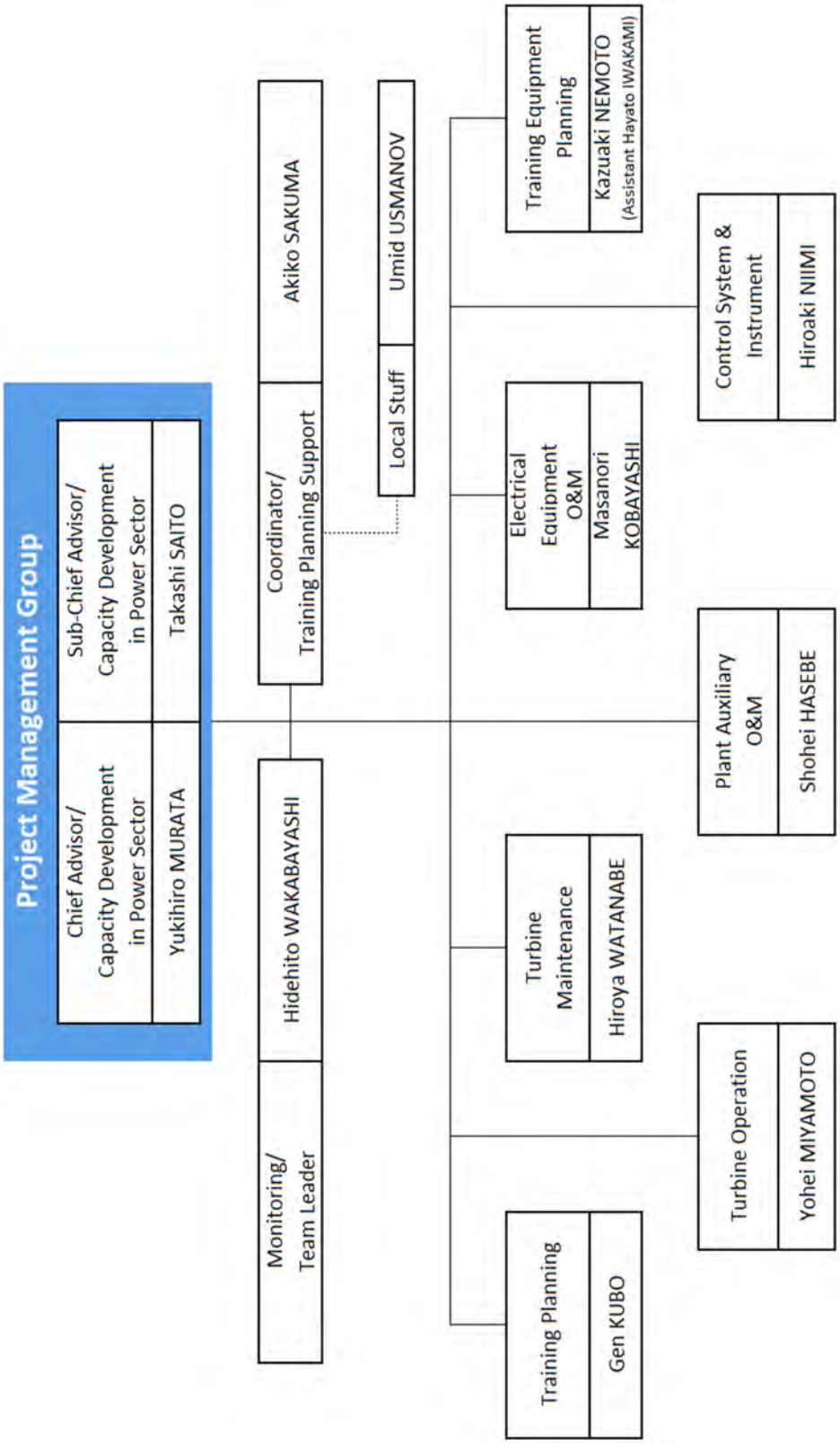
2-1 To confirm the current status and issues of human resource development plan and staff training plan and accreditation system of O&M staff
2-2 To confirm the current status and issues of training in existing training center
2-3 To understand the current status and issues on capacity of CCPP O&M staff
2-4 To plan of human resource development and staff deployment, and accreditation system of O&M staff
2-5 To implement training plan* for capacity building of O&M of CCPP
2-6 To implement trainings of O&M of CCPP in the training center
2-7 To implement monitoring and evaluation system for training of O&M of CCPP

3-1 To develop curricula and training materials for CCPP O&M training.
3-2 To try out curricula and training material developed through training
3-3 To make an installation plan of necessary training equipment for O&M of CCPP
3-4 To install necessary training equipment for O&M of CCPP3-5 To advice for improvement of training facilities by UE.
3-5 To advise to renovation and construction of training Center and its facilities

4-1 To cultivate trainers through activity No.3-1 and No.3-2
4-2 To train necessary trainers through training in Uzbekistan and Japan
4-3 To train necessary trainers through training in Uzbekistan and Japan
4-4 To establish accreditation system of trainers

1.4 Project Implementation System

JICA Expert team (JET) operates project activities according to the organization shown in the following Figure 1.4-1, and activity responsibilities of each member are shown in Table 1.4-1.



(Source JET)

Figure 1.4-1 Organization Chart of JICA Expert Team

Table 1.4-1 Activity responsibility of each member

	Position	Main Responsibility		Activities	Outputs (except submittion of report)
		Hard-side	Soft-side		
A	**Chief Advisor/ Capacity Development in Power Sector**	Education system	Qualification system for operators Oganization and system for training	- Preparation for field work, negotiation with UE - Selection of personnels for interview, securing venues for interview - Briefing on the results of domestic work and negotiation with UE - Coordination on selection of trainees for local training and establishment of the venues - Negotiation and hearing of local needs - Overall coordination on work schedule - Coordination on trainnees of TOT in Japan - Collaboration and coordination for the procurement and use of simulator installed by the Japanese ODA Yen loan	Qualification system for operators（Draft) Plan and implementation of TOT in Uzbekistan Plan and implementation of TOT in Japan Implementation of PCM training course
B	**Sub-Chief Advisor/ Capacity Development in Power Sector**	Education system	Qualification system for operators Oganization and system for training	- Preparation for field work, negotiation with UE - Selection of personnels for interview, securing venues for interview - Briefing on the results of domestic work and negotiation with UE - Coordination on selection of trainees for local training and establishment of the venues - Negotiation and hearing of local needs - Overall coordination on work schedule - Coordination on trainnees of TOT in Japan - Collaboration and coordination for the procurement and use of simulator installed by the Japanese ODA Yen loan	Qualification system for operators（Draft) Plan and implementation of TOT in Uzbekistan Plan and implementation of TOT in Japan Implementation of PCM training course
C	**Training Planning**	Training system (Layout of the training center)	**Training curriculum** **Training scheduling**	- Survey on the current training plan - Analysis on necessary capacity of CCPP trainers in UE by categorised - To draft accreditation system to appoint trainers, to gather views of the stakeholders - Integration and arrangement of training curriculum and textbooks	Training Plan - Short/mid term schedule (Draft) Plan and implementation of TOT in Japan and Uzbekistan Accrediation system for trainers（Draft) Integration of training curriculum Unification and adjustment of training equipments and textbooks
			Layout of the training **Specification and user guide for training equipments**	- Collaboration and coordination for the procurement and use of simulator installed by the Japanese ODA Yen loan - Survey on the current situation of training center and equipments - To list training equipments matching the training plan, to coordinate the stakeholders - Finalize the specification of the training equipments	Layout plan of training center based on the advice by E-I Training equipment list based on the advice by E-I
			Monitoring the effectiveness of training	- Monitoring the training of TOT of UE for CCPP O&M - Proposing the ideas for improvement on training contents	PCM training Structure of training feedback system
D	**Monitoring**	Training system (Layout of the training center)	Training curriculum Training scheduling	- Survey on the current training plan - Analysis on necessary capacity of CCPP trainers in UE by categorised - To draft accreditation system to appoint trainers, to gather views of the stakeholders - Integration and arrangement of training curriculum and textbooks	Training Plan - Short/mid term schedule (Draft) Plan and implementation of TOT in Japan and Uzbekistan Accrediation system for trainers（Draft) Integration of training curriculum Unification and adjustment of training equipments and textbooks
			Layout of the training center Guide on specification and use for equipments	- Collaboration and coordination for the procurement and use of simulator installed by the Japanese ODA Yen loan - Survey on the current situation of training center and equipments - To list training equipments matching the training plan, to coordinate the stakeholders - Finalize the specification of the training equipments	Layout plan of training center based on the advice by E-I Training equipment list based on the advice by E-I
			Monitoring effectiveness of training	- Monitoring on training for TOT of UE of CCPP O&M - Proposing the ideas for improvement on training contents	PCM training Structure of training feedback system
E	**Turbine Operation**	GT and its control system GT indoor auxiliary ST and its auxiliary and valves	CCPP O&M Operation Outline Operation Simulator Operation Simulator	- Survey on the current curriculum, textbooks and training equipments - Development of the training curriculum on trubine operation - Development of the training matirals based on the above curriculum - Implementation of training based on the above training materials - Review of the operation standard of CCPP (GT,ST) - To propose the operation standard of CCPP (GT,ST)	Training equipment list Training curriculum on GT/ST operation Training material on GT/ST operation Supervision of TOT in Japan Implementation of TOT in Uzbekistan Plan for CCPP operation regulation
F	**Turbine Maintenance**	GT and its auxiliary ST and its auxiliary	Combuster inspection outline Standard inspection outline Back up management outline	- Survey on current curriculum, textbooks and training equipments - Development of the training curriculum on trubine maintenance - Development of the training matirals based on the above curriculum - Implementation of the training based on the above training materials - Review of the maintainance standard of CCPP (GT,ST) - To propose the maintenance standard of CCPP (GT,ST)	Training equipment list Training curriculum on GT/ST maintenance Training material on GT/ST maintenance Supervision of TOT in Japan Implementation of TOT in Uzbekistan Plan for CCPP maintenance regulation
G	**Plant Auxiliary O&M**	Boiler heat exchanger Condenser Gas compressor Water supply and coolant Vacuum pomp Auxiliary steam system plan	Heat balance diagram Ground of decision for Start-and-stop curve Operation Development view	- Survey on the current curriculum, textbooks and training equipments - Development of the training curriculum on plant auxiliary - Development of the training matirals based on the above curriculum - Implementation of the training based on the above training materials - Review of O&M standard of CCPP (plant auxiliary) -To propose O&M standard of CCPP (plant auxiliary)	Training equipment list Training curriculum on plant auxiliary Training material on plant auxiliary Supervision of TOT in Japan Implementation of TOT in Uzbekistan Plan for CCPP O&M regulation
H	**Electrical Equipment O&M**	Generator and cooling system Power panel and cubicle Electric motors Electrical equipments	Power source plan Emergency power supply system Single line diagram	- Survey on the current curriculum, textbooks and training equipments - Development of the training curriculum on electrical equipment - Development of the training matirals based on the above curriculum - Implementation of the training based on the above training materials - Review of O&M standard of CCPP (electrical equipment) - To propose O&M standard of CCPP (elestical equipment)	Training equipment list Training curriculum on electrical equipment Training material electrical equipment Supervision of TOT in Japan Implementation of TOT in Uzbekistan Plan for CCPP O&M regulation
I	**Control System and Instrument**	Central control device/board Measurement hardwares for Chemicals feeding equipments /	CCPP control system Main facilities protection system outline Auxiliary operation outline Interlocking system	- Survey on the current curriculum, textbooks and equipments - Development of the training curriculum on control system and instrument - Development of the training matirals based on the above curriculum - Implementation of the training based on the above training materials - Review of O&M standard of CCPP (control system and instrument) - To propose O&M standard of CCPP (control system and instrument)	Training equipment list Training curriculum on control system and instrument Training material on control system and instrument Supervision of TOT in Japan Implementation of TOT in Uzbekistan Plan for CCPP O&M regulation
J	**Training Equipment Planning**	Layout of training center Training equipment list	Guide on specification and use machinery procurement	- Survey on the current situation of training center and equipments - To list the training equipments matching the training plan, coorination with the stakeholders - Finalize the training equipment list with specificaton - Planning an installation plan including budget of training equipment	Plan on layout of training center based on advice by E-I Equipment list based on advice by E-I
K	**Coordinator /Training Planning Support**			- Scheduling, arrangement and coordination of the the field work, local training participants of the training - Arrangement of the travel by the team - Arrangement of interpreter and translator - To place orders of contracts - Budget control - Assistance to brief the results of the domestic works in Japan and negotiation UE - Assisatant of the person in charge of monitoring	Training Curriculum Training Plan - Short/mid term schedule plan Plan and implementation of TOT in Japan and Uzbekistan PCM training course /PDM
Others	**Interpreter 1** **Interpreter 2** **Interpreter 3/4**			- Support to plan and implement TOT in Japan and Uzbekistan - Interpretation - Negotiation with C/P on behalf of the team during the domestic work in Japan	

(Source: JET)

In addition, the project site and other information are as follows.

(1) Project sites
- UE HQ, Tashkent
- Existing Tashkent Training Center (TTC)
- New Navoi Training Center (new NTC)
- Relating Thermal Power Plants (TPP), i.e. Navoi TPP etc.

(2) Counterpart (C/P)

C/P Organization is UE, which is reorganized as "JSC Thermal Power Plants in 2019. The main C/P staff will be those from the Power Plants Operation Department, Department of Work with Personnel, NTC, Navoi TPP, as well as trainer candidates from other TPP or other departments affiliated to the UE.

(3) Beneficiaries of this project (target group)
- Direct beneficiaries: Engineers and staff in charge of O&M work of existing and future CCPP.
- Indirect beneficiaries: whole C/P

(4) Duration
- First phase: September 2015 - October 2017 (the first year contract period)
- Second phase: November 2017- May 2019 (the second year contract period)

1.5 Work Flow Chart

Based on the (4) "Activities" in 1.3 "Project Objects", the work flow chart at the start of the project is shown in Appendix 1.

1.6 Overall Activities and Results

Overall Activities and Results was as Appendix 2.

1.7 Main Interviewees

The list of main interviewees (1st mission to 13th mission) is as follows.

Table 1.7-1 Main interviewees (1st mission to 13th mission)

Affiliation	Name	Title
Uzbekenergo Head Quarter (HQ)	Mr. Basidov Iskabdar Sabitovich	Former Chairman of the Board
	Mr. Ruslan Mubarakshin	First Deputy Chairman of the Board
	Mr. Djamshid Abdusalamov	Deputy Chairman of the board/ Project Manager, Former Head of Department of Foreign Economic Relations and Investment
	Mr. Shukhrat Sheraliev	Former Deputy Chairman of the Board / Former Project Manager
	Ms.Ayzada Seitniyazova	Head of Department of Foreign Economic Relations and Investment/ Acting Project Manager
Uzbekenergo HQ	Mr. Usmanov Sh.	Former Deputy Head of Department of Foreign Economic Relations and Investment
	Ms. Feruza Daniyarova	Former Deputy Head of Department of Foreign Economic Relations and Investment
	Mr. Sultonmurod Tukhtaev	Former Specialist of Department of Foreign Economic Relations and Investment
	Mr. Xalikov Zokirjon	Head of the Power Plants Operation Department
	Mr. Lutfilla Nurullayev	Former Head of Power Plants Operation Department
	Mr. Umirzakov Shodibek S.	Deputy head of Power Plants Operation Department
	Mr. Tashpulatov Botir	Head of Department of Work with Personnel
	Ms. Shamsutdinova Dilfuza Dilmuratovana	Former Head of Department of Work with Personnel
	Ms. Feruza Turgunova	Former Head of Department of Work with Personnel
	Mr. Kamoliddin Tashpulatov	Former Head of Department of Work with Personnel
	Ms. Feruza Yusupova	Former Head of Department of Work with Personnel
	Ms. Giyazova Munisa	Senior specialist of Department work with personnel
	Mr. Makhmud Turdiev	Former Project Director
Navoi TPP	Mr. Ganiev Kahramon Hudoyberdievich	Director of Navoi TPP／Project Director
	Mr. Yakubov Azim	First Deputy Director Navoi TPP
	Mr. Shukhrat Dostov	Project Implementation Unit Former Director of Navoi Training Center
	Mr. Alibek Khaitov	Head of Human Resources Department
	Mr. Ikhtiyar Abdullaev	Navoi CCPP-1 Unit Manager
	Mr. Ikromov Utkir	Deputy head of Maintenance
	Mr. Badridinov Djamshed	Deputy head of operation CCPP-1

	Mr. Tulqin Nazarov	Assistant Chief Engineer
	Ms. Botirova Rayhonoy	Engineer on Personnel Training
	Mr. Juraev Akbar	Former Engineer on Personnel Training
	Ms. Inobat Ahmedova	Staff of Human Resources Department
	Ms. Chinara Boylatova	Translator of Administration Section
Trainers Candidate (Navoi)	Mr. Musayev Alisher Baxtiyorovich	Leading Engineer CCPP-1, on Thermal Mechanical Equipment (TME)
	Mr. Khasanov Latif Barnoevich	Leading Engineer-programmer CCPP-1
	Mr. Aslonov Aslon Ma'murjonovich	Abroad to Japan by JDS under JICA Former Shift Head of CCPP-1
	Mr. Bayliev Shukhrat Tashpulatovich	Gas Turbine operator CCPP-1
	Mr. Parmonov Azimjon G'ulomovich	Leading Engineer Electrical
	Mr. Toshov Sanjar Shukhratovich	Master Electro Technical Laboratory TPP
	Mr. Narziev Akmal Abdullaevich	Electronics Engineer CCPP-1
	Mr. Djamalov Bakhodir Dilmuradovich	Maintenance Master CCPP-1
	Mr. Toshov Istam	Leading Engineer C&I CCPP-1
	Mr. Saidov Kamoljon Komiljon Ugli	Abroad to Japan by JDS under JICA Former Leading Engineer Programmer CCPP-1
	Mr. Eshev Hamdam Hazratovich	Leading Engineer Electrical TPP
	Mr. Makhudov Aziz Aminovich	Fitter Non-destructive 4th Range Metal LaboTPP
	Mr. Islamov Ismoil	Maintenance Master TME
	Mr. Bozorov Fakhriddin	BOP Operator
	Mr. Prinazorov Nurali	Operator Inspector (Patrol) GBCS
	Mr. Khudoykulov Lutfullo	Gas Turbine Operator CCPP-1
Staff of Navoi Training Center (NTC)	Mr. Istam Suvanov	Director of Navoi Training Center Former Head of Human Resources Department
	Mr. Khamraev Utkir Istamovich	Specialist, Press service
	Ms. Adilova Yulduzkhon Fakhriddinova	Specialist, officer
	Mr. Adilov Oybek Obidovich	Foreman
Ex-Trainers Candidate	Mr. Sadriddin Khodjaev	Chief on Duty at Power Plant (Tash TPP)
	Mr. Askar Khudayberganov	Leading Engineer (Tash TPP)
	Mr. Tokhtaev Nozimkhodja	Deputy Head (Tash TPP)
	Mr. Rasul Shamsiev	Shift Supervisor (Tash TETS)
	Mr. Sobirov Bakhrom	Head of department attracting investments (Syrdaryo TPP)
	Mr. Anvarov S.E.	Tash TETS
	Mr. Yusupov F.M.	Tashkent TPP
	Mr. Oybek Zakhidov	Engineer of Department attracting investments (Angren)
TOT Observer	Mr. Namozov Jakhongir	Electrician
	Mr. Rajabov Khurshid	C&I staff
	Mr. Nabiev Fazliddin	Electrical Maintenance Worker
	Mr. Ahmedov Murod	Electrical Maintenance Worker

Tashkent Training Center (TTC) **	Mr.Sanjar Kadirov	Director of TTC
	Mr. Bakhtiyar Nurmatov	Former Director of TTC
	Mr. Sogdiyev	Deputy Director of TTC
Heat Electricity Design Institute	Mr. Sayfulla Shoismatov	Director
	Mr. Samatov	Project Chief Engineer
	Mr. Sablikov	Chief Architect
Turakurgan CCPP	Mr. Akmal Fayziev	Director of Turakurgan CCPP Former Project Implementation Unit Engineer
	Mr. Nodir	Chief Engineer
Talimarjon CCPP	Mr. Pardaev Abdugani	Head on Training
	Mr. Omonov Odilbek	Engineer on Training
	Mr. Toshov Murod	GT Operator

** Tashkent Training Center; Tashkent Human Resource Development Center

(Source: JET)

Chapter 2

2. Activity Contents

2.1 Output1: O&M Policy of CCPP

2.1.1 Current Status and Issues of O&M policy for CCPP

The Uzbekistan conventional thermal power plants were constructed in the former Soviet Union era, so the specification of these facilities are presumed to similar to that of Navoi. Many of these conventional power plant facilities have problems such as a decline in energy due to their decrepit state, so that the rehabilitation of power plant facilities and construction of new facilities are needed to prepare for the future demand. The government of Uzbekistan is promoting the introduction of highly efficient new power plant facilities, and Japanese companies are aiming to install CCPP which is an advanced technology in wide use internationally. CCPP facilities have higher power generation efficiency than conventional power generation systems and can reduce not only the amount of natural gas used as fuel but also the amount of CO2 emissions, so Uzbekistan has adopted the policy of introduction of environmentally friendly CCPP.

In Presidential Decree PP - 1442, Uzbekistan is setting a priority on the efficient use of energy by modernization of conventional power plants, stable power supply using natural gas reserved in the country, and the development of new power source. To achieve long - term stable power supply and energy efficiency, the first CCPP in Uzbekistan was constructed at Navoi TPP and started commercial operation in 2012. Therefore UE still has less than seven years' experience in CCPP O&M.

At the launch of CCPP-1 at Navoi TPP, 50% of O&M staff were experienced members from conventional power generation in Navoi TPP, while the remaining 50% were publicly recruited and trained. The age range of CCPP staff is from 25 to 50 as of August 2017. (Refer to Table 2.2.1-3, in the following)

In the first mission of the project, JICA Expert Team (JET) obtained and collected O&M management data etc. from UE Headquarters (UE HQ) and Navoi CCPP-1. After that, JET visited UE HQ and Navoi CCPP-1 again during its mission, in an effort to collect and analyze supplemental data.

2.1.1.1 Current Status of O&M and facility at Navoi CCPP-1

(1) Major Equipment of Navoi CCPP-1

Specifications of the Major Equipment of Navoi CCPP-1 are shown in the following table.

Table 2.1.1-1 Specification of the Major Equipment of Navoi CCPP-1

No.	Major Equipment	Specification	
1	Gas Turbine	Type	M701F4(MHPS made)
		Out-put	315MW(15℃)
		Compressor	Axial flow 17-stage IGV
		Combustor	20 cans DLN (Dry Low NOx)
		Turbine	4-stage
		Intake air	with filter
		Exhaust	Stack with damper
		Rotational speed	3000rpm 50hz
		Range of operational load	50%～100% load
		Combustion Temperature	About 1400℃ @Combustor Exit
		Exhaust gas Temperature	About 600℃
2	Steam Turbine	Type	TC2F-40.5
		Rated Out-put	164.15MW @GT100%
		Steam Condition	High pressure 139.8bar abs 550℃
			Intermediate pressure 32.7bar abs 566℃
			Low pressure 4.9bar abs 235.8℃
			Exhaust pressure 72.5mmHg
3	Fuel gas booster compressor	Type	EKA-C-8/12-49HI
		Motor	STD-8000-2RBUHL4 8.0MW
		Ambient temperature conditions	Average 14.5℃、Max. 46℃、Min. -28℃
		Relative humidity	60%
		Suction pressure	12kg/cm2abs
		Discharge pressure	49kg/cm2abs
4	HRSG	Type	Reheat, Triple pressure, Horizontal type

(Source: UE)

(2) Operational conditions of Gas Turbine (GT) and Stream Turbine (ST)
Operational conditions of GT & ST at Navoi CCPP-1 are as shown below.

1) GT operational conditions
(a) Acceleration speed of revolution ——appr.135rpm/min
(b) Max. range of min. load change ——6.67 % of min. load GT (20MW/min.)
※Gas Turbine attains an output of 15MW within 15 minutes of being started.

2) ST operational conditions
Required steam parameters for ST must meet the values in the following two tables.

Table 2.1.1-2 Steam conditions for ST

Item	Condition
Steam Temperature ℃	**350 up to 440**
High Pressure kg/cm2 abs.	**60**
Middle Pressure kg/cm2 abs.	**17**
Low Pressure kg/cm2 abs.	**4**

(Source: UE)

Table 2.1.1-3 Steam Turbine Start Sequences

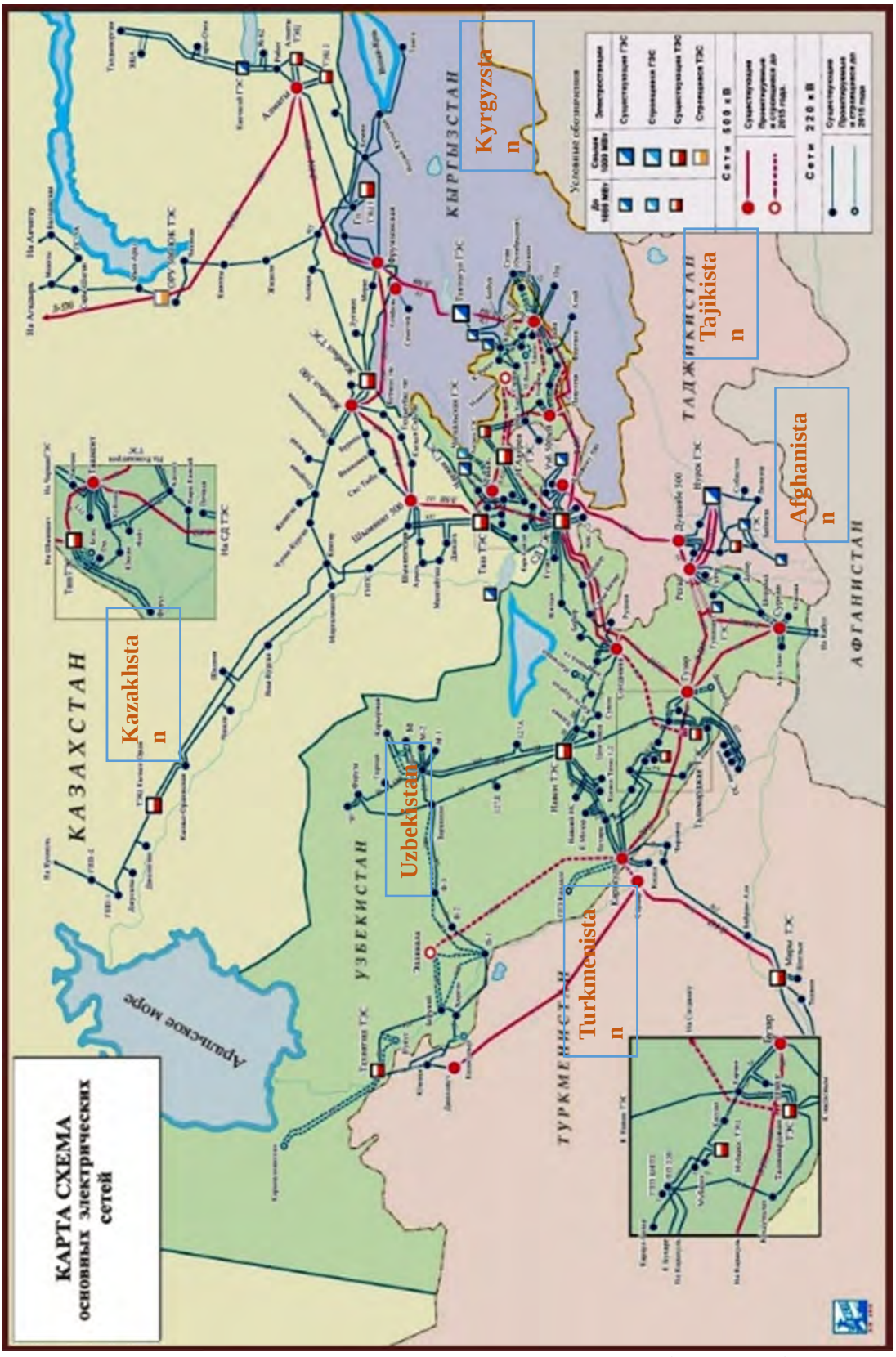
Item	Cold	Warm	Hot	Very Hot
Acceleration Speed	150 rpm/min.	300 rpm/min.	300 rpm/min.	300 rpm/min.
①Friction Control 500 rpm/min.	10min.	10min.	-	-
②Heating 2,200 rpm/min.	120min.	-	-	-
③Synchronization	5min.	5min.	5min.	5min.
Total(①～③)	145min.			
Initial load of Operation time	60min. -5%	60min. -5%	10min. -5%	10min. -5%
Factor of load (up to 30%)	Max.0.5%/min.	Max. 1.0%/min.	Max. 2.0%/min.	Max. 2.0%/min.
Factor of load (30% of load up to nominal)	Max. 1.0%/min.	Max. 1.0%/min.	Max. 2.0%/min.	Max. 2.0%/min.
Time from commissioning till the nominal load	About 360min.	About 180min.	About 75min.	About 75min.

(Source: UE)

(3) Transmission Network/ Grid for Power supply

The Uzbekistan power network was developed as part of the power supply for Central Asia in the former Soviet era, and it is part of the Central Asian power supply grid. Uzbekistan has a control station of this network and it is playing a key role.

Uzbekistan is divided into 4 districts, with Local Control Center in each district. The Central Control Center is located in Tashkent. Navoi TPP is located in the Samarkand district and power supply commands from the Central Control Center are given via phone to the Samarkand Control Center, which in turn gives output command to Navoi CCPP-1 by phone.



(Source: UE)

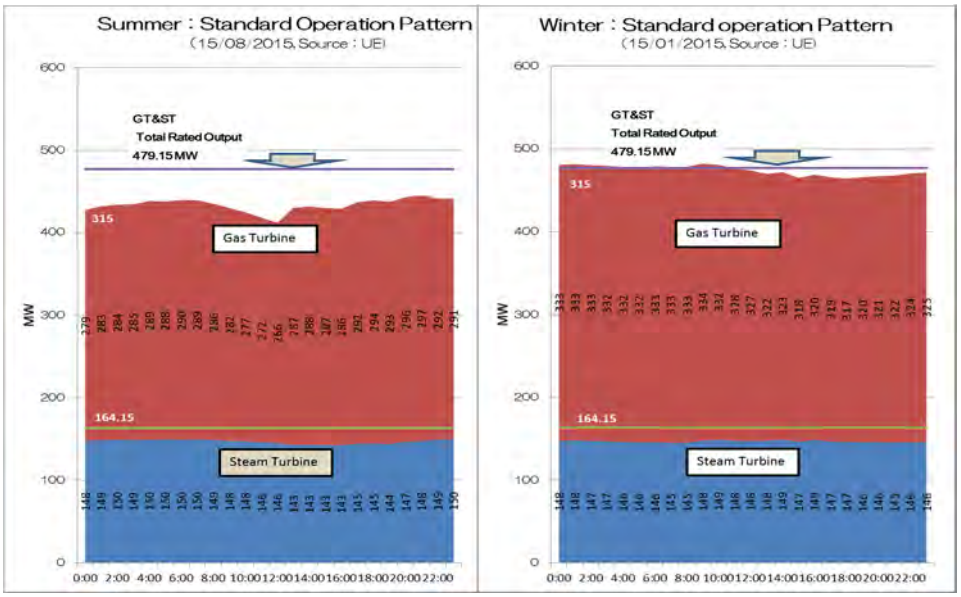
Figure 2.1.1-1 Grid: Electrical Transmission Network of Uzbekenergo

(4) Output of Navoi CCPP-1 and seasonal fluctuation

Uzbekistan's power generation configuration consists of 85% thermal power and 12% hydraulic power from UE. The remaining 3% is generated by organizations other than the UE. Uzbekistan have a seasonal import and export agreement on electricity and irrigation water with Kyrgyzstan and Kazakhstan. Under the agreement, Uzbekistan supplies natural gas to Kazakhstan in winter, natural gas and heavy oil and electric power to Kyrgyzstan, and in summer Uzbekistan get supplies of electricity and irrigation water in return. Most of the fuel for TPP of UE is natural gas, but in some cases it also uses petroleum and coal. UE has 10 thermal power plants and 35 hydro power plants in domestic, a total of 45 power plants. As described in Section 1.1, the power generation ability is 7.8 GW and the efficiency is low due to the aging of the facilities. So UE-HQ gives priority to the operation of highly efficient power plants. As a result, Navoi CCPP-1, which has the latest equipment, is always requested to operate at maximum output as the base load, and older conventional power plants are used for load adjustment.

However, the output power of the gas turbine (GT) is influenced by the air inlet temperature. The temperature becomes higher than the specified value, especially in Navoi where the outside air temperature in summer is very high, so the output power deteriorates.

Operating status of GT & ST at Navoi CCPP-1 and seasonal fluctuation as of January 15, 2015 (during winter) and as of August 15, 2016 (during summer) is shown in the following figure. In The equipment layout of Navoi CCPP-1 is then shown in the subsequent figure.



※1) Taking economic efficiency into consideration, CCPP is in base-load operation and Conventional plant is in load-adjusted operation. (Source: Uzbekenergo)

Figure 2.1.1-2 CCPP-1 operating status in summer and winter
(August 15 (left) and January 15 (right), 2015)

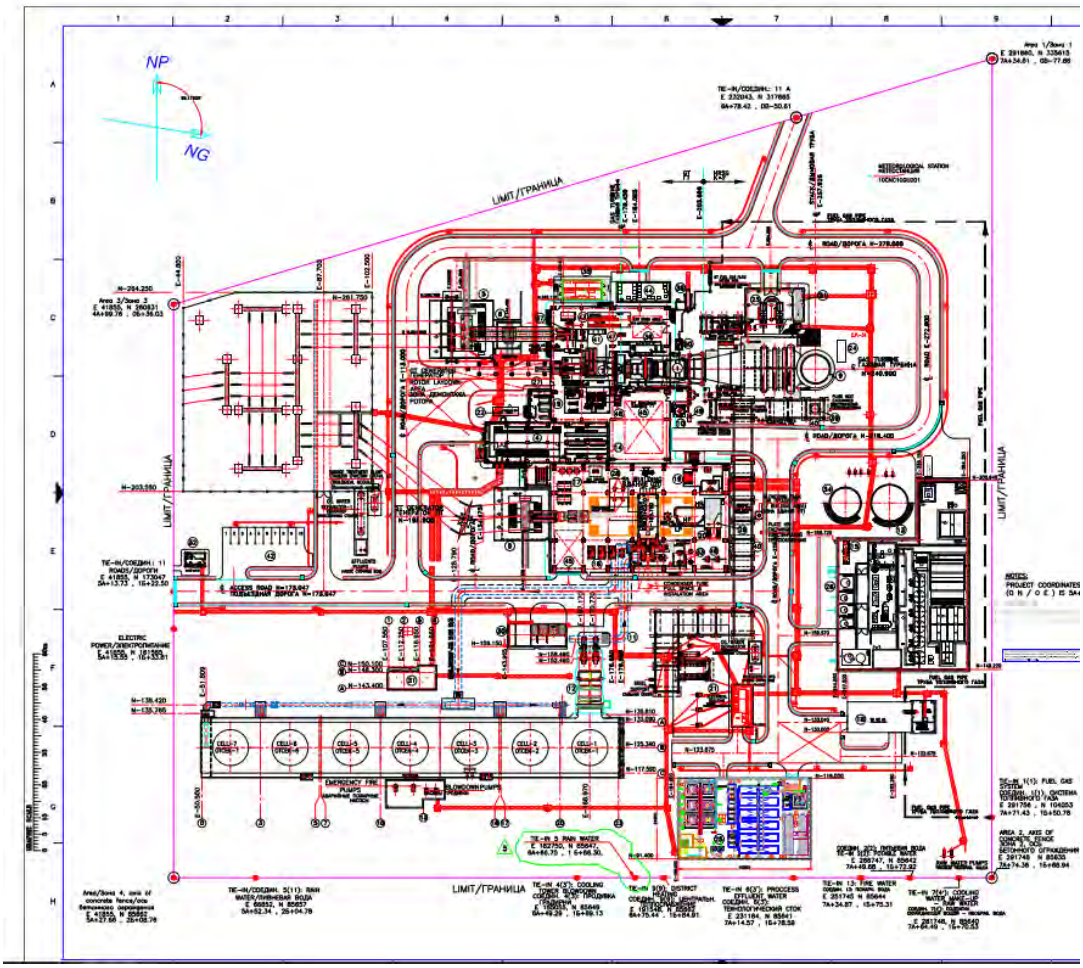


Figure 2.1.1-3 Plant Layout of Navoi CCPP-1

(Source: UE)

(5) Shutdown Record from 2013 to 2015

Since Navoi CCPP-1 began operation, there have not been any cases of plant failure due to human error. Also, there has been no failure of the main equipment, i.e. GT & ST, and there were few cases of unit shutdown due to internal factors from 2013 to 2015. (As for the record after 2016, this could not be obtained, because it had not received approval from UE HQ.)

Table 2.1.1-4 Shutdown Record of Navoi CCPP-1, 2013-2015

Yr	No	Facility	Stop Mode	Stop Date & Time	Re-connected Date &Time	Stopping Duration	Reason of Plant Stop
2013	1	GT	Emergency	2013/1/22 20:50-	2013/1/23 -10:54	14Hr 4min	GT shutdowns due to low flow through the cooler of air cooling. (Incorrect logic/ algorithm the work of usage regulator through OOVT)
	2	ST	Emergency	2013/3/30 23:24-	2013/3/31 -4:38	5Hr 14min	ST Trip caused by the II-stage neutral current transformer protection of ST.KZ on the line L-17-K-TEPO-II.
	3	CCGT	Emergency	2013/6/14 13:04-	2013/6/15 -15:44	26Hr 40min	CCGT Trip caused by the protection of the exhaust temperature difference No9 point in the flow of the GT. (Replacement of the thermal couple)
	4	CCGT	Planned	2013/8/29 1:33-	2013/8/30 -16:53	39Hr 20min	Shut down according to the application for repair of the safety valve TSA cooler and eliminating leakage of steam and condensate.
	5	CCGT	Planned	2013/11/21 3:30-	2013/11/22 -13:42	34Hr 12min	According to the application, for examination combustion chamber of GT with baroscope .
	6	CCGT	Emergency	2013/11/23 21:09-	2013/11/27 -17:02	91Hr 53min	CCGT Trip caused by the protection of the exhaust temperature difference No9 point in the flow of the GT. (to inspect the filters on the line of GT flow)
2014	1	CCGT	Emergency	2014/1/27 13:10-	2014/1/27 -16:00	2Hr 50min	CCGT trip from the protection low flow through OOVT due to short term failure in the software process control system. (reading meters disappeared in the feeding system.)
	2	CCGT	Planned	2014/3/4 00:47-	2014/3/19 -16:30	375Hr 43min	Shut down for scheduled maintenance of CCPP (GT combustion chamber)
	3	CCGT	Planned	2014/5/17 01:56-	2014/5/24 -09:13	175Hr 17min	CCGT shutdown according to the application to replace the 2-sided GT air filters and cleaning ST
	4	CCGT	Emergency	2014/10/13 11:46-	2014/10/13 -14:02	2Hr 16min	Protection is activated by axial displacement of the EAK100 and unsuccessful AVR EAK-200(set failure <Bently Nevada> vibration monitoring and diagnostic system)
2015	1	CCGT	Planned	2015/5/20 00:40-	2015/6/19 -15:57	735Hr 17min	GT inspection
	2	CCGT	Emergency	2015/12/4 19:40-	2015/12/4 -21:06	1Hr 26min	HRSG two fans shutdown (burned input channel module DI pressure control channel cooling air burners)

(Source: UE)

(6) Outline of Boiler & Turbine equipment at Navoi conventional TPP

12 Units of boiler equipment and 11 Units of turbine equipment in Navoi TPP have been in operation 35 years to 53 years since they began operation. Although the plant efficiency has been reduced due to deterioration over time, they are repeating the stop and start-up of operations and are still in operation. On the other hand, JET forecasts that it will become rather difficult for them to procure spare parts and have knowledgeable engineers dispatched from the manufacturers in future. The outline of boiler & turbine equipment at Navoi conventional TPP is shown in the following table.

Table2.1.1-5 Boiler equipment list of Navoi Conventional TPP

Unit No.	Boiler Type	Operation Started Year	Steam Press. (kg/cm2)	Steam Temp. (℃)	Capacity (Ton/hour)
K-1	TGM-151	Feb-1963	100	540	220/220
K-2	TGM-151	Apr-1963	100	540	220/220
K-3	TGM-94	Oct-1964	140	540	500/515
K-4	TGM-94	Oct-1965	140	540	500/515
K-5	TGM-84	Sep-1966	140	545	420/420
K-6	TGM-84	Nov-1967	140	545	420/429
K-7	TGM-84	Sep-1967	140	545	420/420
K-8	TGM-94	Dec-1968	140	545	500/515
K-9	TGM-94	Dec-1969	140	545	500/515
K-10	TGM-84	Mar-1970	140	545	420/420
K-11	TGME-206(CO)	Jun-1980	140	545	670
K-12	TGME-206(CO)	Jul-1981	140	545	670

(Source: UE)

Table2.1.1-6 Turbine equipment list of Navoi Conventional TPP

Unit No.	Turbine Type	Operation Started Year	Installed Capacity (MW)	Steam Pressure (kg/cm2)	Rotation Speed (RPM)	Steam Consumption (Ton/hour)
T-1	VPT-24-4	Feb-63	25	90	3000	220
T-2	VPT-25-4	Apr-63	25	90	3000	220
T-3	K-150-130-(HTZ)	Oct-64	150	130	3000	500
T-4	K-150-130	Oct-65	150	130	3000	500
T-5	R-50-130/13 (21 LMZ)	Sep-66	50	130	3000	470
T-6	PT-60-130/13	Nov-67	60	130	3000	397
T-7	R-50-130/13	Sep-67	50	130	3000	455
T-8	K-160-130 (HTZ)	Dec-68	160	130	3000	520
T-9	K-160-130	Dec-69	160	130	3000	520
T-11	K-210-130-3 (LMZ)	Jun-80	210	130	3000	670
T-12	K-210-130-3 (LMZ)	Jul-81	210	130	3000	670

(Source: UE)

2.1.1.2 Discussion points on O&M management issues

Regarding the O&M of the power plant, it is important to unify the task as a common one under the UE group and to operate so that there is no difference in O&M management. To that end, documentation and standardization of work are most effective.

On the other hand, the personnel of Navoi CCPP - 1 was educated by OJT and training by power plant at site, and it was not possible to confirm documentation of the work itself at the present.

As an issue for the UE, it is necessary to prepare management plans, guidelines, safety management plans, and the like related to the O&M of CCPP, and to promote standardization as the "visualization of work".

By sharing documents as standards in all of the CCPP of the UE, it would be possible to operate so that there are no major differences in the management of each CCPP, and it would be possible to manage the each CCPP so that no significant difference occurs between them. It would lead to secure a foundation for appropriate and prompt responses in case of trouble or an extraordinary situation. Based on the above situation, JET introduced Japanese findings and discussed about the correspondence.

An outline of items discussed in items (1) to (4) below is described. (For details, refer to Appendix 31; [Supplementary document for section 2.1.1.2])

(1) Development of Guideline and Management Plan for O&M CCPP
   1) Items for Operation
   2) Items for Maintenance
   3) Items for Safety Work

(2) Enhancement of Safety Work

(3) Reinforcement of efforts to perform equipment-based maintenance to cope with increasing unexpected troubles due to deterioration of the equipment

UE commented that it would continue to study further concerning (1) to (3) above.

(4) Efforts to maintain hot parts or other parts

In section 2.1.4.5, there is a discussion of the following two points as a "Periodic Inspection and Maintenance Parts Management".

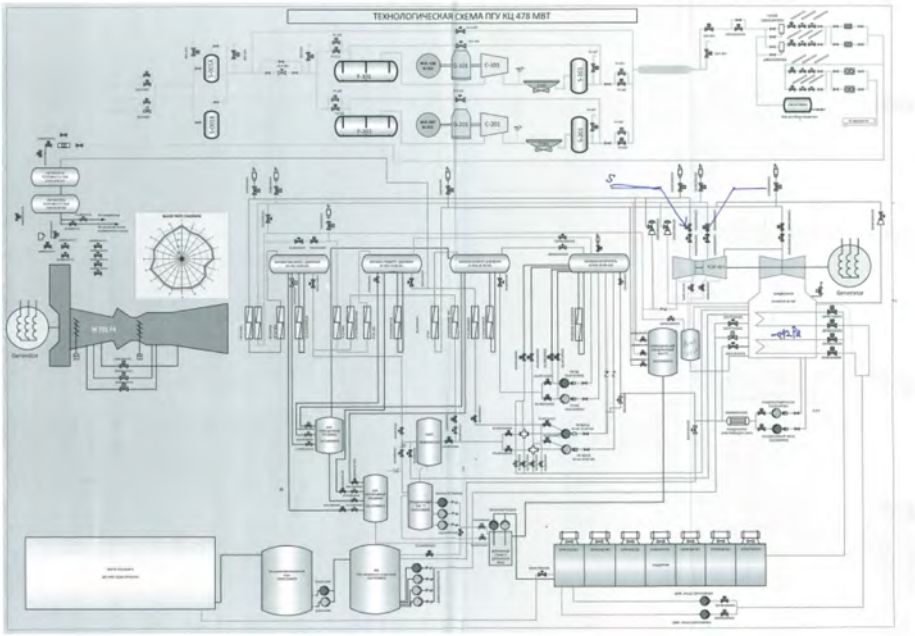
1) Parts rotation plan according to the maintenance frequency
2) Reduction of repair costs

2.1.2 Current Status and Issues of the CCPP Installation Plan

UE already began commercial operation of Unit No.1 (Output: 478MW) of Navoi CCPP-1 in September 2012. The manufacturer for GT, ST and generator is Mitsubishi Hitachi Power Systems. Also, at Tashkent Combined Heat and Power Plant (CHPP), the commercial operation of CHPP was started in October 2013, with one mid-sized GT generator, one Heat Recovery Steam Generator (HRSG) and one ST generator.

CCPPs were installed at Tashkent TPP (370MW x1 unit) and Talimarjan TPP (450MW x2 units) at the end of 2016 during the first phase of this project, and these began commercial operation in 2017.

The main piping diagram of Navoi CCPP-1 is shown in Figure 2.1.2-1, and a picture of the central control room and exterior of Talimarjan TPP shown in Photo 2.1.2-1 follows. Uzbekistan's existing CCPPs in operation as of December 2018 are shown in Table 2.1.2-1.



(Source: UE)

Figure 2.1.2-1 Main piping diagram of Navoi CCPP-1

Photo 2.1.2-1 Central control room and exterior of Talimarjan CCPP-1&2 (450MW x2・MHPS)

Table 2.1.2-1 Existing CCPP in operation (As of December 2018)

No.	Name of Plant	Configuration of Unit	Capacity	Fuel	Maker	Installation Date
1	Navoiy CCPP-1	GT(1)+HRSG(1)+ST(1)	479.15 MW	NG	MHPS	2012.9
2	Tashkent CHPP	GT(1)+HRSG(1)+ST(1)	27 MW	NG	MHPS	2013.1
3	Tashkent CCPP	GT(1)+HRSG(1)+ST(1)	370 MW	NG	GE	2016.9
4	Talimarjan CCPP-1/ -2	1-GT(1)+HRSG(1)+ST(1)	450 MW	NG	MHPS	2016.8
		2- GT(1)+HRSG(1)+ST(1)	450 MW	NG	MHPS	2016.12
5	Navoiy CCPP-2	GT(1) {+HRSG(1)+ST(1)}	450 MW	NG	MHPS	2018.12/Simple Cycle

Simple Cycle ;GT commissioning only

(Source: UE)

2.1.2.1 CCGT Installation Plan

Under the CCPP installation plan for Uzbekistan by 2021, the typical power generating unit is composed of one GT, one HRSG and one ST with output of 450MW, and a cumulative around total of 20 units are planned. The government of Uzbekistan reviewed the procurement cost and power supply, and as a result decided to suspend the CCPP installation plan of Syrdaryo and proceed with the rehabilitation of the conventional thermal power plant facility. Finally, UE decided the installation plan that total of 19 units will be installed as of October 2018. (Reffer Appendix 35; Resolution of the President No PP3981 dated 23 Oct 2018)

This typical unit is equivalent to a total output of 479.15MW (GT: 315MW, ST: 164.15MW) which was adopted at Navoi CCPP-1. A total 14 CCPP units for thermal power generation are planned with an expected total output of 5,859MW. In addition, 27MW x 2 units of Tashkent and 24MW of Fergana, total 105MW have been planned, as a plan for CHPP (CHP).

Table 2.1.2-2 shows CCPP installation plan until 2022. The cumulative power generation amount of CCGT is planned 5,964 MW.

Table 2.1.2-2 CCPP Installation Result and Plan (～2022)

data from No. PP3981, dated 23 Oct 2018

No.	Name of Plant	Configuration of Unit	MW	Fuel	Commissioning/Commercial
1	Navoiy CCPP-1	1-GT(1)+HRSG(1)+ST(1)	479	NG	2012.9
2	Tashkent CHP	1-GT(1)+HRSG(1)+ST(1)	27	NG	2013.1
3	Tashkent CCPP	1-GT(1)+HRSG(1)+ST(1)	370	NG	2017.12 (MF9001FA/GE)
4	Talimarjan CCPP Phase1	1-GT(1)+HRSG(1)+ST(1)	450	NG	2017.8
		2- GT(1)+HRSG(1)+ST(1)	450	NG	2017.12
10	Navoiy CCPP-2	2-GT(1)+HRSG(1)+ST(1)	450	NG	GT=2019.1, ST-BOP=2019.12
11	Turakurgan CCPP Phase1	1-GT(1)+HRSG(1)+ST(1)	450	NG	2019.9
		2- GT(1)+HRSG(1)+ST(1)	450	NG	2019.12
13	Takhiatash CCPP	1-GT(1)+HRSG(1)+ST(1)	230	NG	2020.6
		2- GT(1)+HRSG(1)+ST(1)	280	NG	2020.9
7	Fergana CHPP <NEDO PJ>	2-GT(1)+HRSG(1)+ST(1)	7	NG	2019.12
6		1-GT(1)+HRSG(1)+ST(1)	17	NG	2021.1
8	Tashkent CHPP	1-GT(1)+HRSG(1)+ST(1)	27	NG	2022.9
9		2-GT(1)+HRSG(1)+ST(1)	27	NG	2022.12
14	Talimarjan CCPP Phase2	3-GT(1)+HRSG(1)+ST(1)	450	NG	2022.9
		4- GT(1)+HRSG(1)+ST(1)	450	NG	2022.12
15	Turakurgan CCPP Phase2	3-GT(1)+HRSG(1)+ST(1)	450	NG	Unknown
		4- GT(1)+HRSG(1)+ST(1)	450	NG	
16	Navoiy CCPP-3	3-GT(1)+HRSG(1)+ST(1)	450	NG	Unknown
Total		GT+HRSG+ST(17+Unknown2)	**5,964**	**NG: Natural Gas**	

(Source: UE)

According to the Turakurgan Power Station Construction Preparation Survey Report from July 2014, regarding the augmentation plan for power generation method other than CCPP/CHP, conventional thermal power comprises 1.2 GW and hydraulic power comprises 0.5 GW. CCPP is the core of the power generation plan in Uzbekistan.

Financing of the construction of the CCPPs is shown in the following Table 2.1.2-3. Financing donors are mainly ADB and JICA, while the similar Tashkent CCPP financed by CDB (China Development Bank). At the Tashkent CCPP, a GE gas turbine was installed.

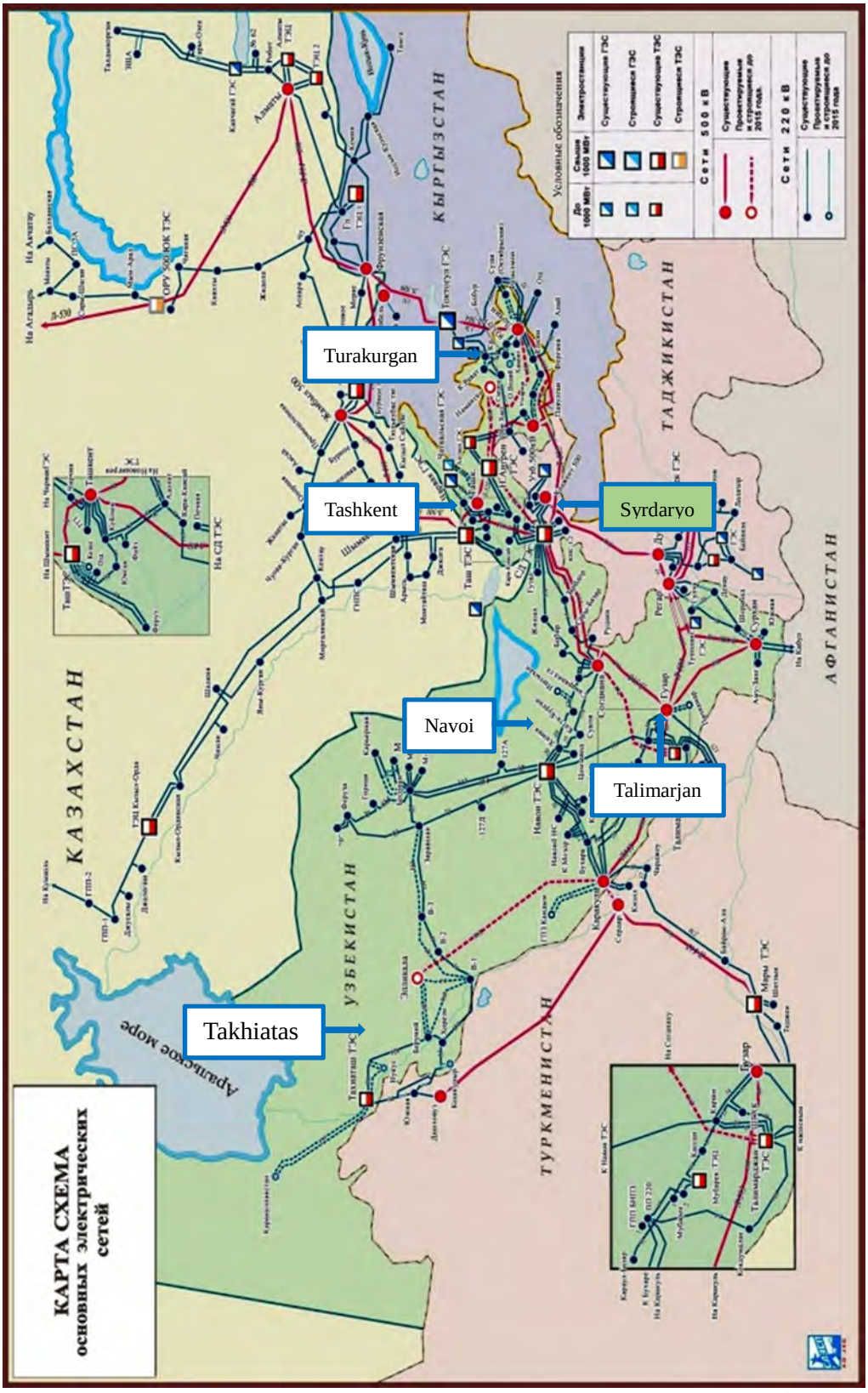
Table 2.1.2-3 Financing situations of the CCPP construction projects

No.	Name of Plant	Number of Unit	Plant Output	Total Output	Start Plan	Finance
3	Tashkent CCPP	1	370	370	2017. 12	CDB
4	Talimarjan Phase-1	2	450	900	2017. 8/12	ADB & JICA
10	Navoiy CCPP-2	1	450	450	2019. 1/12	JICA
11	Turakurgan Phase-1	2	450	900	2019. 9/12	JICA
13	Takhiatash CCPP	2	230/280	510	2020. 6/9	ADB
6/7	Fergana CHPP	2	7+17	24	2019.12 2021.1	NEDO
8/9	Tashkent CHPP	2	27	54	2022.9 2022.12	JICA
14	Talimarjan Phase-2	2	450	900	2022.9 2022.12	ADB
15	Turakurgan Phase-2	2	450	900	unknown	unknown
16	Navoiy CCPP-3	1	450	450	unknown	unknowen

(Source: UE)

The photo of construction site of Navoi CCPP-2 is shown below, and the location of the site planned for CCPP introduction is shown in the subsequent figure.

Photo2.1.2-2 Current construction site of Navoi CCPP-2 (as of December 2018)



(Source: UE)

Figure 2.1.2-2 Planned site for CCPP installations

2.1.2.2 New CCPP O&M Management

It is reasonable for the UE to establish an O&M system for new CCPPs based on the Navoi CCPP-1's system. The required O&M staff per one unit of CCPP is basically 78, and the number of O&M staff (Operator & Maintenance staff) will be 70 staff, basically. It is showed in the following Table 2.1.2-4.

Table 2.1.2-4 Number of Staff for Navoi CCPP-1

Actual Number of Technical Staff	Head (Unit Manager)	Engineering -Technical	Operator	Maintenance
78	1	6	56	15

(Source: UE)

If simple calculation was made based on the number of CCPPs planned to be installed till 2022, more than 800 O & M staff will need to be trained. Moreover including the units for which the operation starting date is unknown, more than 1,000 staff will require training. Table 2.1.2-5 shows the forecast number of technical staff for CCPP. (It was assumed that required staff are 30 persons/unit of O&M staff for Tashkent CHPP, and 30 staff for total 24MW of Fergana.)

Table 2.1.2-5 Forecast number of technical staff for CCPP

	2016	2017	2018	2019	2020	2021	2022	Final
Number of CCPP+CHP Unit	1+1	4+1	4+1	7+1	9+1	9+2	11+4	14+4
Number of O&M Staff	100	310	310	520	660	690	860	1,070
Total Installed Capacity (MW)	506	1,776	1,776	3,133	3,643	3,660	4,614	5,964

(O&M staff of CCPP/CHP=70/30, Fergana=1 UNIT)

(Source: UE)

The following staff members are not included in the above table.

- Staff for planning, environment, administration (including human resource department), cleaning, and canteen operations.
- Team staff for GT/ST inspections.

(1) Early development of technical staff

＜Background＞

The actual number of new O&M staff workforce is assumed to increase to about 1,000 or more. Also, the number of CCPP / CCGT O&M staff needed will rapidly increase to 520 in 2019 and 660 in 2020. Meanwhile, the NTC has not been completed preparation for responding to this situation. For this reason, it is necessary to promote staff training for CCPP without waiting for official establishment of an NTC.

＜Activities for development of O&M staff at Navoi CCPP-1＞

For the CCGT, the UE has conducted training as follows.

Upon the start of operation of Navoi CCPP-1, 10 staff members from the Navoi visited Japan, and they were trained based on the EPC contract between UE and MHPS. In addition, three staff members visited Spain to undergo ABB training (control, program). Regarding the exhaust Heat Recovery Steam Generator (HRSG), an engineer from Nooter/Eriksen (American company) visited Navoi Power Plants to conduct training.

After starting operation, joint study sessions were held by Mitsubishi Electric and Tashkent's staff of MHPS, and two staff members were to be dispatched to JICA program in Japan every

year. From the above, the training has been implemented step by step, and accumulated as a result.

Gaining knowledge such as EPC training from outside the company is being implemented, and simultaneously on the job Training (OJT) in Navoi is being carried out utilizing this knowledge.

A Japanese power company prepared the original operation handbook, and uses it for staff training. However, at Navoi CCPP-1, operation handbooks have not been prepared due to insufficient experience of O&M staff or other reasons. The training materials used for OJT at Navoi CCPP-1 are mainly based on the manufacturer's Operation and Maintenance Manual (OMM), and it is restricted in availability only to Navoi CCPP-1 because of a Non-Disclosure Agreement (NDA) with the manufacturers.

Regarding the ST, UE has sufficient training experience for conventional power plants through existing TTC, and implements training on its own. JET recommended that these O&M staff accumulate work experience at Navoi CCPP-1 with an aim to achieve early development of trained staff.

Under these circumstances, Navoi CCPP-1 accepts the trainees from new CCPP of Talimarjan TPP and Tashkent TPP etc. and implement training based on their OJT education.

- Talimarjan CCPP-1&2 (450MW x2 units) and Turakurgan CCPP-1 (450MW x1 unit) dispatch O&M staff (about 30 staff members for each plant) to Navoi CCPP-1 in an effort to achieve early development of such staff. They are able to accumulate work experiences through OJT for one month.
- 37 staff of O&M at Navoi CCPP-2, college graduates with more than 3 years of work experience in TPP including 5 staff in chemical, participated in the trial training to obtain basic knowledge of CCPP from April 25 to May 25, 2017. The trainer candidate has completed the draft of the lecture plan (Lecture Plan: detailed in 2.2.6.2 (2)).

Although the implementation of the education under 1) and 2) above is not directly related to establishment of a new training center in this project, training for new recruiters of Navoi CCPP - 2 has started as training education related to this project.

- From February 2018, employment of O& M staff of Navoi CCPP - 2 began, and training was started before GT commissioning at the end of 2018. Specifically, in order to make employment decisions, training was starting targeting 40 staff required for GT operation. Machinist trainees totaled 25 staff, 5 in February 2018, 10 in May and 10 in August. After these training sessions, another 10 staff were trained in November, i.e. 5 electricians and 5 C&I, and the remaining 5 machinists were trained in December. Also, 15 staff for ST operation are scheduled to be trained after starting their employment in 2019. In addition, training of 20 staff from Turakurgan from November 2018, and 20 staff from Takhiatash from December 2018, was started and completed by the end of December.

<Issues>

OJT and training by power plant at site, are being carried out for staff of conventional TPP, but the theoretical training of CCGT had not been carried out. Introduction of training utilizing the training materials prepared in this project should be promoted. Both NTC / JET recognized in this point, and training using training materials of this project was started. However, the procedure to officially record and certify the result of training completion of the training has not been completed. The actual result of the training is shown in Section 2.2.7 (2)

(2) Optimum balance of O&M staff

A total of 19 CCPP units will be installed; two units have been operating more than 5 years, 3 units which started operation in 2017 are supposed to need strengthening of staff training. Additionally, 6 units are planned to be installed from 2019 to 2022. Securing O&M staff must

also be considered for newly planned units, i.e. 3 units of CHP and 3 units of unscheduled CCPP. In such circumstances, it has become urgent to secure O&M staff. (Fergana's 17 MW + 7 MW counts as 1 unit)

When starting up the plant, it needs to have its O&M staff in place, and launch can be done smoothly by arranging experienced persons from the existing plant staff. However, despite the fact that there are many new CCPP planned in Uzbekistan as shown above, only staff at Navoi CCPP-1 have sufficient experience in CCPP operation, so the experienced staff available is limited. In addition, in the UE Group, each power plant is an independent company from UE, so almost no transfer of staff has been carried out between power plants. For this reason, it is necessary to implement effective pre-positioning of experienced staff at the same time as implementing advanced training for the initial staff assignment in newly launched CCPPs.

JET proposed a standard staff level as the basis for staff positioning, in the draft Manual, and this was agreed to. (Refer to Appendix 5; Manual for Positioning Plan of O&M Staff)

(3) Plan for optimum placement of O&M staff

For the Thermal Power Department, it is very important for the safety and stability of the power supply to plan and implement training plans for O&M staff, to optimize the staff balance of all CCPPs, and to secure the necessary number of staff with the required knowledge and ability.

The current state of staff allocation of Navoi CCPP-1 is described in Section 2.1.4. In order to secure the staff to be placed, it is necessary to grasp the experience and ability of the staff being secured. In order to arrange the necessary staff at the position and place of work, it is important to grasp the experience and capability of all of UE's O&M staff to be considered for placement in advance.

JET proposes to use "career records" for each individual and to utilize. Here is an example of proposed personal career record table, as follows.

Table 2.1.2-6 Example of staff training/education record

Career Record	Professionality Skills Acquisition Record	Off the Job Training Career	Self-enlightenment Record
			Outside/ Public Qualification
–	–	–	–
–	–	–	–
–	–	–	–

(Source: JET)

For reference, the following table shows the number of staff assigned per MW in Japanese CCPPs.

Table 2.1.2-7 Number of staff in CCPPs (example in Japan)

		CCPP-A
Number of Staff in CCPP	Person (p)	118
Number of Unit	Unit	2
Installed Capacity	MW	1,442 (729MW×1、713MW×1)
Staff number per MW	p/MW	0.082

※The number of staff including clerical staff, and excluding security, cleaning and canteen staff

(Source: JET)

2.1.3 Identification of the Internal Regulations of CCPPs

2.1.3.1 Current status of internal regulations for CCPPs

O&M staff of Navoi CCPP-1 are performing their tasks and training on-site etc. based on the following documents shown in

Table 2.1.3-1. These have been approved by UE HQ and utilized for the standards of daily operation at conventional TPPs.

Table 2.1.3-1 Regulations / Guidelines/ Rules/ Manuals

No.	Title
1	**Rules; The organization of work with the personnel at the enterprises of Power production : registered by Ministry of Justice (No.1178, 2002)**
2	Rules of safety technique on Thermal Mechanical Equipment and other Safety techniques used during operation and maintenance of the equipment
3	Fire safety rules
4	Rules of technical operation
5	Manufacturer's manuals on operation and maintenance of the equipment
6	Rules of providing first aid in case of accidents
7	Rules of "Sanoatgeokontehnazorat State Inspection " on exploitation of vessels working under pressure and exploitation of gas pipelines of high pressure
8	Logbook on testing knowledge on RTS(rules on technical safety),RFCS(rules on fire control safety),RM(rules on maintenance)
9	**Company Standard: Regulations of Combined Cycle Gas Turbine Unit KSt 202-810:2015**
10	**Sectoral Tariff and Qualification manual of power-and-energy sector (ОТКС:Отраслевой Тарифно-Квалификационный Справочник)**
11	**Methodological Manual (Методическая разработка)**
12	OJT for CCPP operational personnel ※November-June is the period for such a training
13	Schedule of that OJT training ※ OJT, weekends, holidays are indicated in the schedule
	Obtained Document

(Source: UE)

(1) Regulations for Overall Work

Among the regulations shown in

Table 2.1.3-1, No. 9, "Company Standard: Regulation of Combined Cycle Gas Turbine Unit (KSt 202-810 : 2015)" is one of the highest-ranked regulations for CCGT, based on the government laws of Uzbekistan. (Refer to Appendix 3) As the sub-title of "Company Standard" includes "Regulations of Combined Cycle Gas Turbine Units", it can be said that it is the only regulatory document specialized for CCGT.

This Company Standard is one of the Articles of Incorporation of the Navoi Thermal Power Station (JSC Navoi TPP), which discloses the obligations for employees and management at the CCGT unit. It concretely specifies the work for maintenance and management of facility and equipment at each division, and all staff who engaged in operation and maintenance of CCGT are required to understand it and work in accordance with it. It is also applied and submitted to the government of Uzbekistan for governmental approval, and is updated every three years. The regulation regulates the duties of the employees for their day to day operations and services. The abstract at the beginning of the "Company Standards" reads as follows

"This provision was developed on the basis of the Charter of the JSC 'NTPP', the qualification handbook for managers, specialists and employees, plant instructions for operation and maintenance of gas turbine equipment, plant instructions for operation and maintenance of steam turbine equipment, plant instructions for operation and maintenance of heat recovery units

(HRSG), and plant instructions on operation and maintenance of gas booster units. It is mandatory for the staff of the combined cycle gas turbine unit (CCGT) to understand the main tasks and functions required."

The Company Standard together with the annex of regulations comprise the internal rules of the JSC Navoi TPP. Staff employed in the CCGT unit must understand and be familiar with the regulation together with its annex (i.e. job descriptions) in order to carry out the routine duties. (Refer to Table 2.1.3-2 List of Job Descriptions) In order to promote the dissemination of the "Company Standard", every employee of the CCGT unit must undergo an oral examination once per year according to the in-house examination system of Navoi TPP. The examination is carried out by a committee consisting of the Chief Engineer, Deputy Chief Engineer and several experts on safety technology.

The contents of the oral examination shall cover topics from labor safety, operation, first aid and fire safety. Staff who pass the examination will continue to be employed. However, those who fail the examination will have to be dismissed from JSC Navoi TPP. The examination results are recorded in the staff cards (ID card; refer 2.2.4(1)), which is considered as the work permit issued by the employer. This rigid examination system maintains employee compliance with the regulation in carrying out their duties at the CCGT.

The "Company Standard" consisting of 15 pages is summarized according to its table of contents as follows:（Company Standard "Regulations of CCGT" are shown in Appendix 3）

1. Area of Application

This provision was developed on the basis of the Charter of the JSC “NTPP”, the qualification handbook for managers, specialists and employees, plant instructions for operation and maintenance of gas turbine equipment, plant instructions for operation and maintenance of steam turbine equipment, plant instructions for operation and maintenance of heat recovery units (HRSG), and plant instruction for operation and maintenance of gas booster units. It is mandatory for the personnel of the combined cycle gas turbine unit (CCGT) to understand the main tasks and functions required.

2. General Provisions

2.1. The CCGT unit is an independent department of the JSC “NTPP.”

2.2. Administratively, the CCGT unit falls under the Director General, and for production and technical matters – under the Production Director.

2.3. The CCGT unit is responsible for providing operational and technical services of the equipment of the unit.

2.4. The CCGT plant equipment includes different kinds of equipment with auxiliaries given in the list.

2.5. The CCGT unit operates on the basis of annual and monthly work plans approved by the TPP management.

2.6. The CCGT unit is guided by regulatory and technical documents and guidelines. There are 5 important areas:

(1) Technical Operations,
(2) Health and Safety Management,
(3) Fire Safety,
(4) First Aid,
(5) Disciplinary responsibility of the employees and executives.

3. Main Objectives

3.1. Fulfillment of the dispatching schedule of electrical load of the power plant.

3.2. Fulfillment of the tasks of production of electricity and thermal energy.

3.3. Ensuring the reliable operation of main and auxiliary equipment of the unit.

3.4. Providing the normative efficiency indicators of primary and auxiliary equipment.

3.5. Maintenance of the main and auxiliary equipment of the CCGT unit in constant readiness to maintain the nominal electric and thermal loads.

3.6. Fulfillment of the production and business plans of the CCGT unit.

3.7. Increasing productivity through better organization of work, use of advanced methods of maintenance and repair for equipment, reducing costs, organization of work around rationalization and invention, protecting the environment and people from harmful effects of production.

4. Functions

5. Rights

6. Interactions

Each department is responsible for particular tasks, and these are described in detail and the interactions are precisely defined.

7. Responsibilities

7.1. The staff of CCGT is responsible for:

As a part of the Company Standard, job description/duties are defined for each task in charge of O&M CCGT. The following table is a list of job descriptions for CCGT.

Table 2.1.3-2 List of Job Descriptions

No.	Job Description	Document No/KSt
0	Regulations of CCGT	202-810:2015
1	Unit Manager	202-811:2015
2	Deputy Head of Operation	202-812:2015
3	Leading Engineer Software	202-819:2015
4	Software Engineer	202-820:2015
5	Electronics Engineer	202-821:2013
6	Leading Engineer TME	202-823:2013
7	Head of the Shift	202-817:2015
8	Senior Operator	202-873:2014
9	Operator of Gas Turbine	202-830:2012
10	Operator-Inspector of Gas Turbine	202-872:2014
11	Operator-Inspector of Boiler Equipment	202-870:2014
12	Operator on Balance of Plant	202-831:2015
13	Operator of Steam Turbine	202-829:2012
14	Operator-Instructor of the Turbine Equipmemt	202/871:2014
15	Operator of Compressor Unit	202-826:2015
16	Operator-Inspector of the Compressor Unit	202-839:2015
17	Head of Gas Booster Compressor Station	202-818:2015
18	Maintenance Master of TME on GBCS	202-836:2015
19	Fiiter GBCS	202-838:2015
20	Deputy Head of Maintenance CCPP	202-813:2015
21	Foreman on Maintenance Master of TME on CCPP	202-822:2012
22	Fiiter CCPP	unknown
23	Metal Lab Defectoscope Worker	202-633:2006
24	Technician of the 1st Category	202-814:2015
25	Chemical Engineer	202-816:2012
26	Lab of Chemical Analysis	202-860:2012
27	Heads of Chemical Water Treatment(CWT)	202-861:2012
28	Operator Water Treatment	202-837:2012
29	Operator-Inspector of Water Treatment	202-858:2012
30	Operator Cleaning Industrial Drain	202-857:2012
31	Operator-Inspector Cleaning Industrial Drain	202-859:2012
32	Senior Electrician Maintenance GBCS	202-865:2012
33	Cleaner CCPP	202-866:2012

(Source: UE)

(Refer to the CD-ROM File A: <JOB Description> for above each document.)

Job Descriptions are structured exactly the same as the “Company Standard” as follows:

1. Object of the rule
2. General Provisions
3. Main Objectives
4. Functions
5. Rights
6. Interactions
7. Responsibilities

Output 1 of the project is "Maintenance and management policy of CCGT is developed", and at the interview[1] of the UE-HQ, this project was discussed. When checking the presence or absence of the policy at UE-HQ, there was a response that there are no policy documents concerning CCGT maintenance and management.

By the way, the term “policy” is abstract, and its content is not necessarily constant depending on how to decide and define it. Although, the “policies” decided by PDM[2] of this project are those limited to operation and maintenance of CCGT. Therefore, “policy” is to express “the comprehensive direction of necessary work in carrying out the work to achieve the planned energy supply obligation by CCGT under the control of UE” as planned. And based on experiences in Japan, JET prepared four manuals related to "O&M Policy for CCGT" suitable for UE, proposed and discussed them, and gained an understanding of their necessity. (Refer to Appendices No. 4 to No. 9: i.e. Manuals No. 1 to No. 6. (a detailed descriptions of Manuals No. 1 and No. 2, concerning the human resource development plan, is in Section 2.2.6. Descriptions of Manuals No. 3 through No.6, concerning O&M policy, are in Sections 2.1.4 and 2.1.5)

- Appendix 4: No. 1 Manual for Human Resource Development Planning-Involving O&M staff
- Appendix 5: No. 2 Manual for Positioning Plan of O&M Staff
- Appendix 6: No. 3 Manual for Preparation (drafting) of the Development Policy and Plan for O&M of CCPP
- Appendix 7: No. 4 System for O&M and Manual for Consolidating and Improving Future Regulations
- Appendix 8: No. 5 Process Supporting Manual for Development of Draft Rules and Rulemaking for the O&M policy and plans
- Appendix 9: No.6 Manual for Safety and Quality Control for Periodic Inspection Work and Large-scale Improvement Work

(2) Regulations for Staff Qualification

In No. 10 of Table 2.1.3-1, Sectoral Tariff and Qualification Manual of the Power-Energy Sector (ОТКС; **О**траслевой **Т**арифно-**К**валификационный **С**правочник Электроэнергетической Отрасли), stipulates the qualifications for thermal power generation work. In OTKC, qualifications related to CCPP are included. They are, i.e. <27 Boiler man> · <28 Boiler cleaning man> · <32 Local operator for gas compressor Unit> · <33 HRSG local operator> · <35 Pump Unit operator> · <41 Gas Turbine Unit operator> · <43 Boiler operator> · <44 Patrol operator for boiler Units> · <45 Patrol operator for Turbine Units> · <46 Steam Turbine operator> · 48 Fuel supply operator> · <58 Boiler operator> · < 73 Fitter maintenance part> · <78 Fitter for equipment of power station> etc.

As UE does not permit copying the OTKC, JET checked the parts of GT Operator, ST Operator, etc. by interviews. JET could confirm that qualified ranking is done for each eligible qualification based on equipment output and steam amount as a standard. For example, <41. GT Operator> covers management operation and maintenance work of GT equipment of 10 MW or more. Staff who completed the specialized education of thermal engineering learn the necessary knowledge about GT, and the rank qualified to work for 10 MW-50 MW is 5th-Rank, for 50 MW-100 MW is 6th-Rank, and for over 100 MW is 7th-Rank. Likewise, also for <46 ST Operator> <43 Boiler Operator> <45 Patrol operator for turbine units> <44 Patrol operator for boiler units>, the qualification rank is determined based on the scale of the corresponding equipment.

These qualification rankings are presumed to be related to the salary rank and promotion system, and are very important in understanding the current system of human resources development of

[1] Items were confirmed at the meeting with the Mr. Akmal Fayziev (PIU Office), Deputy Director of NTPP in the ninth mission in 2017. The Japanese word “houshin” as a term was translated as “policy” and discussed.

[2] Project Design Matrix

UE. However, due to the fact that “JET cannot get copies of the OTKC without permission” it was difficult to fully grasp the current system.

(3) Relation between Training and Regulations

In No. 11 of Table 2.1.3-1, the “Methodological Manual” stipulates a guideline on the training program for all of UE, and a summary on the preparation of a training program for power generation staff is described. At Navoi CCPP-1 also, based on this regulation, they are carrying out collective training and individual training for O&M staff, as follows:

1) Navoi CCPP prepare the training program for collective training annually. Programs are, i.e. "Production-Economic Training Program of Engineering Technicians for CCPP Unit" for engineering - technical staff, and “Production-Economic and Continuing Education Program of the Operational Staff of CCPP Unit” for shift staff. They are carrying out training according to these programs. Collective training related to theories and technologies of conventional plants are being implemented at existing TTC, but it is not being implemented for CCPP technology. The new NTC curriculum / teaching materials, which are being developed in this project, will be for a collective training on CCPP theory and technology. (Refer to Appendix 10 <2015-2016 Production-Economic Training Program for Engineering Technicians>, Appendix 11<2015-2016 Production-Economic Training Program for Staff>)

2) Relation to training on ‘company standard’ and ‘Job Description ‘are mentioned in the previous section (1) above. The individual training program stipulates that “self-study of their own job description” is carried out, and each job description contains contents of No. 2 to No. 7 listed in Table 2.1.3-1 according to the job description. If the 12 training courses of this project are specified in the job description, it is possible to prescribe the training program for all UE groups. As it has already mentioned in Section 2.1.3.1(1), the revision of ‘Company Standards’ and ‘Job Descriptions’ requires government approval, and 2018 was the year of this revision. However it was difficult to revise the ‘Job Descriptions’ within the project period because NTC was not officially established. It was agreed to consider revising the Training Program which can revise under the NTC as another way. The following Table 2.1.3-3 shows the documents relating to ‘Job Description’, ‘Training Program’, other information for each job category for CCPP staff, and OTKC information (by hearing).

(*For OTKC, only the titles of OTKC as of the end of August 2017, is listed.)

Table 2.1.3-3 Job Duties of CCPP Personnel and Documents Obtained

Job title / Traget	Staff Number in UNIT	Job description	Collective Training Program	Individual Training Program for each JOB	Tariff and Qualification Handbook of Power-and-Energy sector (OTKC) by hearing	Other Documents (rules)	Remark (*Italics=Obtained document number*)
All staff of energy generation company						Rules; The organization of work with the personnel at the enterprises of Power production	Registered by Ministry of Justice (No.1178, 2002/ *No55 FS Mission*)
						Methodological Manual	*No13/ 1st Mission*
All CCPP Staff Navoi						KS 202-810:2015 Company Standard, Regulation of CCGT Unit	*No3/ 1st Mission*
Students, workers and specialists for Navoi TPP						KS 202-165:2012 Regulation on training course point on Vocational Training of worker & Specialist	*No47 FS Mission*
Head of CCPP	1	KS 202-811:2012					
Deputy Head of Operation	1		*Training curriculum of engineering-technical staff of KTs BGK office for 2015-2016 academic year*				*No16/ 1st Mission*
Chief Software Engineer	1						
Software Engineer	1	KS 202-821:2012					
Electronics Engineer	1						
Chief Process Engineer	1						
Shift Head	5	KS 202-817:2012		*for Shift Head 2015*			*No17/ 1st Mission*
Senior Operator	5						
Technician	1	KS 202-814:2012 (1st Category)					
GT Operator	5	KS 202-830:2012		*program of GT operator*	71. Instrumental electrical operator/ Fitter for C&I and automation		*No48/ FS Mission*
GT & HRSG *Patrol* Operator-Inspector	5	KS 202-825:2012 KS 202-832:2012	Production - economical and continuing training program of the operational personnel of CCPP Unit for 2015-2016 study year (*No4S/ 1st Mission*)	*for Machinist on HRSG at CCPP 2014;cfor Machinist GT CCGT 2014*	27. Boiler маа		*No20/ 1st Mission; No19/ 1st Mission*
BOP Operator	5	KS 202-831:2012		*for BOP Operator 2014*	43. Boiler operator 58. Boiler operator		*No22/ 1st Mission*
BOP *Patrol* Operator-Inspector	10				33 HRSG local operator 44 Patrol operator for boiler units		
ST Operator	5	KS 202-829:2012		*for ST Operator 2014*	46. ST operator		*No18/ 1st Mission*
ST *Patrol* Operator-Inspector	5	KS 202-824:2012 KS 202-833:2012		*for Machinist on ST at CCPP 2014*	45 Patrol operator for turbine units		*No21/ 1st Mission*
GBS Operator	5	KS 202-826:2012 KS 202-827:2012			48. Fuel supply operator		
GBS *Patrol* Operator-Inspector	5	KS 202-839:2012			32. Local operator for gas compressor unit		
Head of GBS	1	KS 202-818:2012					
Maintenance Staff of GBS	1		Economical and production training program of engineer-technicians for CCPP Unit for 2015-2016 study year				*No16/ 1st Mission*
Fitter of GBS shift	5						
Deputy Head of Maintenance	1						
Maintenance staff of CCPP	2						
Fitter of CCPP shift	5	KS 202-822:2012 KS 202-834:2012			73. Fitter (maintenance part) 78. Fitter on servicing equipment of PP		

(Source JET)

2.1.4 Current Status and Issues for O&M System of CCPP

JET confirmed the current status of O&M at Navoi CCPP-1 and proposed improvements to its policy.

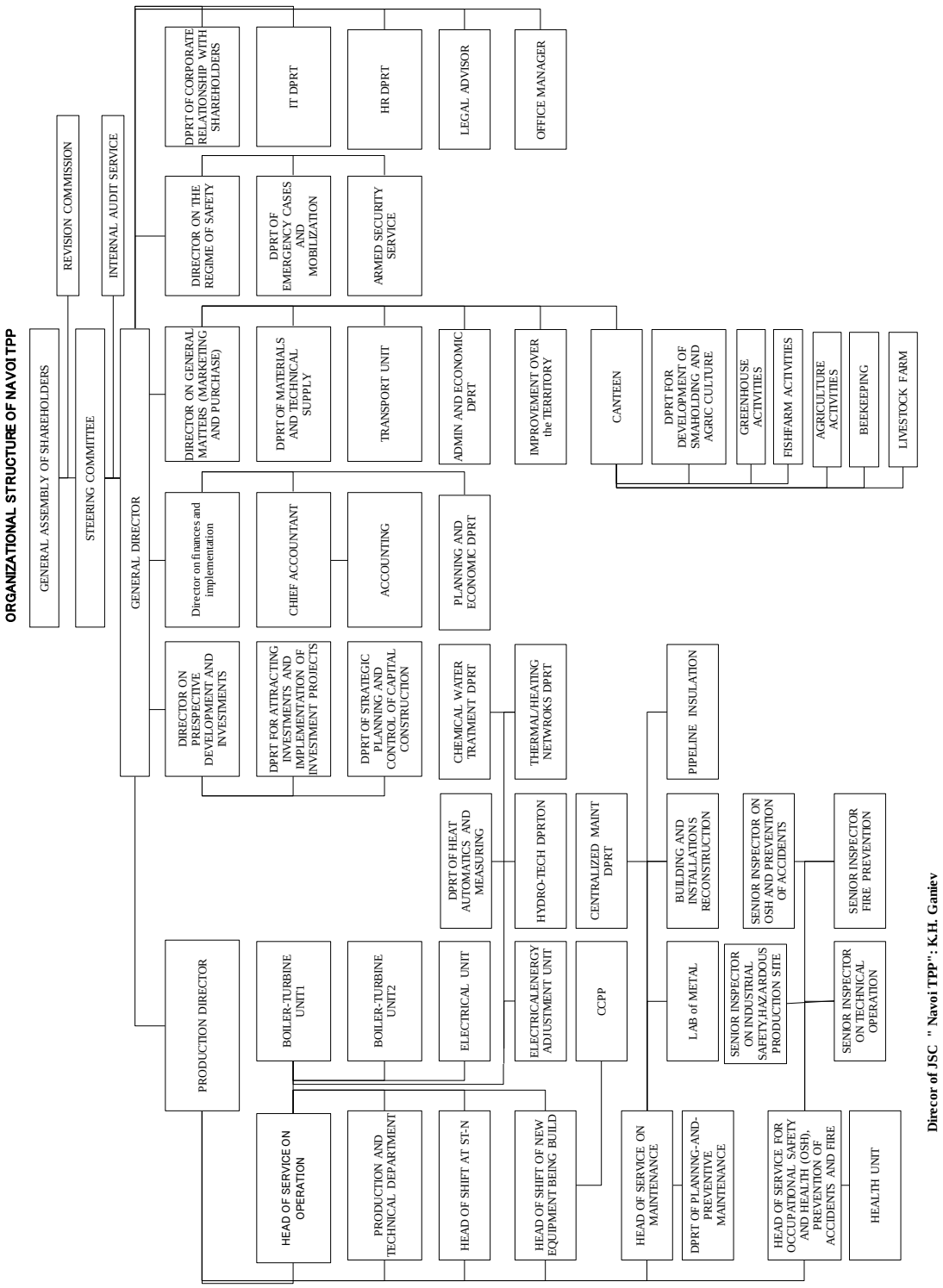
2.1.4.1 Organization and structure of the Navoi Power Station

Current installations at Navoi Power station area are Navoi TPP (a conventional power plant) and Navoi CCPP-1 (a combined cycle power plant), the two power plants are integrally managed.

(1) Organization and structure of the Navoi power station

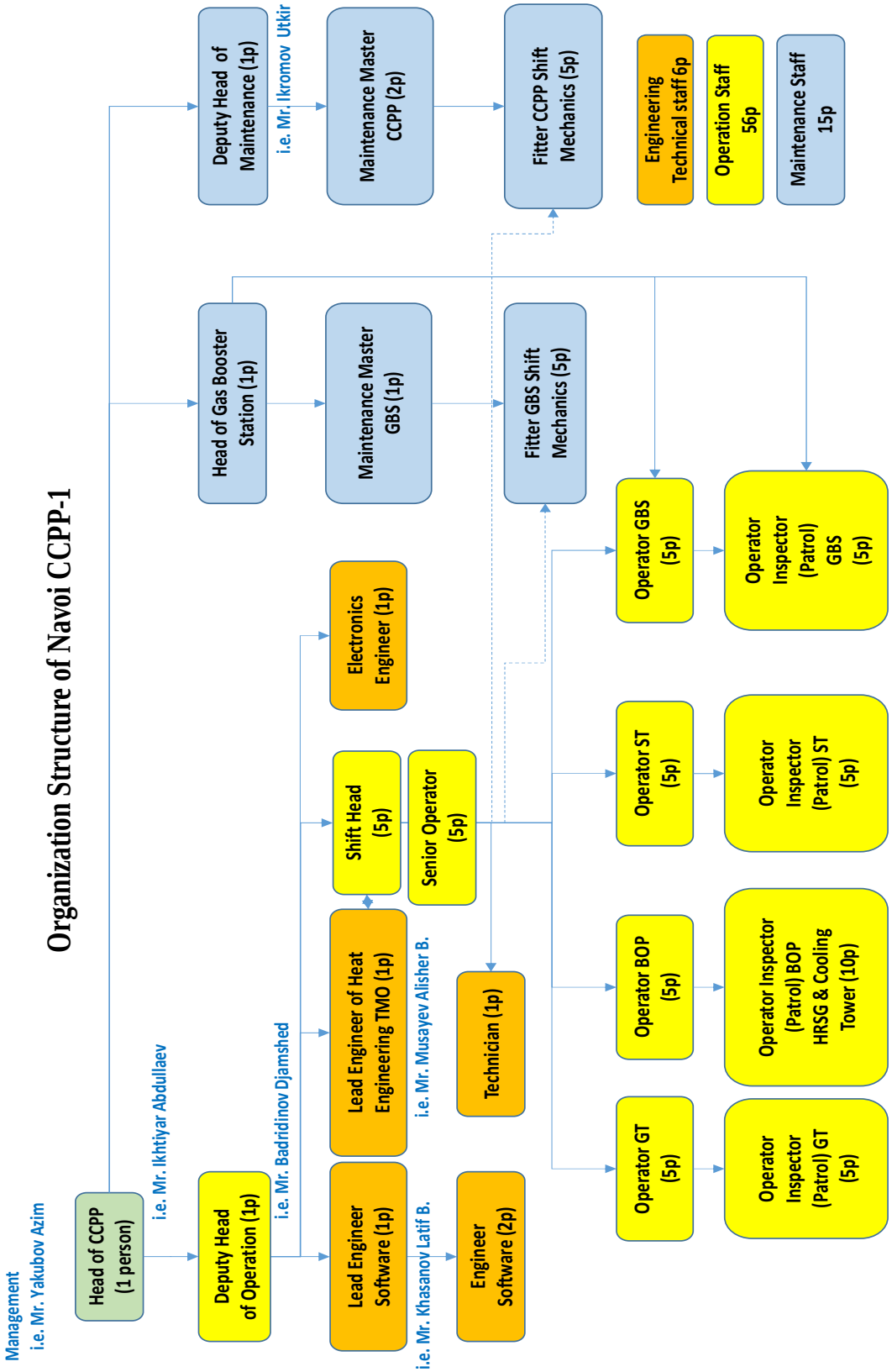
The Navoi power station has conventional power generation units and heat supply facilities, i.e. 12 units of turbines, 12 units of boilers, of classes 25 MW, 50 MW, 160 MW, and 210 MW as described in 2.1.1.1 (6), and a CCPP unit. There 13 divisions in the organization managing these facilities. These are the Boiler Turbine Unit Group 1, Boiler Turbine Unit Group 2, CCPP unit, Electrical Equipment Monitoring Division, Parts Deterioration Monitoring Unit, Chemical Analysis Unit, Hydraulic Power Unit, Heat Supply Unit, Operation Inspection Unit, Repair Planning Unit, Repair Unit, Building Management Unit, and Pipe Maintenance Unit. The O&M staff of the power generation facility consists of 5 groups, 4 groups working in 3 shifts, with 1 group to be used for emergency response or to cover vacations. The maintenance plan of the facility is developed by the UE-HQ and each power station repair planning unit. Responsible for the plan for large-scale maintenance is not the Power Plant Operation Department of UE-HQ, but the electric equipment repair service company (CPEO). On the other hand, the Power Plant Operation Department is directing long-term education and training as the core for the power plant installation plan of UE. And they will carefully select about one person per year from each power station and allow participation in training for 1 to 2 months usually.

As shown in Table 2.1.2-4, 1 Head of CCPP (Unit Manager), 1 Deputy Head of Operation and 6 Engineer-Technicians are located in Navoi CCPP-1. As O&M staff, under the shift head and senior operator (assistant for shift head), are 1 person each as operator and patrol, for gas turbine, steam turbine, plant auxiliaries (BOP), and gas boosting compressor. (2 staff for BOP patrol) With 11 staff for the group, and as mentioned, and 4 groups working in 3 shifts and a preparation group, there is a total of 55 staff. Maintenance staff are calculated with 55 staff, it becomes 78 staff, and including 4 service workers a total of 82 people are organized.
In addition, 15 person (3 person × 5 groups) from the chemical analysis unit from the existing conventional power plant side are also involved, so that the operation and maintenance system consists of over 90 people in total. The current organization of the Navoi TPP is shown in the following figure 2.1.4-1, and that for CCPP-1 is shown in Figure 2.1.4-2.



(Source: UE)

Figure 2.1.4-1 Organizational Structure of JSC Navoi TPP



(Source: UE)

Figure 2.1.4-2 Organizational Structure of Navoi CCPP-1

(2) Current Status of Personal Assignment of O&M staff in Navoi TPP

As of August 31, 2016, Navoi TPP operates with a personnel count of 1,712 (which includes the 82 personnel of Navoi CCPP-1, including 70 O&M staff). The number of staff working in the Navoi TPP is shown in the following table.

Table 2.1.4-1 Number of Personnel at Navoi TPP (including CCPP-1 staff)

Actual Number of Employees	Head	Specialist	Workers	Service Workers
1,712	187	130	1,375	20

(Source: UE)

The breakdown for main technical staff is: 228 staff as Boiler &Turbine unit operators, 225 staff as Maintenance staff, 189 staff for the Electrical Unit, 125 staff for C&I, and 190 staff as Chemical staff.

One Director and four Deputy Chief Engineers (each in charge of “Operational Issues”, “Maintenance”, “New Equipment Operation” and “Thermal and Mechanical Equipment") are positioned in Navoi TTP at all times. The CCPP Unit Manager is the person substantially responsible for the work in Navoi CCPP-1.

1) Current Status of Personal Assignment of O&M Staff at Navoi CCPP-1

The current total staff number of Navoi CCPP-1 is 84. As shown in Table 2.1.4-2, total of CCPP staff are 82 persons, and there are 4 service workers. Table 2.1.4-3 shows the breakdown of CCPP-1 O&M staff.

Table 2.1.4-2 Required Number of Personnel at Navoi CCPP-1

Actual Number of CCPP Staff	Head Unit Manager	Deputy Head of Operation	Engineering Technical	Operation Staff	Maiuntenance Staff	Service Workers
82	1	1	6	55	15	4

(Source: UE)

Table 2.1.4-3 O&M staff of Navoi CCPP-1

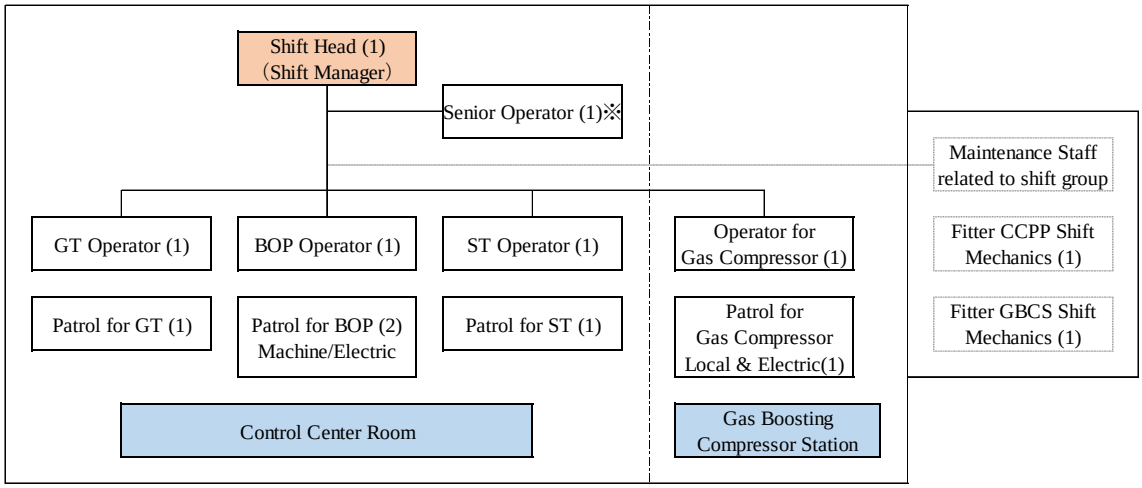
UNIT Manager					1p
Deputy Head of Operation			1p		
Engineering-Technical Staff		Operation Staff		Maintenance Staff	
Leading Engineer on TME	1p	Shift Head (Shift Manager)	5p	Deputy Head of Maintenance	1p
Leading Engineer-programmer	1p	Senior Operator of Power Unit	5p	Head of GBCS	1p
Engineer-programmer	2p	GT Operator	5p	Maintenance Master, CCPP	2p
Electronics Engineer	1p	BOP Operator	5p	Maintenance Master, GBCS	1p
Technician	1p	ST Operator	5p	Duty Worker, Fitter CCPP Shift	5p
		Local Operator GBCS	5p	Duty Worker, Fitter GBCS Shift	5p
		Patrol Operator; GT, ST, BOP-1, BOP-2, GBCS	25p		
Total	6p		55p		15p

55 operator staff will be employed at Navoi CCPP-2 which is under construction.

(Source: UE)

2) Operation structure of Navoi CCPP-1

Five shift groups are composed and each shift group include one shift head and 10 staff for operation. Four shift groups will cover three shifts (eight hours each) with rotation, while the other shift group is assigned as a day shift and vacation adjustment shift. The staff structure of each shift group is shown as following figure.

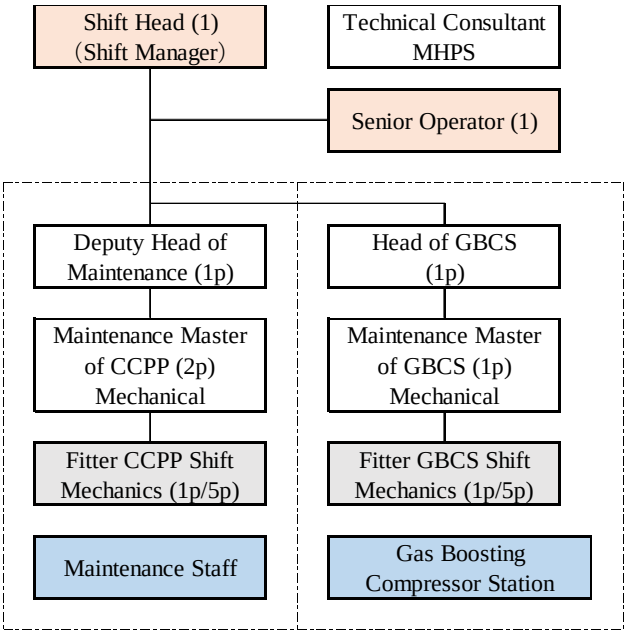


※ The position of Senior Operator was established in 2014, they mainly respond to patrol management, failure of machines and trouble. (Source: UE)

Figure 2.1.4-3 Operation staff of each shift group

3) Daily Maintenance System of Navoi CCPP-1

In CCPP-1, a total of 15 staff, i.e. Head of Maintenance, Head of GBCS, 3 Masters and 10 Fitters, , are related to maintenance jobs in Table 2.1.4-3. They are in cooperation with the Shift Head / Senior Operator, and taking care of the daily maintenance system. For maintenance of electrical and C&I equipment, support is requested from Navoi TPP. These supporting members from Navoi TPP are mostly fixed, while the number of people is increased or decreased according to the degree of difficulty of work. Regarding simple and daily repair, the Operation staff also performs maintenance work. For the patrol, inspections are implemented every hour, and inspection records are recorded every two hours, based on an “equipment inspection list”. The daily inspection framework is extracted from Table 2.1.4-3 and is shown in Figure 2.1.4-4.



(Source: UE)

Figure 2.1.4-4 Daily Maintenance Framework

Gas Turbine (GT) checkout & inspection is categorized into three types as follows.

(a) Daily/ Routine Inspection (implemented by daily maintenance group as Figure 2.1.4-4)
Checking the abnormality of entire plant during operation
(b) Periodic Inspection
Combustor Inspection (CI), Turbine Inspector (TI), Major (Overhaul) Inspection (MI)
(c) Long Term Management/ Service; Rotor and others
(Please refer to detailed description in 2.1.4.5)

4) Periodic inspection framework of Navoi CCPP-1

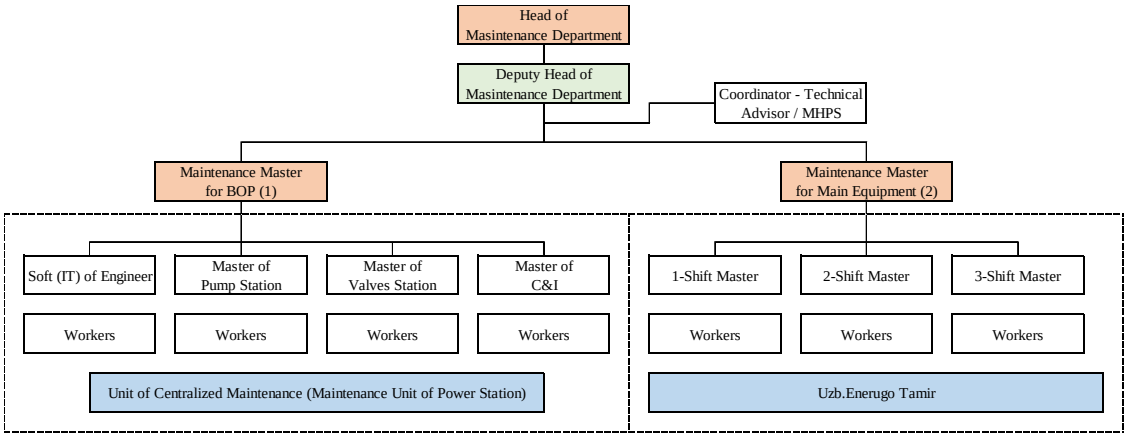
The framework of the periodic inspection for Navoi CCPP-1 is comprised of the Centralized Maintenance Unit (Maintenance Unit of Power Station) at Navoi TPP and UE Tamir (Maintenance Co.), and one person from MHPS participates as Technical Advisor (TA). Equipment disassembly inspections for the major inspections are based on the Manufacturer's Manual for Maintenance of the Equipment with technical support from the manufacturer's TA.

The role and system of periodic inspections is showed in Table 2.1.4-4 and Figure 2.1.4-5. In the subsequent Figure 2.1.4 6, the related organizations and affiliates of Uzbekenergo in the Navoi district are shown.

Table 2.1.4-4 List of main participants for Periodic Inspection

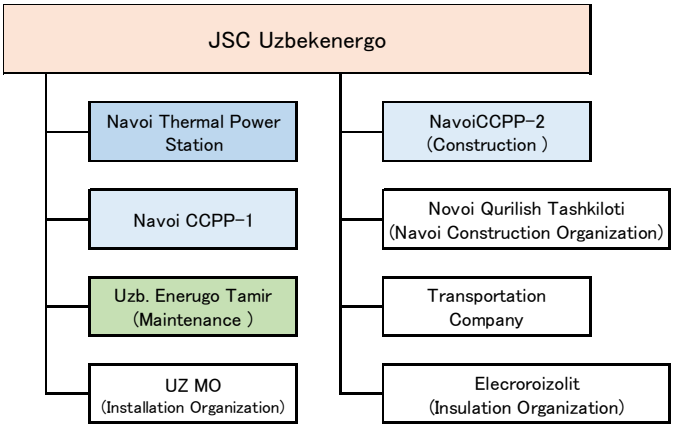
No.	Member	Role
Navoi TPP		
1	Head of Maintenance Department (1p)	responsible manager for periodical inspection
2	Deputy Head of Maintenance Department (1p)	Site manager for periodical inspection
3	MHPS Tachnical Advisor/ Supervisor	Coordinator - Technical Advisor / MHPS
4	Maintenance Master for BOP Equipment (1p)	responsible for inspection of BOP
Unit of Centralized Maintenance：Maintenance Unit of Power Station /Navoi TPP		
5	Soft (IT) of Engineer	responsible for inspection of Soft (IT)
6	Master of Pump Station	responsible for inspection of Pump Station
7	Master of Valves Station	responsible for inspection of Valves Station
8	Master of C&I	responsible for inspection of C&I
9	Workers	responsible for inspection of every equipment
Uzbekenergo Tamir		
1	Maintenance Master for Main Equipment (2p)	responsible for inspection of main equipment
2	1-Shift Master	responsible for 1-Shift inspection team
3	2-Shift Master	responsible for 2-Shift inspection team
4	3-Shift Master	responsible for 3-Shift inspection team
5	Workers	responsible for inspection of every equipment

(Source: UE)



(Source: UE)

Figure 2.1.4-5 Implementation system for Periodic Inspection of Navoi CCPP-1



(Source: UE)

Figure 2.1.4-6 Organizations and Affiliates of Uzbekenergo in Navoi

5) Implementation of periodic inspections

At Navoi CCPP-1, intervals of periodic inspection for Gas Turbines (GT) are every 12,000 hours or every 1.5 years for combustor inspection, every 24,000 hours or every three years for GT inspection, and every 60,000 hours or every six years for major overhaul inspection (MI).

Table 2.1.4-5 Items and Contents of Periodic Inspection

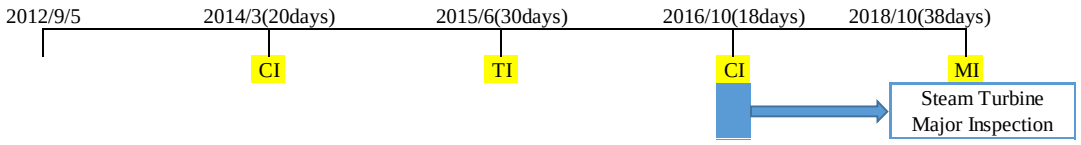
Inspection	Interval of Inspection	Advance procedure	Inspection Items
Combustor Inspection (CI)	Every 12,000hours or Every 1.5 years	Dismantling Combustor basket, transition pieces and fuel nozzle	Visual inspection & NDT*1 of Combustor basket and transition pieces Visual inspection & spark test of ignitor detector Visual inspection of turbine blade row 4 and vane row 1 and 4 Visual inspection of compressor IGB, blade row 1 and vane row 1
Turbine inspection (TI)	Every 24,000hours or Every 3 years	Lifting the upper housing of the turbine	Visual inspection & NDT*1 of turbine blade, vanes and seals Visual inspection of Compressor last row and OGV's blades and diaphragms Combustor inspection is carried out at the same time
Major (overhaul) Inspection (MI)	Every 48,000hours or Every 6 years	Lifting the upper housing of the turbine & compressor, lifting the rotor	Visual inspection & NDT*1 of all components from the flange of compressor inlet casing to the outlet flange of exhaust casing Visual inspection & NDT*2 of rotor and compressor parts Inspection of Auxiliary, Control systems and Instruments shall be carried out during inspection, by staff of power station Combustor inspection and Turbine inspection is carried out at the same time

NDT= Non Destructive Test
*1 Penetrate Test
*2 Penetrate Test, Magnetic Particle Test, Ultrasonic Test

(Source: UE)

Intervals of periodic inspections of the Steam Turbine (ST) are every two years for interim inspection, and every four years for MI.

A Long-Term Parts Management (LTPM) agreement was signed between Navoi CCPP-1 and MHPS, and the structure to respond promptly to cope with problems was established by assigning MHPS TAs at the plant. Meanwhile the TAs concluded that there was no abnormality in the operation data nor any damage to the ST equipment, they suggested to UE to postpone the implementation of ST MI. As the result, UE scheduled the ST overhaul MI to be conducted at the same time as the GT Major Overhaul (MI) was to be implemented in January to March 2018. However, it was postponed to September 2018 due to the peak power demand in winter and other power plant circumstances. The schedule and plan for periodic inspections of Navoi CCPP - 1 conducted so far are shown in the following Figure 2.1.4-7.



(Source: JET)

Figure 2.1.4-7 Schedule and plan of periodic inspections

2.1.4.2 CCPP O&M Management structure in Talimarjan and Turakurgan

(1) CCPP staff assignment at Talimarjan Power Station

At the Talimarjan Thermal Power Plant, which introduced CCPP following to Navoi, 115 persons are in charge of the O&M for 2 UNIT-CCPP. The breakdown of the CCPP staff is as shown in the following Table 2.1.4-6.

Table 2.1.4-6 The Number of CCPP Staff at Talimarjan CCPP

Actual Number of CCPP Staff	Head Unit Manager	Deputy Head Site Manager	Electrical C&I	Operation Staff	Maintenance staff	Service Workers	Chemical Enviroment
115	1	1	30	60	from existing TPP	3	20

（Source: UE）

Among them, the breakdown of the 60 operators is; One shift group consists of 1 shift head, 2 GT, 2 ST, 2 BOP, and 5 patrols. 5 shift groups are reserved. Maintenance staff will be sent from conventional thermal power plants.

(2) CCPP staff assignment at Turakurgan Power Station

For the Turakurgan Power Plant, the human resource development plan in the following table is planned during the CCPP construction period.

Table 2.1.4-7 The Number of CCPP Staff at Turakurgan Power Station

Actual Number of CCPP Staff	Head Unit Manager	Deputy Head of Operation	Engineer Technical	Operation Staff	Maintenance staff	Others, Lab Assistant
67	1	1	4	50	6	5

（Source: UE）

Among them, there are 50 operation staff consisting of “10 shift workers” including “1 Shift Head”, “1 Unit Operator”, “2 Unit Patrols”, “1 Senior Electrician C&I”, “2 Senior Electrician

Electrical", "2 Electrician Electrical" and "1 patrol for Gas Turbine Facility (GTS)", which form "5 shift groups". Maintenance staff are assigned with "2 Fitter Electricians" and "1 Fitter C&I". (Refer to Attachment 12, Turakurgan Personnel). There is no employed staff, because Turakurgan is a new power plant. Therefore special and additional training will be carried out in synchronization with the plant construction later on.

2.1.4.3 Future Development and Directions for Improvement of O&M System of CCPP

(1) Organization for the O&M

Regarding the current maintenance and management system, in order to organize the contents to be handled by each division / department, JET clarified points based on Japanese knowledge, and made proposals for the "Future Development and Directions for Improvement of O&M System of CCPP".

UE and JET discussed this proposals, and these will be aggregated as a manual. (Refer to Appendix 7, No. 4 System for O&M and Manual for Consolidating and Improving Future Regulations)

(2) Restructuring of Scheduled/ Periodic inspection system and establishment of guideline

JET suggested that the periodic inspection system specifying the sharing of roles on the owner side be structured, and the guideline for the implementation procedure be established for smooth implementation of jobs during periodic inspection. It would lead to avoidance of the repetition of similar malfunctions/accidents by error.

UE and JET discussed these proposals to be aggregated as a manual. (Refer to Appendix 9, No. 6 Manual for Safety and Quality Control for Periodic Inspection work and Large-scale Improvement Work)

The UE replied that the contents of the manual created will be "discussed with the maintenance company and manufacturer's TA".

2.1.4.4 Daily Management and Record

The following should be appropriately managed; daily maintenance, planned inspection, periodic inspection, water, chemicals, fuel oils, and expenditure for consumption of fuel etc. Then, it is required to review the correlation with power generation output and efficiency of the generation, and this information will lead the staffs to improve consciousness for effective operation. JET recommended using the following format as a monthly report, as a record for easy checking at a glance.

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Table 2.1.4-8 Example of Power Generation Monthly Report

Monthly Report of Thermal Power Plant (Sample)

Class	Subject for this month to record	Class	Subject for this month to record
Capacity of Plant	Designed generation capacity	Indicator of operation	Maximum load of month
	Available capacity		Minimum load of month
Cost of this month	Consumption of lubricant oil		Power generation (Gross)
	Unit Price of Fuel		Power consumption of auxiliary equipment
	Cost of Fuel		Power generation (Net)
	Unit Price of lubricant oil		Utilization factor
	Debt interest		Availability Factor (Operation Rate)
	Depreciation	Thermal efficiency (specify with HHV or with LHV)	Conversion Factor for HHV of fuel
	Cost of lubricant oil		Consumption of Fuel
	Indirect expenses		Fuel Rate (Gross)
	Maintain cost		Fuel Rate (Net)
Operation situation / UNIT	Times of Starting Operation (Hot, Warm, Cold)		Total calorific value of fuel
	Operating hours from latest periodical inspection		Gross Heat Rate
	Times of Starting Operation from latest periodical inspection (Hot, Warm, Cold)		Net Heat Rate
	Latest periodical inspection final date		Gross thermal efficiency
	Manufacturer's recommended interval of periodical inspection	Shut down record	Date and time of parallel off
	Latest annual inspection final date		Date and time of parallel in
	Cumulative operation hours		outage hours
	Cumulative times of Starting Operation (Hot, Warm, Cold)		Distinguish of Planned/ unplanned/ command stop
	Start date of operation		Reason for suspension in detail

HHV: Higher Heating Value, LHV: Lower Heating Value

(Source JET)

2.1.4.5 Periodic Inspection and Maintenance Components Management

Generally, UE does not conduct parts inventory management to reduce inventory parts and manage tax obligations. However, the delivery date of some hot parts of CCGT takes more than one year, and in some case it influences plant operation because of lack of parts. UE HQ has managed the amount of costs of each plant's parts inventory. Navoi CCPP's part inventory cost is the highest compared to other power plants, because hot parts are expensive. And receiving approval for purchase applications for spare parts is difficult. UE is planning for the installation cumulative 19 units of CCPPs and CHPs, and recognizes that policy and plans for inventory control are the most important issue. The maintenance of hot parts is important for CCGT, so that UE asked for JET to enrich the training subject of "No. 5 Gas Turbine Hot Parts Maintenance". For these requests, JET provided contents for the training materials, about the methods to manage hot parts, and to extend their use period, diagnosing the remaining life, including periodic inspection, and after-sales service by manufacturers.

UE needs to consider inventory management regarding some parts with expected deterioration which influences operation and have a high frequency of deterioration. They have maintenance contracts with manufacturers as one form of periodic inspections, and are considering utilization of maintenance service from the manufacturer for GT hot parts. UE (UE) requested JET to explain the types, advantages, and disadvantages of Long Term Service Agreements (LTSA), and JET explained these also.

In formulation of the maintenance policy, planned implementation will be necessary considering long-term maintenance contracts with relevant manufacturers, and management of inventory repair and spare parts of power stations. Accordingly, it will be necessary to make available case studies of repair experience and maintenance, and to arrange the creation of manuals, guidelines and the technical base related to quality and safety simultaneously. JET proposed the following approach considering with these.

(1) Parts rotation

It's necessary to plan parts rotation in line with the frequency of periodic inspection and maintenance of GT. Although Navoi CCPP-1 is the only CCPP implemented periodic inspection in past in Uzbekistan, JET suggests that sequentially adopting spare parts management, taking repair periods into account with the aim to comprehensively establish parts rotation. The parts rotation plan should not only include parts replacement, but also timing for disassembly, assembly and the plan for parts purchase. After other CCPPs are installed, UE will be able to carry out more effective parts rotation by sharing inventory parts among CCPPs.

(2) Reduction in repair costs

Since the purchase and repair costs of hot parts for GT account for about 90% of the entire repair costs, JET suggests that efforts be made towards reduction of repair costs, other than LTSA. Following Table 2.1.4-9 shows the main improvement points related to reduction of repair costs.

Table 2.1.4-9 Main improvement points for decreasing repair costs

Implementation item	Contents of Implementation
Proper management of lifetime by deterioration survey	To conduct deterioration survey of lifetime for rotor blades, stator vanes, shrouds, combustion parts and discarded items. In case there is room in their lifetime, the cycle of inspection and replacement could be extended.
Regeneration of material organization	The cycle of replacements could be extended by regenerating material organization through regenerative heat treatment (solution heat treatment) or pressurized heat treatment (hot isostatic pressing).
Change in specifications of coating and materials	It is best to cooperate with manufacturer to improve reliability, like as improving alloy coating and change materials of rotor blades.
Installation of upgraded parts	Efforts should be made to improve reliability leading to extension of lifetime and reduction of repair costs by introducing rotor blades, stator vanes in which up-to-date technologies are incorporated. Also, in introducing such parts, compatibility should be evaluated after conducting field tests partially.

(Source: JET)

UE concluded a contract for LTPM for seven years including the long term price guarantee with MHPS, and MHPS dispatches TA for periodic inspection and supply of hot parts and expendables. UE and MHPS approve the purchase of necessary parts (including hot parts), with confirmation from each other during periodic inspection.

Table 2.1.4-10 shows the comparing LTSA contract and contract of Navoi CCPP-1 as follows

Table 2.1.4-10 Comparison of Service items by contracts

Service Item	Contents of contract-LTSA	Navoi
Supply & repair of hot parts	Parts supply and repair shall be conducted before the schedule planned.	○ (LTPM)
Dispatch of Adviser & workers	Advisers and workers shall be dispatched at the Periodic inspection of combustor, turbine and major inspection.	○
Stationing on site of Project managers	Project managers shall be stationed on site to promptly cope with maintenance trouble.	—
Guarantee of periodic inspection days	Working days of Periodic inspection of combustor, turbine and major inspection shall be guaranteed (In case an order is placed to the manufacturer for combustor, turbine and major inspection, etc.).	—
Guarantee of operating rate	Annual operating rate of unit shall be guaranteed (In case an order is placed to the makers for combustor, turbine and major inspection, etc.).	—

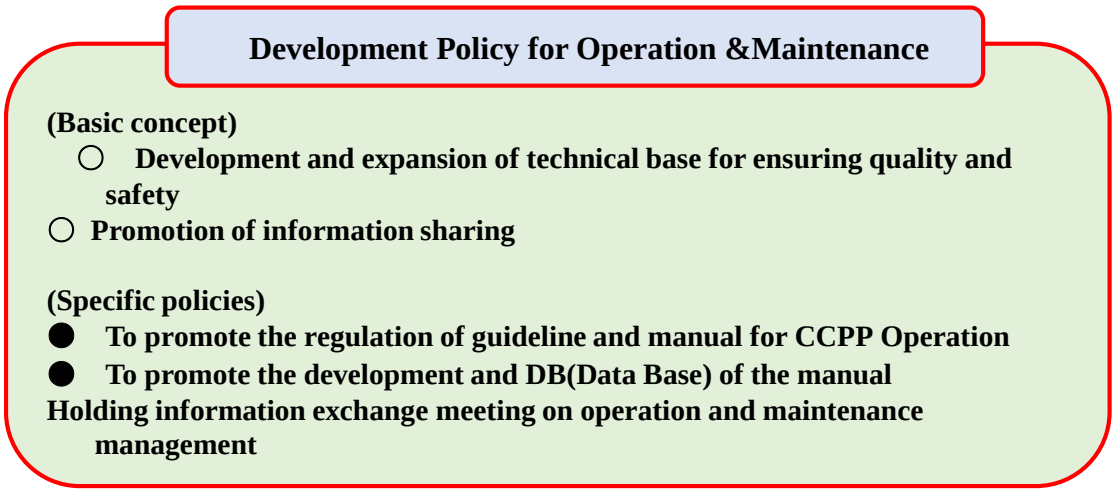
(Source: JET)

* LTSA; Long Term Service Agreement; LTPM Long Term Parts Management

JET explained the necessity of spare parts stock and effective management method in No. 5 Gas Turbine High Temperature Parts Maintenance Training and TOT in Japan. UE deepened its understanding of spare part inventory management and maintenance contracts with the manufacturer, and JET suggested that the UE select the optimal service for it.

2.1.5 Discussion and suggestions for O&M management

JET discussed the "Development of Policy for Operation and Maintenance" with UE, and suggested the establishment of related manuals. (Refer to the Appendix 6/ No.3 Manual for preparation (draft) of Development Policy and Plan for O&M of CCPP) The general directions of suggestions are as follows.



(Source: JET)

Figure 2.1.5-1 Proposal of Development Policy for O&M Standardization

2.1.5.1 Suggestion to prepare Internal Standards/Rules for O&M of CCPP

To ensure security and quality of CCGT and smooth operation of the management of CCPP, JET recommended the establishment and the brush-up of internal regulations. By preparing handbooks etc., it will help staff to be able to quickly refer to standards/rules as guidance. Positive effects of this would include, (i) Enhancing technological capabilities of technicians in leadership position of power plant, (ii) Sharing the knowledge of engineers among leadership positions throughout the power plant, (iii) Easy reference to the information complying with the actual condition of the several power plants.

OMM of Navoi CCGT has significant volumes of information, which comprises over 30 kinds and over 15,000 pages. Although OMM is directly used as training material in Navoi, it is too much volume for staff to utilize. JET proposed that UE make O&M Handbooks, including minimum required content with constantly used reference issues, to be easy to carry and refer to. In addition, JET proposed to collect the latest technical information that cannot be fully handled by existing training centers, and the preparation of regulations such as facility inspection method, facility judgment standards, and security standards.

2.1.5.2 Arrangement and Expansion of Technical Data Base (DB) to Ensure Quality and Safety

JET proposed that a database of guidelines, standard documents, manuals, accident cases etc., be established that can be consulted from anywhere in CCPP within UE group, to promote further information sharing. It is expected to accelerate the accumulation of accident cases and countermeasures, and to accelerate the revision and improvement of standards by sharing DB access with each power plant, business office and head office.

2.1.5.3 Proposal for Information Sharing --- Experience and Knowledge of O&M Management for CCPP

To promote the sharing of information, meetings for sharing O&M information are required to be organized. The information regarding malfunctions is highly confidential and heavy attention needs to be paid to this when sharing. In Uzbekistan the UE power stations operate independently as subsidiaries of UE, and sharing information of malfunctions need to be implemented through UE headquarters. So, it is recommended that meetings for sharing O&M management information be convened by UE HQ.

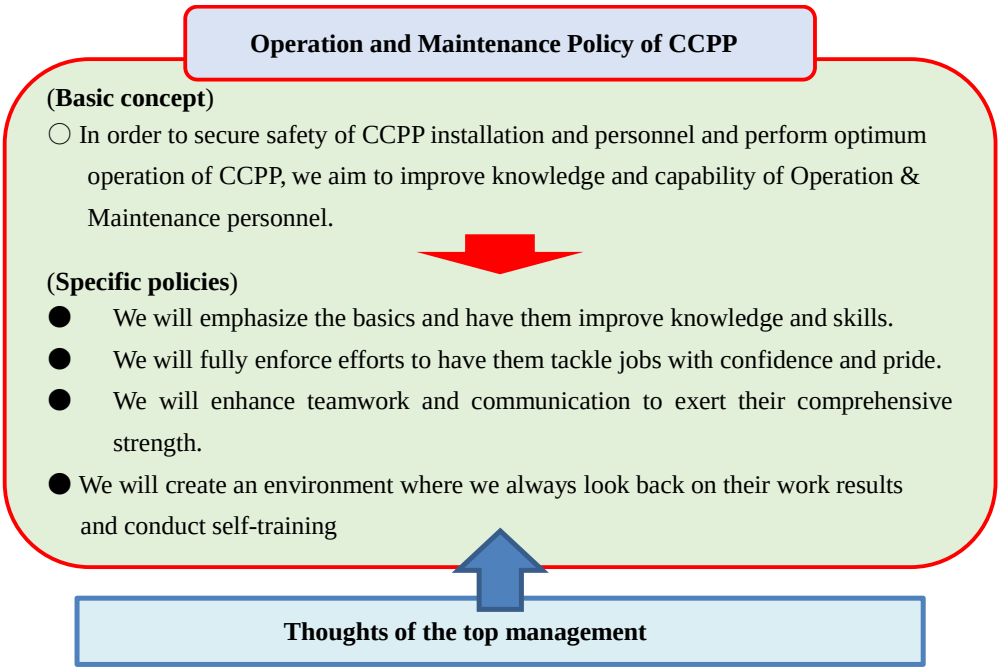
2.1.6 Cooperation for the Internal Regulations for Policy and Plan of CCPP O&M

UE HQ is responsible for promoting the creation of regulations for O&M management policy and planning. The department that manages the operation of the power plants is UE HQ / Power Plants Operation Department. That department takes into consideration the electricity demands across Uzbekistan and handle CCPP as a base load, and manages the arrangement of other power generation at each power plant. Actually, Navoi CCPP-1 and Talimarjan CCPPs are the existing CCPPs, and they need to keep full output as a base load, except for periodic inspections. At this moment, for O&M including periodic inspection of CCPP, it is needed to consider Navoi CCPP-1, Talimarjan CCPP-1&2 and Tashkent CCPP.

By the way, at the periodic inspection in Navoi CCPP, the combustor inspection scheduled in September 2016 was postponed for one month in order to conduct periodic inspections of other existing conventional TPP. In addition, the major overhaul inspection, scheduled for March 2018, was also postponed to October 2018. From these standpoints, JET discussed with the Power Plant Operation Department of UE to deepen their understanding for O&M policy and planning and to implement suitable inspection of CCPP.

The O&M for CCPP is quite different from that for conventional TPP. At Navoi CCPP-1, employees of Navoi have been undergoing O&M training through various opportunities from when construction started, and six years have passed since commencing commercial operation. So, it was decided that the training of the mechanism and functions of CCPP, auxiliary equipment for GTs and its O&M shall be implemented through this Project. Training material prepared in this Project is not only based on EPC training at Navoi CCPP-1 construction, but also includes the information of new equipment for new CCPPs.

More CCPPs are planned to be installed in the future, it is necessary to promote standardization for the communicating and sharing of CCPP O&M policy and planning including periodic inspection. JET proposed a manual for O&M policy and planning, according with the following concept. (Refer to Appendix 8, No. 5 Process Supporting Manual for Development of Draft Rules and Rulemaking for O&M Policy and Plans>)



(Source: JET)

Figure 2.1.6-1 Proposal of O&M Policy for CCPP

2.2 Output2 : Human Resource Development Plan, Training Plan, and Accreditation System of CCPP

2.2.1 Current Status and Issues on Capacity of CCPP O&M Staff

2.2.1.1 Confirmation of Capacity of CCPP O&M Staff

(1) Judging job performance, knowledge and skills of O&M staff

1) Hearing survey on capacities of O&M staff

JET confirmed that the capacity of CCPP O&M staff is appropriate through the hearing survey of job performance of the O&M staff (knowledge and skills). The contents and results of hearing are shown in following Table 2.2.1-1 and Table 2.1.2-2. Interview results are shown in the table. The evaluation of competence was classified into 3 categories, i.e. High: ○, Middle: ∆, Ordinary: X.

Table 2.2.1-1 Interview Results for Capacity of CCPP Operation Staff

Classification	Interview Issues	Evaluation ; Remarks (Competency : ○, △, ×)	
			Explanation
General Items & Common Items	Precautions in operation in general	○	They understand basic rules of chain of command and operate based on reports, communications and directions they receive.
		○	They understand precautions on safe behavior and others.
	Understanding General basic items	○	They understand the key control equipment numbers (Sequence numbers).
		○	They can use tools, jigs & safety protections properly.
Knowledge of disaster prevention	Understanding Dangerous goods High pressure gas & chemicals	○	They understand characteristics and handling of dangerous goods (NG, etc.), high pressure gas (ammonia, etc.) and industrial chemicals.
	Understanding handling disaster prevention equipment including firefighting equipment	○	They understand installation purpose, structure & operating methods of disaster prevention equipment including fire extinguishing system.
Handling of electricity	Understanding operation of power sources	○	They operate switching-on/-off of power sources of auxiliaries (Metal-clad, Power Center and Control Center) keeping safety in mind.
		○	They can safely measure insulation resistance and decide on abnormality of measured values.
Various devices & equipment	Understanding the main engine & auxiliary system and installation purpose and structure of equipment	○	They understand the main engine and auxiliary system.
		○	They understand the installation purpose and can decide that any equipment is in operation and shutdown by normal valve structure.
		○	They understand difference in type & structure and function, and characteristics of each equipment.
	Early detection & prevention of expansion at times of abnormality	○	They understand purpose, focal points & condition monitoring of patrol inspection to achieve early detection and prevention of expansion at times of abnormality.
	Understanding normal status and abnormal status of auxiliaries & main engine	○	They comprehend vibration, temperature, noise and readings within the normal range and can decide conditions in and out of the range utilizing auscultation bar, etc.
	Understanding protective device of auxiliaries & main engine	○	They understand the limit values and warning values.
		○	They operate with the understanding of types & systems as well as warning values and activating values of protective devices.
	Understanding and operation of starts, stops & switching operations of auxiliaries and main engine	○	They operate with the understanding of starts,& stops as well as switching operation of auxiliaries and main engine, and function confirming tests.
	Understanding responsive operation, precautions and key points in case of abnormality in auxiliaries and main engine	○	The understand responsive action to take and precautions and key points in case of anbnormality in auxiliaries and main engine. ※ As for CCPP, because they are required from UE (HQ) to basically operate with maximum output under the instructions “to preferentially operate more efficient types of equipment,” they seldom have an opportunity to conduct normal start-up and shutdown operations. Also, due to decreasing accidents in installations, they have fewer opportunities to take responsive actions.

(Source: JET)

Table 2.2.1-2 Interview Results for Capacity of CCPP Maintenance Staff

Classification	Interview Issues	Evaluation ; Remarks (Competency : ○, △, ×)	
			Explanation
General items	Understanding and observing matters to be attended to in maintenance work, execution of works, etc.	○	They carry out their jobs with the understanding of the importance of work communication and procedure and the proper way of a works observer.
	Understanding of necessity of managing equipment specifications	○	They understand necessity of equipment specification management. ※Because They has not experienced improvement work of equipment at Navoi, They has no opportunity of maintaining it.
	Understanding of management of maintenance records	○	They understand necessity of management of maintenance records and are capable of performing maintenance. They keep records of malfunction, pending matters, inspection, accidents, etc. of equipment (excluding spare parts & accessories). ※ Since a different way of thinking across the year in the UE, it is difficult to purchase spare parts and accessories.
	Understanding of necessity of drawing management	○	They understand necessity of drawing management
	Understanding of necessity of having spare parts, items in possession and their managing method	○	They take hold of possession status of spare parts and accessories and decides whether the quality of an item is good or not. ※ It is determined in consultation with the manufacturer.
	Whether capable of patrol inspection and extraordinary inspection	○	They understand purpose of inspection and determine abnormality to carry out his job.
	Whether capable of conducting periodical inspection	○	They perform their jobs with the understanding of purpose and method of regular inspection. ※ It has been carried out in accordance with the instruction and consultation by the manufacturer.
	Whether capable of gauging control	○	They understand gauging control and are cabable of such control. They also understand importance and necessity of precision control and perform work. ※It has been confirmed to the manufacturer.
Works plan	Whether capable of doing paperwork	○	They perform their jobs with the understanding of the aim of works plans, timing to perform works, etc.
	Whether capable of deciding necessity and timing of performing works	○	They decide on the necessity of works plans, the timing to perform works, etc. for the equipment they are in charge. ※ Power plant will wait for Instructions from the Grid
	Whether capable of reflecting details of maker's recommendations (proposed improvements, etc.) to works plan	○	They are capable of simlpy consider whether or not to adopt maker's recommendations for each equipment, taking into account the current deterioration and malfunction status of the equipment. ※ It is determined in consultation with the manufacturer
	Whether capable of reasonable planning of works to be performed imultaneously with other large-scale works	○	They perform jobs by planning work concentration in line with the timing of other large-scale work. ※ It is determined in consultation with the manufacturer.
	Whether capable of establishing minimal works scope	○	They take hold of equipment status and work environment and carries out his work by establishing work scope. ※ It has been confirmed to the manufacturer.
Works designing	Whether capable of estimating works cost	○	hey are capable of estimating work cost in accordance with the work estimation rule.
	Whether capable of selecting materials under the conditions of use	○	They carry out their jobs, selecting materials based on structural drawing, working drawing, etc. of the equipment.
	Whether capable of selecting necessary working equipment	○	They carry out their jobs, selecting working equipment to efficiently perform normal work. ※ It is determined in consultation with the manufacturer.
	Whether capable of estimating lean amout of materials from work plans, drawings, etc.	○	They are capable of extracting amount of materials based on equipment structure, work drawing, etc. ※ It has been confirmed to the manufacturer.
	Whether capable of drawing a critical path for the relevant works	○	They are capable of adjusting relevant work which does not affect critical processes. ※ It has created in consultation with the manufacturer.
Works execution	Whether capable of preparing works plan incorporating work procedure and works system	○	They are capable of carrying out their jobs, preparing proper works plans (operating manuals). ※ It has created in consultation with the manufacturer.
	Whether capable of deciding and using proper tools and measuring devices	○	They are capable of selecting necessary tools and measuring devices to use them. ※ It has been confirmed to the manufacturer.
	Whether capable of adjusting installation (equipment)	○	They are capable of understanding structure and performance of installation and adjusting equipment based on maker's advice.
	Whether capable of deciding any work is being performed in accordance with specifications	○	They are capable of making technical decision on whether the required points described in the specifications during the working process are properly performed. ※ It has been confirmed to the manufacturer.
	Whether capable of preparing Test Operation Manuals	○	They are capable of preparing manuals based on the existing Test Operating Manual. ※ It has created in consultation with the manufacturer.
	Whether capable of deciding abnormality from records	○	They are capable of deciding abnormality of any equipment from the phenomena such as abnormal noise, abnormal smell, vibration, etc. ※ It has been carried out in accordance with the instruction and consultation by the manufacturer.
Response to trouble	Response to small trouble	○	To cope with trouble, They are capable of preparing repair plans making use of shutdown of the relative unit.
	Response to big trouble	○	The manufacturer's TA gives advice how to take countermeasures, during periodic inspection. Although there were many equipment troubles at the initial stage of the plant operation, currently there are few cases of emergency responses to any trouble of Gas turbines, Gas turbine controllers and Steam Turbines. Also, because there are less periodical inspections of Gas turbines, in OJT there is a lack in experience required for maintenance personnel to acquire professional skills.
	Whether capable of deciding when to take countermeasures	○	They are capable of deciding malfunction status and report comments. ※When it is first trouble with no experiences, staff have ability to consult with the manufacturer, and responds."

(Source: JET)

JET pointed out that it is important to pay attention to long-term perspectives so as to not create gaps in the experience and age composition of the staff when considering staff assignment. Table 2.2.1-3 shows the staff composition with regards to age and education level.

- The number of working staff of CCPP up to the age of 30 is 57, accounting for 70% of CCPP staff.
- The number of university graduates is 58, accounting for 72% of CCPP staff.
- The average age is around 33 years old.

Table 2.2.1-3 Staff structure Composition of Navoi CCPP-1 (As of August 2017)

	Actual Number	High School Graduator	College University Graduator
Up to 30 years	57(70%)	23(28%)	58(72%)
Up to 40 years	21(26%)		
Up to 50 years	3(4%)		
total	81		
Average Age	33 years	—	—

(Source: UE)

2) English ability of Navoi CCPP-1 Staff

JET also confirmed the English ability of the O&M staff.

(a) Engineering-Technical Staff and Operating Staff

Because PC displays in Central Control Room are in English, the staff can read English, but there are limited number of staff who can speak English.

(b) Maintenance Staff

Most of the maintenance staff can neither read nor speak English.

Currently, the maintenance staff routinely use English and Russian documents which were submitted by manufacturers at the time of construction.

3) Level of O&M staff for PC experience

All the O&M staff at Navoi CCPP-1 use Word, Excel and Power Point.

(2) Issues

JET pointed out the following items as issues and measures for improvement to better the capacity of O&M staff.

1) Education and training for troubleshooting of the unit by utilizing the newly-installed simulator

JET recommended that training with a simulator, a combined type of a typical unit, be provided to cope with the case of an emergency of the unit. It is most effective for improving the skills of operators in “normal starts and stops of the unit” and “troubleshooting of the unit”.

(a) At a newly-installed or recently-built plant, there will be a higher reliability of such installation, and less frequency of trouble occurring along with continued stable operations. As a result, the operators cannot be expected to improve their operation technology through actual experience, such as by start-and-stop operations and in taking actions to avoid trouble.

To cope with such situations, mock operation training of the operators with simulators and programming with engineering tools will enable them to similarly have such an experience, and it can consequently contribute greatly to the actual operations by such the

operators. On the other hand, the maintenance staff will also have fewer opportunities to experience trouble and they will have no chances to implement the programs for themselves; as a result, the operations may become “a black box” for them so that there should be many cases where they entrust trouble-shooting, alterations, etc. to the manufacturers. Troubleshooting is also useful for the development of instructors and maintenance staff. Therefore, it is very important to effectively utilize simulators for training purposes, and it is essential to develop systems and implementation procedures to put them into practice efficiently, so JET proposed as following 2 points.

(b) Improvement of professional skills of C&I staff and maintenance staff with training using maintenance tools

The GT is controlled by MHPS’s “Netmation” control system. The GT operates under “Netmation Logic” and is monitored from “Netmation Operation Graphic”. In the case of any GT trouble, GT operations need to be changed, so the “Netmation Logic” or “operation graphic” needs to be changed immediately. In order to improve the professional skills of maintenance staff, JET proposed training with maintenance tools. Also, it is useful for C&I engineers to enhance his/her knowledge and skills. Training is carried out with same maintenance tools of the GT controller.

a) Maintain the control logic and operation graphic:
   - Create/Edit the control logic and operation graphic.
   - Display the list of control logic and operation graphic.

b) On-line tuning and monitoring:
   - Online monitoring the control logic.
   - Online tuning the control parameter.
   - Display the real-time trend.

c) Establishment of an inventory parts management system using IT to promptly cope with accidents: Effective inventory management

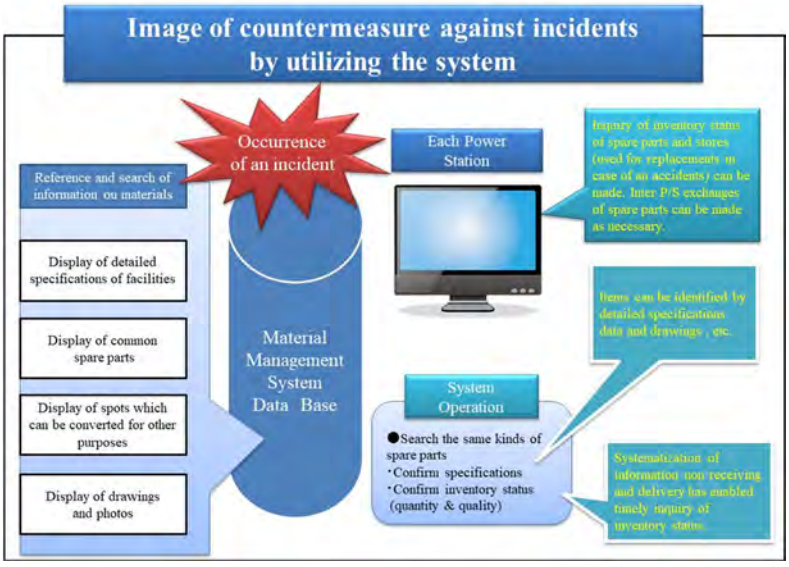
JET suggests that parts management system, which is unified management by a small number of staff of inventory information, such as a variety of spare parts in large quantities, should be established. With this proposed system, it is possible to conduct facility maintenance work efficiently by sharing information company-wide, and enables prompt searching for or diversion of items in case of an emergency.
The Main Use. DB System structuring duration and examples of utilization of DB> are as follows, and an image of incident countermeasures are shown in the following Figure 2.2.1-1.

＜Main use＞
- **Prompt checking of materials in case of an accidents ; Prompt recovery by diversion.**
- **Unified management and sharing of a variety of materials (spare parts, stores, accessories, maker’s information on stocks, etc.) kept in shop.**

The material managing system shall also be introduced to CCPP. (Such systems have already been introduced to the existing TPP.)

＜System structuring duration＞
- **The duration necessary for the material management system structuring is estimated arround10 months.**

＜Example of utilization＞
- **In case No.1 bearing is damaged, whereabouts of the spare parts will be prompt grasped.**



(Source: JET)

Figure 2.2.1-1 Image of incident countermeasures

2.2.2 Current Status on Human Development Plan of CCPP O&M Staff

In Japan a human resource development plan is usually not planned for a single fiscal year but for multiple years, leading to the development and promotion of individual staff. On the other hand, the UE's plan is not systematically organized. It is difficult to compare the Japanese system with UE's.

At present training of CCPP is implemented at Navoi CCPP only for inside Navoi, it is not easy to train except for Navoi CCPP's staff training. In this situation, other new CCPP staff participate in the training on-site (OJT) in Navoi before launching the new CCPP. For another solution for the launch of new CCPP in Tashkent, the Navoi O&M staff participated in the commissioning of Tashkent CCPP and trained the Tashkent staff with trial operation as OJT training. While developing future O&M staff considering the necessary number of staff, the current system does not have enough trainers who could train for the CCPP program, and that is reason for the start this project. It is necessary to develop a human resource development plan that takes into account the number of necessary staff and trainers with regards to the CCPP construction schedule.

At Navoi TPP, current training related to CCPP is mainly based on the EPC training of the manufacturer, using the manufacturer's O&M Manual (OMM) as the teaching material, and OJT is also being carried out. A systematic training system in the entire UE, such as for conventional thermal power generation, has not been established for CCGT. Japanese electric power companies develop human resources emphasizing "milestones of human resource development." It includes the thought of "Targeting the level to which staff will be trained, and the timeframe for when this will be achieved by implementing OJT" which is the basic condition when considering human resource development. JET have confirmed that UE's methods of human resource development through OJT are different from those employed by Japanese electric power companies, such as that described above.

(1) Human resource development plans through OJT at Navoi Power Plant

The annual human resource development plans (training plans) are prepared by the Human Resource Department at Navoi TPP. The Human Resource Development Division consists of 5 staff numbers. Also, human resource development is implemented after the training plans through OJT are established and budgeted. In the organization of the system of the Human Resource Development Division, the roles of staff members are as shown in the following Table 2.2.1-1

Table 2.2.2-1 Staff and roles of human resource department of Navoi TPP

Human Resource (HR) Department / Navoi TPP	Functions and Duties
Head of HR department (1 person)	Organizes activities of HR
Engineer on perspnnel training (1 person)	Recommends on capacity building aspects
Engineer on internal processes (1 person)	Makes calculation, turnover of staff, pension issues
Senior inspector (1 person)	Translation of documents, preparation of Orders, registration and follow up of leave (holiday, etc)
Engineer on work with professional colleges (1 person)	Build cooperation with industrial college, ensures contribution into curricula of college training, ensures/facilitates practical time for college students

(Source: UE)

1) Engineer for staff training

The engineer for training is in charge of keeping training records, dispatch of trainees and staff management. Routine and regular trainings are carried out for cost reduction, improvement of efficiency and safety measures, etc. to operate and maintain power plants. Uzbekenergo HQ issues the instruction document as “to receive training every 3 to 5 years” and the engineer for training checks the track records of the training. After the project completion, they will be also in charge of the monitoring and evaluation system of training at NTC.

2) Internship

University students, i.e. from Navoi State Mining Institute, Tashkent State Technical University, etc., who have the intention to work at Navoi CCPP, participate in one year internships at Navoi CCPP-1, and then endeavor to acquire professional qualifications such as English and computer technology at their universities.

3) Annual education costs

As shown in the following table, retraining costs for Engineer and Technical Staff increased greatly in 2015. In light of future expansion of new CCPP units, Navoi TPP are conducting re-training of O&M staff, i.e. utilization of human resources.

Table 2.2.2-2 Project Estimation of Expenses for JSC Navoi TPP
Staff Qualification and Training for 2013-2015

(Unit : Thousands so'm/Сум)

No.	Name of Article	2013	2014	2015
1	Professional Training New Workers	24,863.4	20,494.7	16,152.8
2	Retraining of Workers	36,627.8	41,755.0	46,228.0
3	Retraining of ITR (ITR = Engineer Technical Personnel)	11,256.0	9,151.3	25213,12
4	Payment for Training of STC (Staff Training Centre) under JSC“Uzbecenergo”(Workers and ITR)	13,378.4	11,351.3	11,286.1
5	Obtaining and preparation of visual benefits and TCO	2,000.0	-	4,000.0
	Total	88,125.6	82,752.3	102,880.0

(Source: UE)

(2) Method of human resource development

The ranks of staff for promotion in the O&M Division at Navoi CCPP-1 is shown in the following table.

Rank	Operation Dept	Maintenatce Dept	Notes
-	New Employee		※1) Workers Class is up to Rank-6.
1	Patrol	Worker※1)	※3) Senior will support his superior manager.
2	Operator		
3	Senior Operator※3)		
4	Shift Manager		
5	Technician Engineer※4)		※4) Engineers are in charge of safety & quality control jobs
6	Leading Engineer	Maitenance Master※2)	※2) The Maintenance Master, as the manager at the same level as engineers, is responsible for repair process, administration, documentation, etc., and manages workers.
7	Unit Deputy Operation Manager	Senior Master※3)	※3) Senior will support his superior manager.
8	Unit Manager※5)	Site Manager	※5) Unit Manager is usually appointed from the operation department
9	-	Maintenance Unit Deputy Manager	
10	-	Unit Manager※5)	

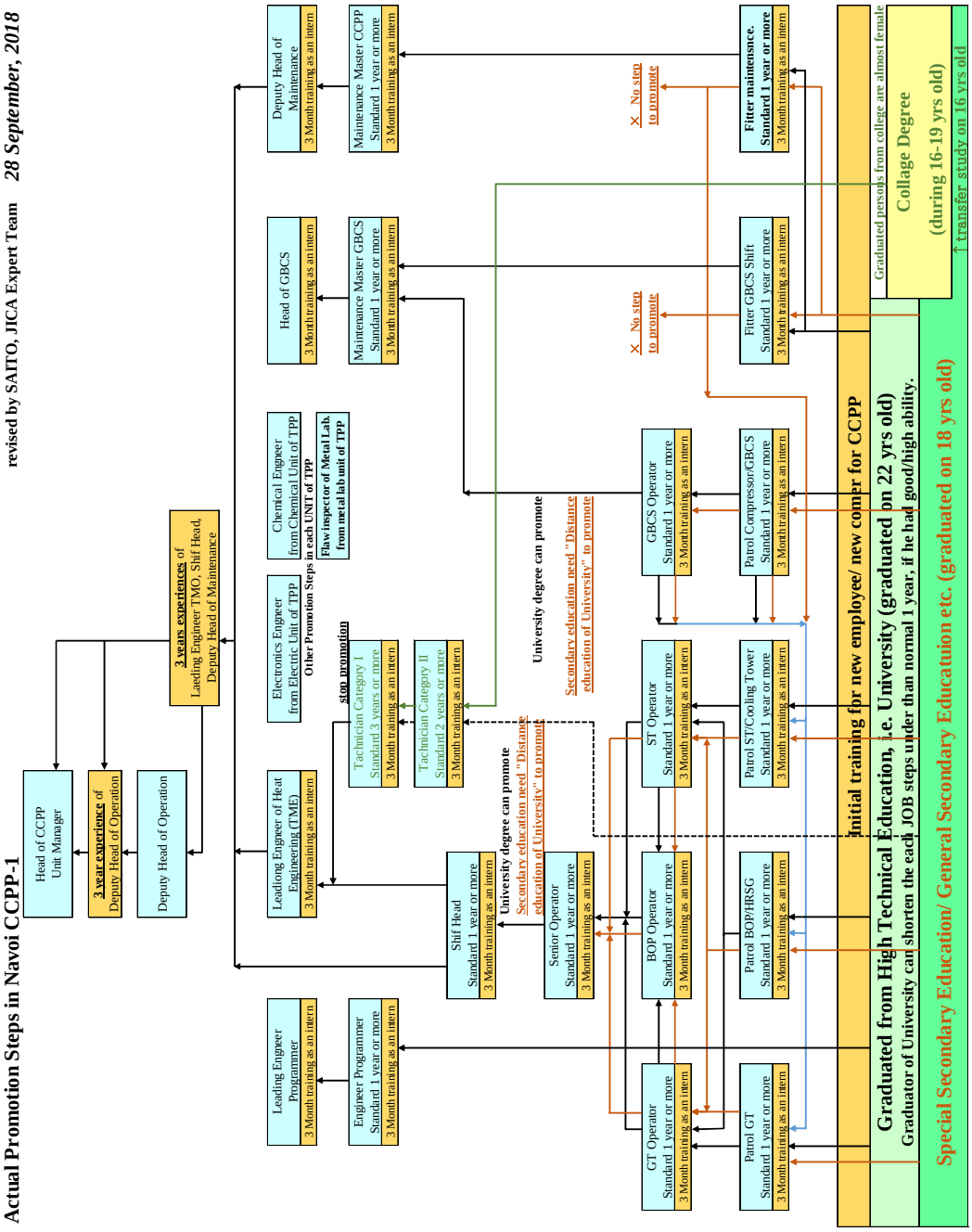
(Source: UE)

Figure 2.2.2-1 Staff ranks in O&M division of Navoi CCPP-1

For many years, human resource development for O&M staff at Navoi Power Plants has been carried out through OJT based on the following training curriculum.
For example:

1) Newcomers first undergo a medical check-up, and then their assignment is made to various divisions, such as the Operation Division or Maintenance Division, as a result of a staff interview. (Employment position and affiliation will take into consideration their experience and career path)
2) O&M staff assigned to each division shall be trained with internship training for three months maximum. Senior staffs observe and evaluate their performance, and those who pass an oral certification test can proceed to duplication training. Duplication training is “receiving training on troubleshooting of equipment with attendance of more senior employees”.
3) After finishing the 12-day duplication training, newcomers shall take the certification test. The O&M staff who pass the test can get a job as regular staff.

Regarding the relation between specific organizational promotion steps and training education, this is shown in Figure 2.2.2-2, which was made based on the interviews from Figure2.1.4-2.



(Source: JET)

Figure 2.2.2-2 Promotion Step for Navoi CCPP-1 Staff

An internship period of 3 months is established for every promotion step, and training necessary for duties is set up.

(3) Acquire internal qualification (position)

At Navoi TPP, staff takes a qualification test to obtain internal qualification as follows.

- Qualification Test Site
  2 sites; i) CCPP Unit, ii) TPP Unit
- Staff covered by the test
  (a) CCPP Unit

a) Operation Division : Person in charge placed in blue-colored position described in above Figure 2.2.1-1.
b) Maintenance Division: Person in charge placed in orange-colored position described in above Figure 2.2.2-1.

(b) TPP Unit: Person in charge placed in red-colored position described in above Figure 2.2.2-1.

- Completion of Training

The annual training curriculum at Navoi CCPP-1 is implemented in the following 3 categories, namely, 1): Newcomer training, 2): Periodic training and 3): Unplanned training. Staff who passed 1) & 2) receive a signature indicating their qualification on their ID Certification Cards. If any person has and higher result from training and if there are vacant positions of a higher rank, he can be promoted to it. (The ID card is described in detail in Section 2.2.4)

1) Newcomer training

Newcomers are required to attend training (as seen in following Table 2.2.2-3), and upon completing the training, they are certified as O&M staff.

Table 2.2.2-3 Scheme for the training of a newcomer

Measures	Timing/period
Medical check up of the health condition of a newcomer	3-4 days
Workplace/ laborer safety, Fire-prevention	15 min. plus guidelines for reading
Initial briefing at workplace	15-20 min.
Admission for internship	15 min.
Internship	Max 3 months
Knowledge check-up	3 days (by pc-based testing and interview by Commission at TPP or CCPP
Duplication	12 days
Emergency and fire-control training	Max 2 days
Admission to independent work	2 Months
Check-up of knowledge on Technical safety	Every year Or in case of good results and knowledge it will be checked every 3 years
Testing knowledge on operation and fire-safety	Every year Or in case of good results and knowledge it will be checked every 3 years
Attestation/testing the level of knowledge in relation to the position hold by a person	Once every 3 years
Capacity building	Once a year attends a month training
Training for a new position	Decided by superior manager of a person

(Source: UE)

(a) Qualification test after the completion of an internship :

Certification after the completion of an internship will be conducted by the test certificate committee of unit.

a) Eligible staff to be judged by Unit Certificate Committee are
Patrol Staff & Operator Staff for Operation Staff;
Worker staff ranked No. 2 to No. 6 for Maintenance Staff.
b) Test items are, <a. Safety measures b. Disaster-preventing measures c. Pressure vessels/Piping, d. Duties related to each job description, etc. >
c) Unit Certificate Committee certifies the completion of training (committee details are described later in provision (4) below)
d) Staff who pass the test receive a signature on their ID Cards to certify completion of the internship, with schedule of a test for the next step.

(b) Recognition of qualification of senior staff by overall TPP Certificate Committee:

a) Eligible staff are higher than Engineer of Operations or Master of Maintenance.
b) TPP Certificate Committee certifies the completion of training (committee details are described later in provision (4)).
c) Those who passed the test have their ID cards signed for accreditation

(c) Skipping system

O&M staff who joined the company after obtaining qualification as an IT Engineer, Electronic Engineer, etc. in universities can be put in positions such as Engineers in IT and / or Electronic Division, etc., if they passes the Internship Completion Test of the Power Plants.

2) Periodic Training

O&M staff at Navoi TPP are trained based on the training program determined every year, and their ability is confirmed by an oral test to verify their understanding.

From the rules listed in Table 2.1.3-3 in 2.1.3, selected individual training programs are listed and summarized in the following table. The targeted trainees are similar to those in point (3) 1) (a) above, and there are group training and personal learning items. The periodic training is shown in the subsequent Table 2.2.2-4.

Table 2.2.2-4 Regular training items for O&M staff at Navoi TPP

＜Training Program of Navoi TPP (Feb.24,2016)＞

No.	Items	Remarks
1	Logbook on testing knowledge on RTS(rules on technical safety),RFCS(rules on fire control safety),RM(rules on maintenance)	—
2	Production-economical and continuing training program of the operational of CCPP Unit for 2015~2016 year	Contents : 1. A theoretical course of technical skills -28hours 2. Labor protection and Safety Technique -10hours 3. Study of economical matters -10hours 4.Fire-technical qualifications -12hours
3	Program for individual training for Mechanic of gas turbine equipment at CCPP	Number of hours : Totally 160 hours
4	Program for individual training for Inspection Engineer on Boiler Equipment at CCPP	Number of hours : Totally 140 hours
5	Program for individual training for Inspection Engineer on ST at CCPP	Number of hours : Totally 160 hours
6	Program for individual training for Operator of ST	Number of hours : Totally 160 hours
7	Program for individual training for Shift-Head of Unit of CCPP	Number of hours : Totally 42hours
8	Program for individual training for Auxiliary Equipment operator (BOP operator)	Number of hours : Totally 160 hours
9	Curriculum of continuing production and economic training of operational staff of Navoi TTP for 2014～2015	—
10	Program of individual training of GT operator	as sample (there are main positions where such training program is available)
11	Program of individual training of GT equipment patrol	—
12	Training and capacity building for the staff of Navoi TPP for 2015 (Plan)	—
13	Measures for organizing training for Navoi TPP JSC for 2014-2015	this reflects maintenance staff training

(Source: UE)

(a) Collective training / Group training for shift workers of Navoi CCPP-1

No. 2, “Production-Economic and Continuing Education Program of the Operational Staff of CCPP Unit” in Table 2.2.2-4 is collective training.

a) Trainee; Operation staff; Rank 1 - Rank 4 (see Figure 2.2.1-1)
b) Trainer; Deputy Manager/ Leading-Engineer/ Technician class
c) Implementation schedule; monthly 5 times/ 1 hour each (from 4 p.m. to5 p.m.)
d) Actual Participants; Shift Staff, 11 staff after day shift (see Figure 2.1.4-3; In Navoi CCPP-1, i.e. 55 staff members in Table 2.1.4-2, are the target trainees and are scheduled for each shift)

The content of the training is the educational program in four fields which is revised every year, shown in the following Table 2.2.2-5.

Table 2.2.2-5 Economic and Continuing Education Program

No.	Training Subject	Number of Subtitle	Study hours	Number of Teachers
1	A theoretical course of technical skills.	17	28	4
2	Labor protection and Safety Technique	8	10	3
3	Study of economical matters	5	10	2
4	Fire-technical qualifications	8	12	3

(Source: UE)

Although three fields, except for theoretical course No.1 in above Table are treated as the contents of training for CCPP, it is thought that these are included in the OJT of conventional thermal power generation. The department corresponding to the content of the lecture is in charge of the lecturer. Since the content of the training No. 1 in Table 2.2.2-5 is based on the manufacturer's OMM, it does not cover the work contents of CCPP. Therefore in this project, training No. 1 cannot be admitted as compatible as a baseline of systematic training of CCPP. The detailed contents of No. 1 of Table 2.2.2-5 are shown in the following Table 2.2.2-6.

Table 2.2.2-6 Detailed table of No. 1, A theoretical course of technical skills

№	Training Title	Hour
1.1	Features and operation of Steam Turbine TC-2F-40.5.	2
1.2	Auxiliary equipment of the steam turbine.	1
1.3	Features and operation of gas turbine M701F4	2
1.4	Auxiliary equipment of the gas turbine.	1
1.5	Features and auxiliary equipment of HRSG.	2
1.6	Exploitation of the HRSG.	1
1.7	Exploitation of the CCPP's saturating pumps.	1
1.8	Exploitation of the CCPP pumps.	2
1.9	Exploitation of the pressure vessels.	2
1.10	Exploitation of the CCPP drums.	1
1.11	Exploitation of the central thermal systems of the CCPP.	2
1.12	Requirements of the state inspection "Sanoatgeokontelnazorat" to the pipe-lines and vessels.	1
1.13	CCPP gas facilities exploitation.	2
1.14	Exploitation of the auxiliary equipment of CCPP.	2
1.15	Starting and stopping features of CCPP.	2
1.16	Heat scheme, working principle and construction of CCPP	2
1.17	Study of the orders about violating the requirements to the main constructions of the station and requirements regarding exploitation.	2

(Source: Navoi TPP)

(b) Individual Training Program for each occupation

No. 3 to No. 8, and No. 10 in Table 2.2.2-4 are training programs categorized by job, which trainees can complete by taking the necessary courses for each job and passing the certification exam. (Refer to CD-ROM data in Appendix 32; Individual Training Program). Contents of the training programs obtained for "Operator GT", No. 10 in Table 2.2.2-4, is shown in following Table 2.2.2-7.

Table 2.2.2-7 Example of individual training program for GT Operator

No	Themes	Hours
1	Basic information on the production and organization of the workplace. Duty regulations of the GT operator	8
2	Safety, industrial hygiene and fire safety in the shop of CCGT CS. Facility regulations and safe operation of vessels, pipelines and gas facilities.	16
3	GT flow charts and its auxiliary equipment	24
4	Construction and principle of operation of the main and auxiliary GT equipment	32
5	Startup, service and stop of the main and auxiliary GT. An emergency stop of the main and auxiliary equipment of GT.	32
6	Information from the electrical engineering. Cooling service of the GT generator and seal oil system of the generator.	16
7	ACS (automated control system) TS, technological protection and blocking of the gas turbine.	24
8	Ways of conducting economic mode of the main and auxiliary equipment of GT.	8
9	TOTAL	160

(Source: UE)

(c) Self-study/ training

As described in section 2.1.3.1 - (3), the training is implemented every year about the ”Company Standard” and "Job Description" corresponding to each job category, as self-study/ training of Navoi CCPP-1. The results of the learning are confirmed by a recitation or memorization examination. In the first year after being in charge of a job, the Certification Committee of TPP, composed of experts in the power plant, carries out a test. After the second year in charge, the direct supervisor conducts the test. At first, JET requested to edit the 12 courses of this project into the job description, but as described in 2.1.3.1 (3) 2), it is difficult to revise Job Descriptions. So, the Project discussed and promoted the equivalence to individual training programs as described in 2.2.2.1 (3) 2) (b).

(d) Collective training for Engineer-Technicians

The training for senior staff of Navoi CCPP - 1 is implemented based on the collective training program “Production-Economic Training Program for Engineering Technicians for the CCPP Unit” in Table 2.1.3-3, which is revised every year. Because training is 22 hours in total, training is divided into multiple lectures. The manager (Head of CCPP / i.e. Mr. Ikhtiyar Abdullaev, at present) is in charge of the training. Table 2.2.2-8 shows the concrete training contents of Navoi CCPP-1 2015-2016.

Table 2.2.2-8 <Economical and production training program of Engineer-technicians for CCPP Unit> for 2015-2016

№	Topics	Hour
1	Study of the "Labor protection" law of Republic of Uzbekistan.	1
2	Study of "Internal labor orders of Navoi TPP"; "Rules of organizing work with personnel"	2
3	Technical-economical indicators of the station.	2
4	Technical features of the main and auxiliary equipment of CCPP Unit.	1
5	Maintenance of turbines and HRSG of CCPP Unit.	1
6	Work order system. Organizational and technical measurements during repair of the equipment.	2
7	Safety technique rules in exploitation of heat-mechanical facilities.	2
8	Operation of CCGT Unit equipment on economical mode.	2
9	Study of all violations of the production instructions, accidents and orders which took place in State JSC "Uzbekenergo" during 2014-2015 years.	1
10	Electric and heat energy for our own needs. Production and transfer of the electric and heat energy.	2
11	Rules of using electric and heat energy. Number 245 decree of the cabinet of ministers dated on 07.04.2010	2
12	Repeating study of PP-56 and RH-34-114.	2
13	Regulations for registration and verification of the accidents.	2
	Total:	22

(Source: UE)

The contents includes 5 categories: Safety-related: Nos. 1, 2, 7; Economic operation: Nos. 3, 8; Technical related: Nos. 4, 5, 6, 10; Incidents: Nos. 9, 13 and Directives from higher organizations: Nos. 11, 12. Contents should be the latest information every year for senior staff to manage CCPP.

a) Trainee: Senior staff of operation, excluding ranks 1 to 4.
b) Trainer: Unit Manager, i.e. Ikhtiyar Abdullaev
c) Implementation schedule: One hour every Wednesday
d) Actual Participants: Substantially,17 staff are eligible as trainees at Navoi CCPP-1
e) Certification: Certificate Committee of entire Navoi TPP

3) Unplanned Training

This is training conducted for staff who have caused operational trouble or equipment incidents while performing their duties due to human errors, etc. Those who pass the examination will keep their current positions, otherwise they will lose their positions. However, there is an additional examination for those who failed it.

(4) Evaluation and confirmation of training

The training result in Navoi TPP is confirmed and certified by the certificate committee (Table 2.2.2-9), which evaluates the comprehension of the training contents based on the training program. The examination is conducted on an oral basis.

Those who pass the examination will receive an authorized signature on their ID cards for accreditation. If there is any vacant position, suitable staff from certified staff will be promoted. The Certification Committee consists of examiners/evaluators. Members of committees and position are shown sin the following table.

Table 2.2.2-9 Members of the Certification Committee

Committe of UNIT/ CCPP		Certificate Comitte of TPP	
Position	Person	Position	Person
Unit Manager	1	Director	1
Unit Deputy Manager	1	Chief Engineer	1
Technician Engineer	1	Head of Human Resources Development	1
Maintenance Master	1	Inspector of Safety Technique	1
		Inspector of Fire Safety	1
		Inspector of “Sanoatgeokontehnazorat"	1
		Operation Inspector	1
—	-	Unit Manager of CCPP	1
TotalNumbe of person	4	TotalNumbe of person	8

（Source: UE）

(5) The promotion roadmap for staff of CCPP-1

The promotion roadmap of O&M staff is described in section 2.2.6.3.

2.2.3 Current Status and Issues on the Training Plan

At UE, the training plan of the staff is formulated for each year, on the other hand, mid-term to long term training plan is not prepared. Specifically, UE formulate an annual business plan for the entire electric power sector every year, which includes a training plan with number of trainees to be trained.

The training for conventional thermal generation technologies is implemented in the existing TTC. JET obtained the 2014 training course plan, the 2015 training course plan and the 2016 training course plan. (No. PP355 dated 5.11.2013 for 2014, No. PP316 dated 13.10.2014 for 2015, and No. PP458 dated 2.11.2015 for 2016; Refer to Appendix No. 30, List of Collection Data). Training courses are more than 100 annually, and the courses for conventional thermal generation technologies are 25 subjects with 50 courses. In the annual training of 2014, 25 subjects were related to thermal power technologies and 15 subjects with 22 courses were related to the important technologies. (Refer to Table 2.2.3-1)

Training for conventional thermal generation at the existing TTC are described in Section 2.2.5.1, and training of CCPP at Navoi TPP are described in Section 2.2.5.2, respectively.

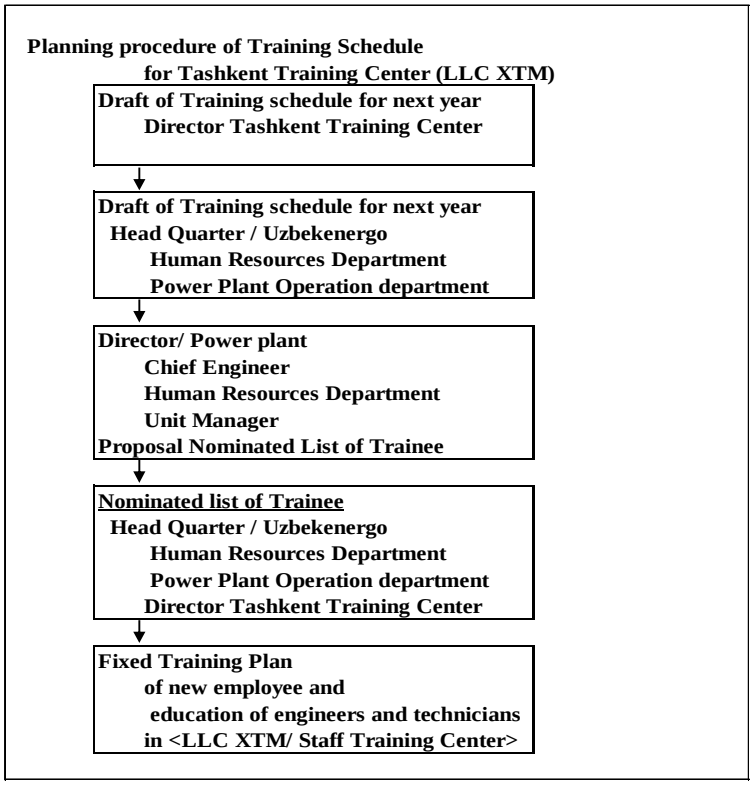
Table 2.2.3-1 2014 Training Implementation Plan at TTC

No	Training Course Title	Course Number	Course Field	Target Trainee	Course Duration	Resiponsible Trainer	Ref No
1	Sr Operators and Engineer Inspectors of ST Boiler equipment	1	ST Boiler	Inspector Sr Operator	3 WKs	Training Cernter Tashkent TPP	No10 PP355
2	Operators and Engineer Inspectors of ST Boiler equipment	1	ST Boiler	Inspector Operator	3 WKs	Training Cernter Tashkent TPP	No25 PP355
3	Operator of Boiler type PTVM, KVGM, DKVR Gas & Oil fired	1	Specific Boiler	Operator Gas & Oil Boiler	3 WKs	Training Cernter Tashkent TPP	No69 PP355
4	Machinist for reapir boilers, fittings, pipelines	1	Boiler Piplile etc	Machinist Repair person etc	2 WKs	Training Cernter Tashkent TPP	No73 PP355
5	Operators, Sr Operators and Engineer Inspectors of Turbine equipment	2	ST Turbine	Inspector Operator Sr Operator	3 WKs	Training Cernter Tashkent TPP	No44/54 PP355
6	Machinist for repair of ST Turbine equipment	1	ST Turbine	Mchinist Repair person etc	2 WKs	Training Cernter Tashkent TPP	No93 PP355
7	Staff at substation, Dispatcher of Main network Head of shift of electric workshop at TPP/CHPP	1	Electric workshop	Electrician Shift Head	3 WKs	Training Cernter	No28 PP355
8	Electric Fitters of 4-5 rank for Auto measuring	2	Electric Measuring	Electric Fitter	3 WKs	Training Cernter Energosozlash	No47/63 PP355
9	Chief Metrologists, Metrology Engineers for the condition of measuring tools	1	Metrology	Chief Metrologist Metrology Engineer	2 WKs	Training Cernter Energosozlash	No49 PP355
10	Electricians for maintenance of electric equipment at Power Plant	1	Electric Equipmemt	Electrician Maintenance	3 WKs	Training Cernter Energosozlash	No55 PP355
11	Elecrtricians for repair and installation of cable lines (ST Boiler)	1	Electric Wiring	Electrician Maintenance	3 WKs	Training Cernter	No79 PP355
12	Compressor unit operator	1	Compressor	Machinist Operator	2 WKs	Training Cernter Tashkent TPP	No8 PP355
13	Machinists for repair and maintenance of gas equipment	4	Gas Equipment	Machinist Maintenance	2 WKs	Training Cernter Tashkent TPP	No15/71/80/87 PP355
14	Machinists for rerpair of pumping equipment	2	Pumping Equipment	Machinist Maintenance	2 WKs	Training Cernter Tashkent TPP	No30/83 PP355
15	Staff responsible for workable condition qand safety operation of Vessel which work under pressure	2	Pressure Vessel	Machinist Staff	2 WKs	Training Cernter	No66/94 PP355
16	Certification of Electric and gas welder	3	Welding	Welder	3 WKs	Training Cernter	No22/35/91 PP355
17	Strappers	3	Heavy Weight Job	Strapper	2 WKs	Training Cernter	No31/60/84 PP355
18	Staff resiponsaible for safe implementation of work by cranes	2	Heavy Weight Job	Crane Operator	2 WKs	Training Cernter	No50/85 PP355
19	Engineering and Technical staff resiponsibler for maintenance of Lifting Mechanism in work condition	1	Heavy Weight Job	Staff of work	3 WKs	Training Cernter Tashkent TPP	No92 PP355
20	Engineering and Technical staff for supervisiona over safe operation of Lifting Mechanism	1	Heavy Weight Job	Supervisor of work	2 WKs	Training Cernter	No76 PP355
21	Flame cutting torch operators	3	Flame Cutting	Flame cutting Operator	2 WKs	Training Cernter	No43/70/86 PP355
22	Courses Related with Relays & Protection	6	Line Protection	Electrician	3 WKs	Training Cernter Central service of Relay…	No18/38/65/68 /74/95 PP355
23	Couse Related with Safety	5	Safety Management	Engineer and Management Staff	2 WKs	Training Cernter Safety Reliablity service	No20/40/53/61 /62 PP355
24	Courses Related with Computer	2	Computer	Staff	2 WKs	Training Cernter Energo AutomaticControl	No41/51 PP355
25	Courses Related with Enviroment	2					

(Source: JET)

(1) Procedure for preparing the annual training plan at Tashkent Training Center (TTC)

At first, the draft of training plan for the next year is prepared by the existing TTC, and then presented to each TPP via the Department of Work with Personnel and Power Plants Operation Department of UE HQ. Each TPP submits an application for the registration of staff members who will join each training course. UE HQ and TTC confirm the application from each TPP, the various implementation conditions, such as the number of trainees and the implementation period, and finalize the annual training plan. The flow for creating UE's annual training plan is shown in Figure 2.2.3-1 as follows. Refer to Appendix 14, PP458 Training plan 2016 TTC



(Source: JET)

Figure 2.2.3-1 Procedure for preparing annual training plan

(2) Formulation of mid-term training plan

In UE, as described above, the Department of Work with Personnel is involved in creating an annual training plan, but the formulation of a mid-term training plan has not been implemented. In addition, since NTC has not yet been officially established, there is no system for formulating a mid-term training plan in UE HQ. It is necessary to strengthen the relationship and cooperation among the Department of Work with Personnel and Power Plant Operation Department of UE HQ, and the Human Resource Development Department of the Navoi TPP, and to have a close exchange of information.

(3) 2019 Annual Training Plan of NTC

UE formulates the annual training plan based on the procedure shown in Figure 3-1 above. JET respects this procedure of UE, prepared a manual draft about the preparation and issue of the training plan on May 2018, and discussed this. (Refer to Appendix 15, Manual for Training Plan_Draft_Final)

Contents of the manual draft were agreed upon during the 12th mission in July 2018. However, as of March 2019 manuals have not been officially enacted and the training plan for 2019 has not been issued by NTC. At this moment, NTC is not officially established, and it is required to cooperate with UE HQ.

(4) Preparation of Lecture Plan (Lesson Plan)

In order to implement the training, it is necessary to prepare in advance the training implementation plan (Lecture Plan) that clarifies target subjects, implementation hours, trainer names, trainees (target job and position, and acceptable number of trainees), necessary training equipment etc. For these requirements, JET prepared a manual draft for the Lecture Plan including

the format of the Lecture Plan, and proposed on May 2018. (Refer to Appendix 16, Manual for Lecture-Lesson Plan) The trainer candidates prepared and completed drafts of lecture plans of 12 subjects, along with this proposal.

However, as of March 2019, the manual for lecture plan had not been enacted, and also the draft of lecture plan for each 12 courses created are not enacted as an NTC document. In order to prepare the 2019 annual training plan, lecture plans are necessary, and JET have requested to NTC and Human Resource Department of NTPP for official approval and issuance of the 12 subject lecture plans, in November 2018. And, JET pointed out it also in the 4th JCC. (Refer to Appendix 13, Request to Confirm the Progress of the Project)

2.2.4 Current Status and Issues on Certification/ Accreditation System for O&M Staff

(1) Training Certification for O&M Staff

The existing TTC implements training for conventional TPP staff. O&M staff are certified by the results of the training center and by the result of OJT training at each TPPs.

1) After completing the training at the existing TTC, it will be recorded on a personal ID card, i.e. a blue certificate of completion is issued by TTC for staff who completed training.

Photo 2.2.4-1, Photo 2-3 Personal ID Card with Training Record and stamp of TTC

2) At each power station, staff training, including OJT, is carried out according to individual training program for each job class. By training confirmation, the results of training are recorded on a personal ID card issued by each power station, and then they are certified as O&M staff.

Photo 2.2.4-2 Personal ID Card with Training Record and Stamp of Navoi TPP

Photo 2.2.4-3 Personal ID Card with Training Record and Stamp of Tashkent CHPP

For these personal ID cards in 1) and 2) above, it is necessary to notify the issue to each local government's office for each business establishment. (The concrete procedure method is unconfirmed.) Currently, the Certification of CCPP O&M staff is operated only with training and OJT in Navoi CCPP-1.

3) For the conventional TPP, the certification of training is in cooperation with Uzbekistan National Accrediting Organization, i.e. "Sanoat geokhontehnazorat". JET recommended the adoption of the same the procedure for CCPP training certification at the "New Navoi Training Center (New NTC)".

The scope of "Sanoat geokhontehnazorat" is specified as "pressure vessels and their handling", "pipeline-related" and "heavy material handling". The related fields of "Sanoat geokhontehnazorat" correspond with seven subjects among the 12 training subjects for the project. The remaining 5 subjects are out of scope for "Sanoat geokhontehnazorat", and the new NTC and UE HQ shall manage the training certification for these 5 subjects.

(2) Issuance of ID card by New Training Center (certification of CCPP O&M staff)

I n this project, rather than enhancing the training contents of existing TTC, the ID card had been pursued for the purpose of developing a new CCPP training center. In order to issue the ID card of the NTC, it is necessary to obtain permission from the Ministry of Higher and Secondary Specialized Education of the Government of Uzbekistan. For permission, it takes much time to check the training functions, such as the building facilities of the training center, training materials, lecturers, opening bank accounts, etc. During the project period, in September 2016, the construction site of the training center was changed from Tashkent to Navoi. Preparations for the building were delayed. Also in June 2018, there was an unexpected staff change due to health problems of the candidate for director of training center. As a result, the official start of New Training Center was clearly delayed. From the Uzbek side, there were also the thinking that New Training Center should be treated as a Branch Center of TTC, to avoid a long time waiting for permission. JET pointed out that it is important to ensure the independency of the new training center management, regardless of the form of the organization and the specifics of the registration permission. Then, at the 4th JCC in 14th mission, PD (Director of Navoi TPP) stated that "NTC will operate under NTPP" and it was confirmed that the UE head office side also agreed.

(3) Current Status of Trainer Accreditation of UE

In UE, trainers are assigned in consideration of their experience, years in their career, position, superior's recommendation and interviews. The training of conventional power generation technology has two types: group training in the TTC and OJT on-site. This situation is similar with the Japanese one. Trainers are assigned who works in conventional thermal power plant. The process of the trainers' appointment from conventional TPP are as below.

1) Selection of the candidate for trainer in TTC (A)

Trainers at TTC are selected among the staff of Tashkent TPP following procedures as below.

(a) Making a list of trainer candidates

The person in charge of the Human Resource Department of Tashkent TPP selects trainer candidates, who have experience in almost all jobs at thermal power station in about 10 years from university graduation and has adapted his knowledge to the subjects requested. (They are probably promoted to GM or sub GM).

(b) Screening by Certification Committee of TPP:

Deliberations on candidate's aptitude are implemented by the Certification Committee. Committee members are composed of four or five members, including the Chief Engineer of Tashkent TPP, GM Human Resources Department, GM Boiler, GM Turbine, GM Plant Operation, and so on.

(c) Recommendation of trainers from Director of Tashkent TPP:

The Director of Tashkent TPP recommends trainer candidates through the GM Power

Plants Operation Department, taking account of the committee evaluation.

(d) Interview:

The Director of TTC interviews the candidates and hires them as trainers after remuneration negotiations.

2) OJT trainer appointment at Tashkent TPP (B1)

The GM or deputy in the field of training subjects has the responsibility of selecting experienced staff.

At Tashkent TPP, the OJT subjects are covered in the specific fields of (i) Machine Operations, (ii) Electric Department, (iii) Measurement Department, (iv) Chemical Department, (v) Fuel Department, (vi) Boiler Department, (vii) Maintenance Department, and (viii) Heat Supply Department. OJT trainers are appointed from those who have experienced about 30 to 40 years in the subject areas. Selections are implemented by the GM or deputy of each department, without evaluation by the committee. The Human Resource Department confirms the trainer and the conditions of employment, etc. by itself, and they become OJT trainers officially after approval by the Director of TPP.

3) OJT trainer appointment at Tashkent CHPP (B2)

(a) The GM or deputy selects candidates who have experience in the training subjects. Candidates should have more than 30 years' experience and be GM, sub GM, or OB.

(b) Aptitude assessment by committee:

Candidates are approved by the Director of CHPP based on the committee evaluation. After that, the candidates officially become OJT trainers at CHPP, with agreement on employment conditions, etc.

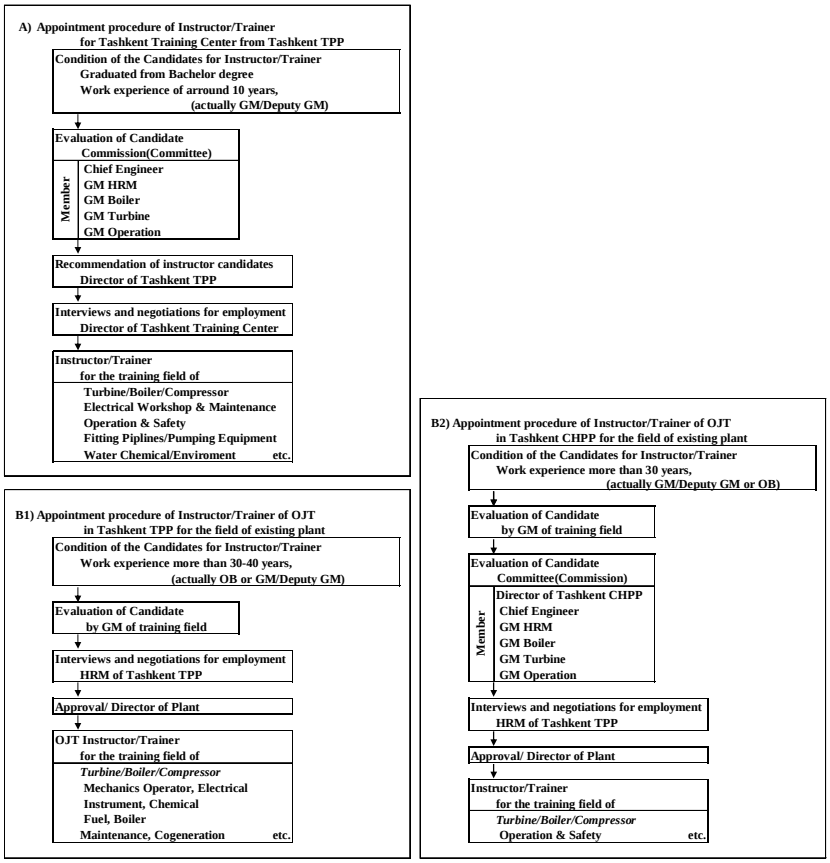
According to 1) to 3) above, the appointment of trainer in conventional power generation can be summarized as follows:

【A】Off-JT (TTC) trainer is a person who is a university graduate and almost 10 or more years' experience in power plant operation. He should have acquired sufficient basis for understanding theory, experienced work throughout the power plant, and can grasp the overview of the power plant.

【B】OJT trainer is a person who has over 30 years' experience at a power plant, and should be an experienced veteran who knows the field work of power plants.

Basically, the evaluation of candidates for a trainer is implemented by the power station. Evaluation will be carried out and suitability decided by commission /committee and/or on the judgment of the responsible GM. Finally, the Director of the power station approves the decisions. The procedures in (A) and (B), for appointing trainers as above are shown in following Figure 2.2.4-1.

These procedures are for appointment of trainers for conventional thermal power generation. The situation for CCPP training is different, as shown in the lead sentence of point (3) below. Only two CCGT plants installed in Uzbekistan in the past, i.e. Navoi CCPP-1 and Tashkent CHPP-CCGT, were needed to conduct the training for CCPP/CCGT. TTC has not prepared for staff who can implement the training comprehensively, training materials, or training equipment for CCPP/CCGT. Current situation of appointment of trainers for CCPP/CCGT is shown in points 4) and 5) below.



(Source: JET)

Figure 2.2.4-1 Trainer appointment procedure of UE

4) Appointment of OJT and/or on-site trainers at Navoi TPP CCPP-1 (C1)

The CCPP trainers are appointed by a different procedure than the conventional power generation. The Navoi TPP-CCPP-1 manager and/or engineer becomes the trainer and conducts the training using the CCPP O&M manual as training materials.

As described in section 2.1.3 (3) for the collective training, regarding the training subject of "Production-Economic Training Program for Engineering Technicians of CCPP Unit", the trainer is the Head of CCPP. Also, for the training subjects of "Production-Economic and Continuing Education Program of the Operational Staff of CCPP Unit", trainers are senior staff not less than leading engineer, actually Leading Engineer TME or Deputy Head of Operation.

5) Appointment of trainer for Tashkent CHPP-CCGT (C2)

(a) All CCGT staff have a university degree.

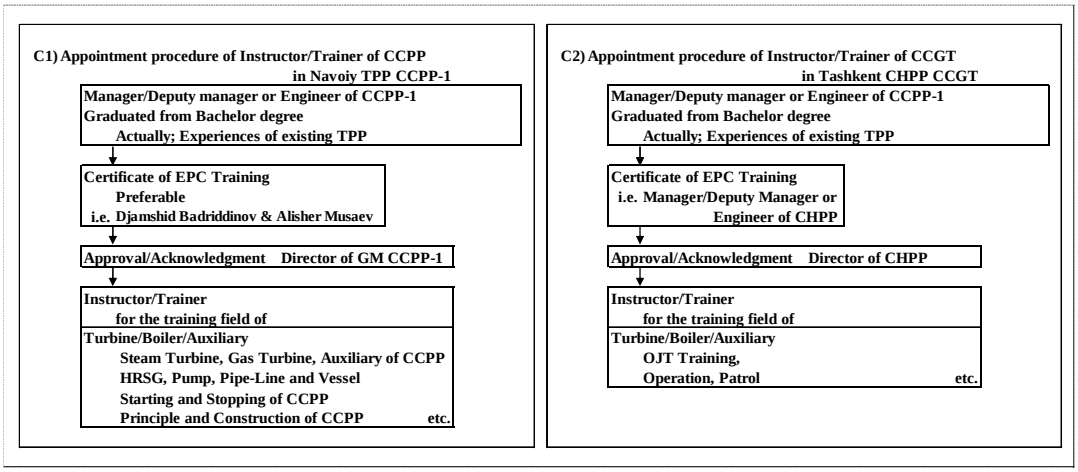
(b) EPC training in Japan was conducted twice when installing CCGT.
The first EPC training was for the GT operation maintenance staff, and the second EPC training was to become a trainer of CCGT.

(c) The Director of CHPP determines trainers from among the Managers or Deputy Managers.

According to 4) 5) above, appointment procedure for trainers of CCPP/CHPP in UE can be arranged as follows.

【C】Trainers for CCPP/CCGT have university degrees and their positions are higher than the engineers.

At the same time, trainers have completed the EPC training for combined cycle. The appointment procedure for trainers related to CCPP/CHPP is shown in following Figure 2.2.4-2.



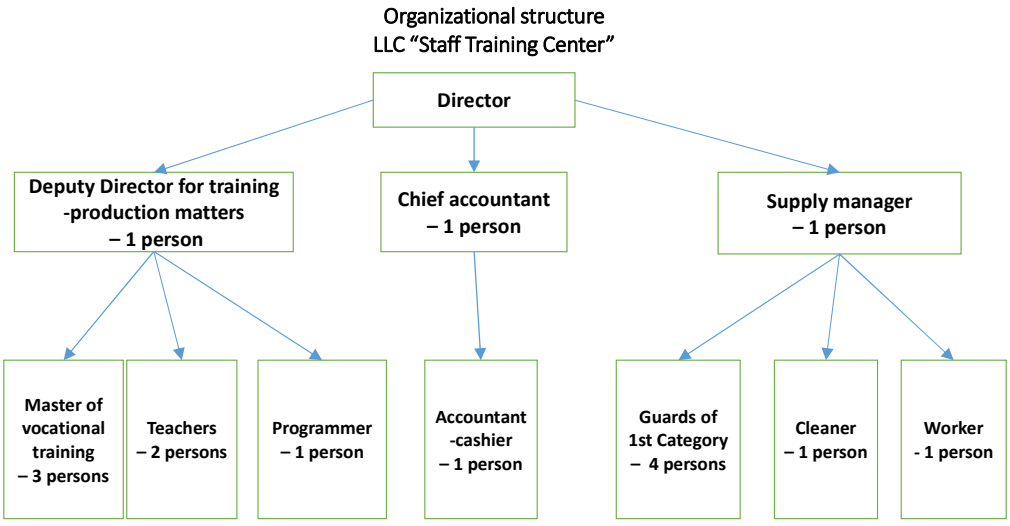
(Source: JET)

Figure 2.2.4-2 Appointment procedure of trainer in CCPP/CCGT

2.2.5 Current Status and Issues on Existing Training Center

2.2.5.1 Current Status of Collective Training in Tashkent Training Center (TTC)

At the TTC, trainings are mainly focused on the theory of conventional thermal power generation technologies through classroom lectures. There are 16 staff members under the director in TTC. Only two among them are full-time trainers. As mentioned in 2.2.3 above, there are almost 100 annual training courses, including conventional thermal power generation technologies. The courses of conventional thermal power generation technologies have 25 subjects/ 50 courses (it is around 50% of the entire courses). Since two full-time trainers cannot implement all of courses, part-time trainers are employed for each subject as necessary. Part-time trainers in the field of power generation are employed by recommendation from Tashkent TPP. The assignment of staff in TTC is shown in following Figure 2.2.5-1.



(Source: JET)

Figure 2.2.5-1 TTC Organizational Structure

The trainees receive certification (i.e., signed personal ID card) from the training center after the completion of training in TTC. (Refer to 2.2.4) “Sanoatgeokhontehnazorat” attends the completion examination for the courses of pressure vessel, such as boiler, turbine, compressor, and also gas pipeline and heavy equipment/material work. They give the approval signature as a proof of completion.

Trainees who completed the collective training have training by power plant at site, and OJT at their own power station, and pass the required experience and OJT completion tests, then have the qualifications for operation in the relevant field certified and recorded on personal cards at each power station. Regarding the field of subjects that need to be certified by “Sanoatgeokhontehnazorat”, confirmation will be made with their attendance for the completion examination.

In other words, in order to be accredited as O&M staff, it is required to complete the corresponding group training and training by power plant at site, / OJT training.

2.2.5.2 Current Status of CCPP Training in Navoi CCPP

Regarding the CCPP training at Navoi TPP, this was covered in Section 2.2.2.1 “Current Situation of the Human Development Plan in Navoi CCPP”, but it will be described here in detail focusing on current state of OJT.

(1) OJT Contents for O&M staff at Navoi CCPP-1

In OJT for O&M staff at Navoi CCPP-1, training is conducted on basic knowledge, which is required to perform power generating jobs, such as views on unit protection, control and shutdown, while mainly focusing on the function and system network of CCPP equipment. For example, training is conducted so that they can acquire the professional skills (knowledge & capability) shown in the following Table 2.2.5-1, utilizing instruction and operation manuals for facilities by manufacturers.

Table 2.2.5-1 OJT items for acquiring professional skills

Subjects	Contents
1. Overview of the CCPP Equipment	Features of the power generation of CCPP
	Main system of CCPP
2. Power generation basis of CCPP	Principle and configuration of Gas Turbine (GT)
	The configuration of the system of the HRSG (low, medium and high pressure system)
	House power supply system (overview of the house electrical system and equipment)
	Control of plant protection (overview of the control and protection system of plant)
3. Power generation of CCPP	Detail of the equipment of the configuration of gas turbine
	・Combustor
	・Turbine
	・Inlet guide vane (IGV)
4. Control & Instrument system	Plant protection and control (details of the plant protection system and control device)
	Control of GT
	Structure of the control device for GT
	The function of each control circuit
	Interlock of the unit trip
	Interlock of GT protection
	Interlock of the Steam Turbine protection
	Interlock of the HRSG protection

(Source: UE)

The following unit operation manuals are utilized at Navoi CCPP.:

1) Normal start-up and stop operation manuals

In general, automatic operations by computation is categorized in the following 6 itemized processes:

(a) Condensate system start-up
(b) HRSG start-up
(c) Gas Turbine start-up
(d) Gas Turbine synchronization / load-up
(e) Steam Turbine start-up
(f) Steam Turbine synchronization /load-up

In addition, the stop operation follows the processes of above start-up process in reverse.

2) Operation Manual to address abnormal situations

(a) House load operation within the Power Station (P/S):

In case operation cannot be continued due to any accidents in electric power transmission system, it is necessary to disconnect power transmission immediately. In such a case, operation continue while in isolation from the power transmission system, supplying power only to cover the load within the P/S. This is called “house load operation”.

(b) Run-back operation

In the case of difficulty to keep the rated load operation of the plant due to an abnormality, the operation is changed to reduced load. This is called “run-back operation”.

3) Rapid response power supply operation by independent start-up of GT

If thermal efficiency were disregarded, it is theoretically possible to start up only GT independently. (Simple Cycle/ Open Cycle)

4) Environment Inspection

When the Environment Protection Division of the Navoi TPP conducts a site check with a frequency of once per month or so, appropriate inspections are taken addressing items such as water quality, exhaust gas, and vibration parameters. JET advised the utmost importance of acquiring basic knowledge concerning the operation of environmental facilities and showed examples of oil condition and water treatment facilities in Japan. Uzbekenergo comments that the Environmental Department is already implementing adequate environmental education.

(a) Management standard for Oily condition

JET explained characteristics of gas turbine oil and management standard values, as in the following Table 2.2.5-2. (Representative example by Japanese Power Company).

Table 2.2.5-2 Management standard for Oily condition

Characteristics	Japan’s representative CCPP	
	Oil Specification	Normal management reference value
Dynamic viscosity (㎟/s)	About 32	28.8～35.2
Acid value (mgKOH/g)	0.08	
RBOT value (mim)	960	more than 600
Color	LO.5(ASTM)	—
Moisture (%)		0.05 or less
Rust performance	Pass(no rust)	—

(Source: JET)

a) Because when GT oil reaches the management threshold value, deterioration progresses rapidly, it should be replaced as soon as possible.
b) During operation, it should be managed to maintain the characteristics of GT oil.
c) If it is confirmed that there is no turbidity in liquid by appearance, gas turbine oil can be considered to meet the control standard value without moisture.
d) If any abnormalities were found by appearance, the actual moisture value should be analyzed.

(b) Feed water treatment of CCPP in Japan

a) Feed water treatment which suits the system materials

CCPP has no feed water heater, and basically ferrous material is used (titanium piping is only for the condenser) for system materials. Because no copper material, such as drum-type boilers, is used in CCPP, the pH of feed-water is treated as having alkalinity of 9.3 to 9.6.

b) Water treatment of drum-type boilers:

As for the water treatment of drum-type boilers, applicable methods are determined by maximum working pressure of boilers. At less than 5MPa, alkaline treatment or phosphate treatment is applied. At more than 5MPa, phosphate treatment or volatile materials treatment is applied.

*Note: At 5MPa to 7.5MPa, alkaline treatment is applicable.

Table 2.2.5-3 Reference value for water quality standards
(JIS/ Japanese Industrial Standard)

	Indicator item	JIS Standard value
Feed Water	pH	8.5～9.6
	Dissolved oxygen(μg/L)	7 or less
	Hydrazine(μg/L)	more than 10
	Electric conductivity (mS/m)	0.05 or less
	Total iron (μg/L)	20 or less
	Total copper (μg/L)	5 or less
Low-pressure Boiler Water	Max. allowable working pressure (MPa)	1～2
	pH	9.8～10.8
	Electric conductivity (mS/m)	120 or less
	Phosphate ion (mg/L)	10～30
	Silica (mg/L)	50 or less
Medium-pressure Boiler Water	Max. allowable working pressure (MPa)	5～7.5
	pH	9.2～10.2
	Electric conductivity (mS/m)	40 or less
	Phosphate ion (mg/L)	3～10
	Silica (mg/L)	5 or less
High-pressure Boiler Water	Max. allowable working pressure (MPa)	15～20
	pH	8.5～9.8
	Electric conductivity (mS/m)	6 or less
	Phosphate ion (mg/L)	0.1～3.0
	Silica (mg/L)	0.2 or less

(Source JET)

5) Operation monitoring & operation maneuvering equipment, etc. in Central Control Room
OJT training is also implemented for the following operations, such as operation monitoring and driving operation, which are implemented in the central control room (CCR).

(a) Measures to prevent malfunctioning
To prevent malfunctioning by establishing redundancy of the systems.
a) Interlocking by signal of 2 out of 3.
b) Control of intermediate values through triplicating transmitters.

(b) Russian indication on PC display for monitoring and driving operation.
PC image for operation and monitoring is specified to display in English. However, in respect to measures for external responses in case of emergency, one PC image is specified to be displayed in Russian, so that the staff can read/talk in Russian in an emergency.
The MHI/MHPS Control System for the main equipment including GT & ST of CCPP, sends data to ABB System for BOP. And ABB system transmits them to a large display (TV) in turn.
The image of the monitoring operation in CCR is as in the following figure:

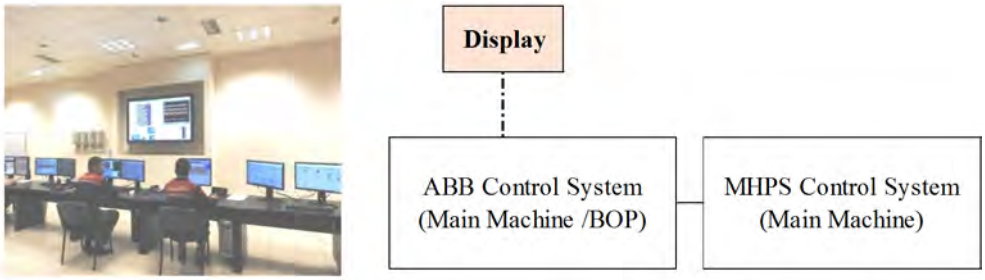


Figure 2.2.5-2 Image of the monitoring operation in CCR

At Gas Boosting Compressor Station (GBCS), the operation staff monitor and operate the Gas Receiving Pipeline, Gas Boosting Pipeline and Boosting Compressor.

2.2.6 Creating Human Resource Development and Training Plan, Accreditation System

The main counterparts of the project are Project Director (Director of Navoi Power Station) and NTC Director, but before the establishment of New Training Center, the Manager of the Human Resource Department of NTPP is responsible for the management budget of the training institution and staff placement. However, the Navoi side is not in a position to prepare and decide the human resource development plan etc. for the whole UE. With regard to the human resource development plan, training plan and accreditation system, it is necessary to further strengthen cooperation with the Department of Work with Personnel, Plant Operation Department and Foreign Economic Relations and Investment Department in UE HQ, and receive advice from them.

2.2.6.1 Creating Human Resource Development Plan

UE prepares the human resource plan for each year, which is different from the Japanese system. In Japan, training for improving skills uses a long term perspective, different training is given each year for each staff level. JET pointed out first, that the departments related to the human resource development plan of UE should correspond to the Department of Work with Personnel and Power Plants Operation Department.

JET proposed two draft manuals for human resource development of UE, with examples of human resource development plan in Japan, and this was agreed.（Refer to Appendix 4, No. 1

Manual for Human Resource Development Planning, and Appendix 5, No. 2 Manual for Positioning Plan of O&M Personnel）

The following points from (1) to (7) describe the outline of the No. 1 Manual for Human Resource Development Planning. Points (8) to (13) show a summary of the No.2 Manual for Positioning Plan of O&M Personnel.（For details, refer to the attached manuals.）

(1) Basic concept of the human resource development plan

1) With growth based on self-responsibility (self-development), appropriate coaching by senior staff, and OJT, are the basics. The senior staff shall seek to develop staff while recognizing Appendix 4, Attachment 1 “Mental Preparation in Developing and Coaching.”

2) A human resource development plan, utilizing the engineering simulator, shall be prepared separately.

(2) System of O&M Staff Development Policy of CCPP

1) Management of UE HQ had requested information about “how to develop human resources at CCPP in a Japanese power company where GT manufactured by MHPS is installed”. The project discussed about the formulation of a human resource development plan (including Road Map). Human resource development methods of UE had been improved over a long period. Therefore, it was understood that is not appropriate for UE to adapt Japanese methods. JET recommended UE to study the way of “Human Resource Development Plan for O&M Staff of CCPP”, which is based on the way used by a Japanese power company, and to conduct “human resource development in which training is provided based on setting certain target levels.”

2) In Appendix 4, Attachment 2, the aim is to establish a system where Plan, Do, Check and Act (PDCA) are adequately conducted. By reviewing and revising it every year, it is designed to develop staff who meet the needs of the job site.

(3) Skill level of staff

The technical level of the staff is basically classified in 5 stages as shown in following table. In addition, up to Stage IV will be trained for O&M staff. Stage V is the necessary skill level beyond the Engineer / Master class, familiar with work and perform improvements on work.

(4) Record system of specialty (knowledge & skills):

Newly assigned staff to each division shall implement training provided as a series of development in the relevant workplace from common basic stage to applied stage, for each job. Thoughts on development management from common basic stage through application stage II are shown in Appendix 4, Attachment 3, No. 1 Manual for Human Resource Development Planning.

Regarding acquisition of specialized skill and proficiency, it is recommended to record in a database (DB). Each individual information recorded in the DB corresponds to a “Confidential Document” and “Documents to be handled with Care”, and proper DB management as described below is necessary so that recorded contents do not leak out.

1) Management of records

(a) Database Manager

a) Chief Training Coordinator of CCPP Training Center

b) Personnel in CCPP Training Center appointed by Chief Training Coordinator

(b) In charge of DB recording

a) Records of newcomers prior to being assigned shall be managed by the DB Manager.

b) Records of development stages after being assigned shall be managed by their superiors in each workplace.

c) Records of engineer, technician and/ or managers, shall be managed by the Director or senior managers, and records of Directors or senior managers shall be managed by themselves.

d) In the above b) and c), the history of participation in internal training and acquisition of external qualifications shall be recorded by DB Manager.

・Note that initial registration shall be made by each individual. If an individual does not fill out his own form, he cannot confirm his entry details on the screen and so it is necessary to pay attention to it.

(c) Record Items

a) Basic information

・Date of joining company, academic career

・Specialty & present abilities, name of position, job in charge of

・Assignment date to present position

b) History of job assignments

・Affiliation, name of position/ post,

・Assignment date to present position

c) History of acquiring professional knowledge and skills

For Operation staff, Maintenance staff, and persons in charge, each of the following items shall be recorded as examples.

・Date of starting skill development, date of acquisition, each development stage at conventional TPP and CCPP, respectively.

・ Date of acquiring professional skills knowledge & skills; which are common company-wide.

・Date of professional skill (knowledge & skills) acquisition at each power station.

・Regarding the operation, personnel shall be judged by their superiors based on simulator training history.

・Skills of maintenance and planning/chemical/environment shall be comprehensively judged by superiors after confirming from the viewpoint of job execution and job assignment history of the personnel.

*Note: The judgment on the degree of the operation personnel skill acquisition shall be made only by their simulator training history.

Managers and Engineer/Technicians shall be comprehensively judged from their job assignment history by their superior manager.

d) Job history

・Job assignment history, contents and year implemented

・Self-study/ Individual development history

e) History of attending collective training courses (common, professional courses)

・Subject of professional training course and dates attended

・Subject of common training and course attendance dates

f) History of acquiring external qualifications

・Name of external qualifications acquired, date qualified

(5) Roadmap for human resource development

A roadmap for human resource development of O&M staff is shown in Appendix 4, Chapter 5.

(6) Information sharing among Technical Training Supervisors

JET proposes the establishment of a Technical Training Supervisor Committee (Super Tech Meeting), in Appendix 4, Chapter 6, as a conference system for sharing the results of coaching by Technical Training Supervisors (Super Tech) in each TPP, etc.

(7) Multiple skills development through periodic staff exchanges (rotation)

Troubleshooting and rapid emergency responses are required for staff, they need to further acquire new knowledge/ skills of CCPP. JET recommends strengthening cooperation among departments to acquire new knowledge/ skills, such as for assessing trouble, as information from other departments. New employees in Navoi CCPP seldom change from the sections from which they are initially assigned. The periodic staff exchanges between the Operation Division and the Maintenance Division are an effective method for upgrading the skills of the whole workforce to obtain multiple skills. Therefore, JET recommended considering the periodic rotation of staff.

The details of advantages of multiple skills, implementation period for development and effects of multiple skills are shown in the manual. (Refer to Attachment 4, No.1 Manual for Human Resource Development Planning)

(8) Purpose of Positioning Plan of O&M Staff

It is aimed at achieving the optimum balance of staff, placement of appropriate staff into the appropriate places, promotion of staff, improve training and education effects.

(9) Definition of the optimal placement of staff

Optimal placement is to ensure that there is the necessary Operators and Maintenance staff with the necessary knowledge and skills. It becomes the optimal balance between O&M staff.

(10) Related standards/ Manuals

1) O&M system and integrated manual; improving future regulations
2) Human resource development planning manual, including O&M personnel

(11) Required skill level of O&M Personnel

(12) Suitable positioning of staff

On education and training, for positioning of staff with the appropriate level to the relevant department.

(13) Scope

This manual applies to all of the O&M staff of CCGT.

2.2.6.2 Preparing training plan

Regarding the training subjects dealt with in this project, training subjects proposed by JET have been deepened by discussion, and training subjects were chosen at the 1st JCC in February 2016. Thereafter, in the 4th Mission in May 2016, trainer candidates requested revision the course contents of the electrical field training, and JET adopted their request and revised the plan.

(1) Decision of subjects for O&M training:

In the selection of subjects and contents in this project, JET recommended the important subjects based on the discussion in the project, and proposed them to UE. JET pointed out that

UE itself should promote subjects for strengthening and enhancement even for the training subjects removed from this project, after completing this project.

Subjects and contents for O&M training in the mechanical field:

In the 2nd mission in December 2015, the eight subjects shown in the following Table 2.2.6-1 were proposed for the mechanical field. These are combinations of training subjects aimed at Japanese power companies and subjects that PET has previously successfully provided for JICA country-focused training, and optimized.

Upon consultation between the Navoi TPP and UE HQ, 5 of 8 subjects were selected. Official agreement of training subjects was reached in the 1st JCC/Workshop on February 26, 2016 in the 3rd mission. The selection table for the subjects is shown in the following Table 2.2.6-1.

Table 2.2.6-1 Selection table of training subjects for the mechanical field

Training Subject	Decision	Reason for adoption/rejection
Non-destructive inspection training	Adopted	Skills and knowledge of non-destructive inspection methods to evaluate the quality of welded sections are required, and there was much interest from both Navoi CCPP and UE HQ.
Vibration analysis training	Adopted	It was important to learn measures to deal with vibration generated by rotating machinery, and there was much interest from both Navoi CCPP and UE HQ.
Remaining service life diagnosis training	Adopted	Although Navoi CCPP determined that this course was unnecessary as it requires more advanced technology than non-destructive inspection, this was adopted because UE HQ determined that this is essential knowledge to gain CCPP operation experience.
Denitrifier training	Rejected	Denitrator equipment was uncommon throughout Uzbekistan. Therefore this course was unnecessary.
Water quality management training	Rejected	CCPP boiler water quality management standards are not so strict, and there was little interest from both Navoi CCPP and UE HQ.
GT/combined power generation facilities training	Adopted	Although the content of this course provides an outline of the CCPP for young engineers, Navoi CCPP determined it unnecessary because they provided similar content training in their new employee training program. However this course was eventually adopted because UE HQ determined that efficient training is required, as the number of CCPP plants increases in the future.
GT hot parts maintenance training	Adopted	There was much interest from both Navoi CCPP and UE HQ as this knowledge is essential for the maintenance of GTs.
Pump and fan maintenance training	Rejected	There was ample proficiency in regular BOP maintenance in existing conventional plants, there was little interest from both Navoi CCPP and UE HQ.

(Source: JET)

Subject and contents for O&M training in the Electrical/C&I field

The content of the training subjects in the Electrical/C&I field was initially decided at the 1st JCC/Workshop. A trainer candidate requested revision of the technical contents in the 4th Mission in May 2016. JET considered their request and revised the description to focus on CCPP especially, therefore there is no major change in the contents. As a result, the title of training subjects for Electrical/ C&I were changed as shown in the following Table 2.2.6-2.

Table 2.2.6-2 Changes of course Title for Electrical/C&I field

Subject No.	Subject Title agreed in 1st JCC	Revised title after consideration
6	Overall control system for generator	Details of Electrical Facilities for Gas Turbine CCPP
7	Control system for generation facilities (except as GT and Generator)	Operation & Control Theory of Gas Turbine CCPP
8	Control & Instrument	Details of Control & Instrument Devices for Gas Turbine CCPP

(Source: JET)

The training materials revised after the contents were set covered the contents requested by the Uzbekistan side and presented at the 8th and 9th mission. However, at this time the Uzbekistan side requested additional different revisions to separate the volume by section.

However, due to the nature of this project, JET suggested that it should be edited autonomously by the Uzbekistan side themselves so that it is easy to use sustainably without assistance in future, and this was agreed.

Subject and contents for O&M training in the facility/equipment field

Nine subjects were proposed in the facility/equipment field as shown in Table 2.2.6-3. These are based on the completed contents of the EPC training provided by MHPS for UE, and designed with consideration of the contents of the EPC training planned to be carried out in the future. As a result of hearings and discussions with Navoi CCPP staff and UE HQ, four subjects were selected from nine. Finally, this selection was officially agreed and decided at the 1st JCC / workshop (held on February 2016) in the 3rd mission. The following Table 2.2.6-3 shows the selection reason for subjects.

Table 2.2.6-3 Selection Table of Training Subjects for Facility Field

Training Subject	Decision	Reason for adoption/rejection
Gas Turbine Overview	**Adopted**	**Contents from EPC Training; Integration to one title of ＜Gas Turbine O&M＞**
Gas Turbine Operation Training	**Adopted**	
Gas Turbine Control system	**Adopted**	**Contents from EPC Training**
Gas Turbine Electric Control System	**Adopted**	**Contents from EPC Training**
Gas Turbine Operation Practical Training with Simulator	Rejected	After the simulator delivery implemented by the other project scheme
Gas Turbine Maintenance Plan from seminar documents	Rejected	Maintenance is essential for intermediate and advanced staff, but priority is CCGT itself for UE
Gas Turbine O&M Lecture	**Adopted**	**Very important to correspond as a troubleshooting (for advanced staff)**
ST Operation Training	Rejected	Priority is CCGT upper than Steam Turbine (ST)
ST Electric Control System	Rejected	

(Source: JET)

Finally, the outline of the subjects decided is showed in the following Table 2.2.6-4. Table 2.2.6-5 shows the preparation and delivery schedule of training material and training equipment.

Table 2.2.6-4 Outline of Training Subjects

Training Course List for Mechanical Field

No.	Training course name	Trainees	Contents and aims	Examples of successful application	Training type	Number of instructors		Training frequency (Example)	Training period (Example)	Number of trainees (Example)	Training equipment	Notes
						Main instructors	Assistant instructors					
1	Non-destructive inspection training	People who perform non-destructive inspection work People who plan and observe various non-destructive inspection work	Principles, features and basic handling skills for various non-destructive inspection methods used in power station facilities (PT, MT, ET, UT, RT). Teaching of points to keep in mind when observing various non-destructive tests (quality evaluation, and results determination procedures). Teaching of the level of application at the site, and points to keep in mind during practical training for tests such as magnetic-particle tests using a cut model.	Proper planning of inspection work is possible thanks to having general knowledge in regard to various non-destructive inspection methods (PT, MT, ET, UT, RT). It is possible to allow quality evaluation, and results determination through non-destructive inspection work observation.	Classroom lectures + Practical training	1	1	A few times a year	2 days	Approx. 10 people	･PT equipment set (test pieces, various waste materials) ･MT equipment set (test pieces,Magnetic yoke to induce a magnetic field,black light for magnetic particle testing) ･UT equipment set (test pieces, Digital flaw ditector, Ultrasonic thickness meter) ･RT equipment set (film projector, inspection film)	
2	Vibration analysis for rotating machinery training	People in charge of the operation and maintenance of rotating machinery Effective training regardless of electrical/mechanical expertise or power generation/maintenance work	Basic knowledge of vibration generated by rotating machinery, and technology to remedy the occurrence of vibration. Teaching how to check for vibration phenomenon using a model rotor, and learning through effective vector balancing training. Vibration analysis techniques (frequency analysis, etc.) and treatment techniques (mode circle balance method) for typical vibration generation factors in rotating machinery are taught using a model rotor to reproduce vibration generation phenomenon. Trainees complete a series of exercises to learn measurement, analysis, and countermeasures.	Basic response/countermeasures are able to be carried out for general (unbalanced) vibration. Equipment diagnosis can be performed on typical vibration phenomena occurring in rotating machinery. Simple diagnosis using results measured with a portable vibration meter or IRD analyzer can be performed. Factorial analysis using results from a FFT analyzer/rotating machinery mechanical vibration analyzer is possible. Basic multifaceted balance correction of the main equipment is possible using the modal circle method.	Classroom lectures + Practical training	1	1	A few times a year	3 days	Approx. 10 people	･Model rotor and analyzer ･vibration meter ･IRD analyzes ･FFT analyzes	
3	Remaining service life diagnosis training	People in charge of managing the maintenance of boilers/turbines (steam and gas) People who have knowledge of the structure of such equipment	Teaching of degradation mechanisms of metals used for high temperature/pressure applications in boilers and turbines (steam and gas), as well as knowledge regarding evaluation such as precautions for applying optimal evaluation methods. Teaching of management of diagnostic evaluation work, and techniques to judge diagnosis results, through exercises to calculate remaining service life and practical training using the replica method and structural observation.	By knowing degradation mechanisms of high temperature/pressure equipment, it is possible to better understand factors needed to grasp the current state of equipment. Better understanding of boiler/turbine equipment parts that undergo degradation, and their appropriate countermeasures. Understanding the outline of remaining service life diagnosis work, and experiencing important points during observation work allows work to be carried out smoothly. It is possible to understand the optimal application range of various methods used to carry out remaining service life diagnosis.	Classroom lectures	1	-	A few times a year	3 days	Approx. 10 people	･Relica set ･optical microscope ･Waste materials (GT hot parts, boiler tube)	
4	Gas turbine/combined power generation facilities training	Employees of combined cycle power stations Especially young and newly transferred employees	Teaching of basic knowledge regarding gas turbines and combined cycle power generation methods. Especially training based around the structure, function, and maintenance of gas turbines and exhaust heat recovery boilers. Teaching of problematic cases encountered by combined power generation equipment.	Young employees or employees newly transferred from a conventional power station to a combined power station can quickly gain knowledge of combined power generation equipment, and it is possible to continue to work smoothly into the future.	Classroom lectures	1	-	A few times a year	3 days	Approx. 10 people	･Combustor cut model ･GT cut modelc	
5	Gas turbine high temperature part maintenance training	People in charge of gas turbine high temperature part maintenance	Teaching appropriate maintenance methods for gas turbine high temperature parts, and knowledge required to extend the service life. Improving practical skills that can be passed on and applied to other equipment.	Better understanding of inspection, repair and management methods for high temperature parts makes it possible to carry out more appropriate maintenance and management work. Understanding of various types of inspection and test methods allows effective selection of appropriate methods to apply. Understanding remaining service life diagnosis methods for high temperature parts, helps when investigating ways to extend the service life.	Classroom lectures	1	-	A few times a year	3 days	Approx. 10 people	･Combustor cut model ･GT cut modelc	

Training Course List for Electrical Field

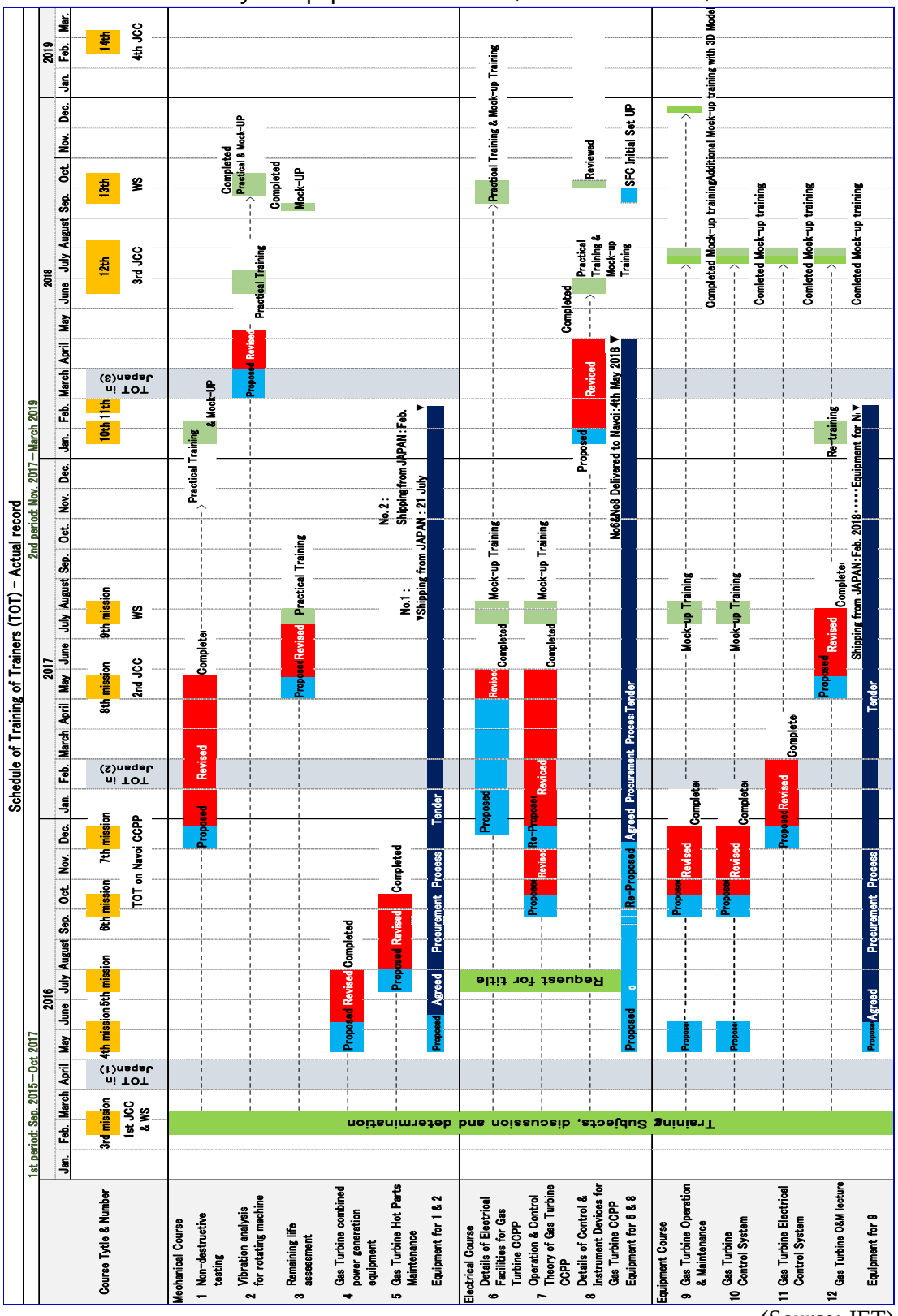
No.	Training course name	Trainees	Contents and aims	Examples of successful application	Training type	Number of instructors		Training frequency (Example)	Training period (Example)	Number of trainees (Example)	Training equipment	Notes
						Main instructors	Assistant instructors					
6	Overall control system for generator	･People in charge of Electrical / C&I Operation ･People in charge of Electrical / C&I Maintenance ･Intermediate level or above (Required for understanding of conventional equipment)	･Structure, composition and management of exciation device ･Composition and operation management of AVR ･Composition and operation management of SFC ･Composition and operation management of digital protective relay of power plant instrument	･Understanding the monitoring adjusument method in operation ･Discovering the abnormality of equipment at an early stage, and dealing with the problems. ･Taking the appropriate measures when abnormality occures in the operation of power plant equipment.	Classroom lectures + Practical training	1	1	A few times a year	4 days	Approx. 8 people	Digital relay (Small substitutes or model) SFC	
7	Control system for generation facilities (expect as GT and Generator)	･People in charge of Electrical / C&I Operation ･People in charge of Electrical / C&I Maintenance ･Intermediate level or above (Required for understanding of conventional equipment)	Understanding about the composition and operation procedure of ST control device, HRSG, BOP. e.g.Collection function of operation data Contents of alart（slight failure&serious failure） Cause and remedy in the case of abnormality occurs	･Understanding about the composition and operation method of various maintenance device, and performing the appropriate maintenance and management task.	Classroom lectures	1	-	A few times a year	3 days	Approx. 10 people	-	
8	Control & Instrument	･People in charge of Electrical / C&I Operation ･People in charge of Electrical / C&I Operation ･Beginner to Intermediate level (Understanding of digital technology is not essential)	Understanding the construction of measuring device, (e.g. pressure sensor, temperature sensor and combustor vibration monitor device) and operation function of servo adjustment valve	･Understanding the basic composition of C&I instrument, and becoming to understand the contents of the related drawings / books	Classroom lectures + Practical training	1	1	A few times a year	2 days classroom lectures + 3 days practical training	8people	･Sequencer ･Switch/sensor ･Electromagnetic valve ･PC ･Software development environment ･sarvo valve (for display) ･Combustor vibration monitor device (for display)	

Training Course List for Facility Field

No.	Training course name	Trainees	Contents and aims	Examples of successful application	Training type	Number of instructors		Training frequency (Example)	Training period (Example)	Number of trainees (Example)	Training equipment	Notes
						Main instructors	Assistant instructors					
9	Gas Turbine Operation & Maintenance	･Beginner to Intermediate level ･Gas turbine operationt and maintenance operator （Specialized field of mechanical or electical does not matter）	･Learning about basic structure of gas turbine and important points in operation. ･Reviewing the gas turbine maintenance outline, and learning about preparatory of periodical maintenance ･Operation Guide Line and Safety Featusre ･GTCC Plant Operation ･GT Commissioning Procedure ･GT Long Term Maintenance Contract	･Understanding the gas turbine operation and maintenance ･Understanding the necessary matter of preparatory of periodical maintenance ･Understanding the long term maintenance plan of gas turbine	Classroom lectures	1	-	Once a year	3 days	Approx. 15 people	3D-models of rotor blade & stator blade	
10	Gas Turbine Control system	･Beginner to Intermediate level ･Gas turbine operationt and maintenance operator （Specialized field of mechanical or electical does not matter）	･Learning about maintenance system of gas turbine ･GT Control System Operation and Maintenance ･Main Features of GT Control System	･Understanding the control system of gas tuebine ･Maintenancing the main gas turbine instruments	Classroom lectures	1	-	Once a year	3 days	Approx. 15 people		
11	Gas Turbine Electric Comtrol System	･Beginner to Intermediate level ･Gas turbine operationt and maintenance operator （Specialized field of mechanical or electical does not matter）	･Learning about electrical system of gas turbine ･GT Electrical & Control Package	･Understanding the electricall system of gas tuebine ･Maintenancing the electrical equipment of gas turbines	Classroom lectures	1	-	Once a year	1 day	Approx. 15 people		
12	Gas Turbine O&M Lecture	･Advanced level	･Using the actual events and manuals as teaching materials, and attenpting the prevention of recurrence and preventive maintenance ･Gas Turbine O&M Lecture ･Maintenance Philosophy ･Commissioning for Gas Turbine Power Plant	･Prevneting the past troubles and recurrence of nonconformity ･Practice of preventive maintenance	Classroom lectures	1	-	Once a year	1 day	Approx. 15 people		

(Source: JET)

Table 2.2.6-5 Schedule for training materials preparation and delivery of equipment and TOT（as of March 2019）



(Source; JET)

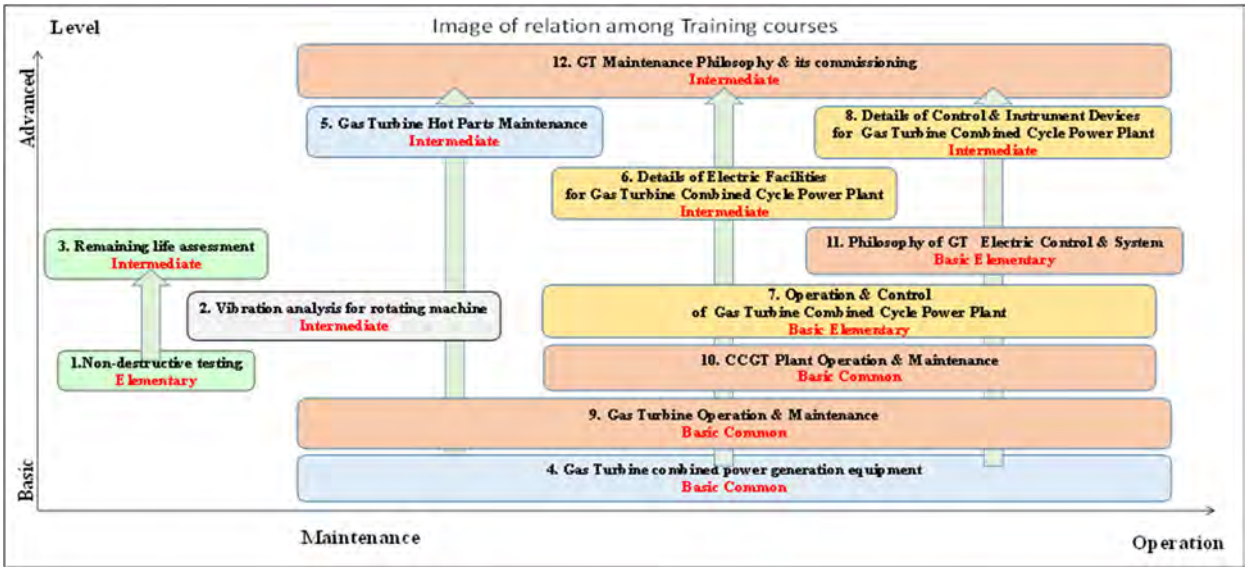
(2) Developing the training plan

As shown in Table 2.2.6-5 on the previous page, TOT for the trainer candidates has been completed in accordance with this schedule.

The training plan for O&M personnel, which is created and implemented by the UE, depends on the establishment situation of the Training Center and its construction. The discussion matters implemented for the training plan are follows.

1) Discussion on developing training subjects and training plans:

JET have prepared and presented a correlation figure among 12 subjects (Refer to Figure 2.2.6-1 below), and have discussed the content and trainees level for each subject.



(Source; JET)

Figure 2.2.6-1 Correlation among training subjects

After the discussion described above, in order to prepare the training plan by UE themselves, JET showed Table 2.2.6-6. It included the necessary number of trainers for each subject, the training period days, the number of trainees, subject field, training level, classification of training subjects, etc., drawing on examples from Japan.

Table 2.2.6-6 Training Level, Target Trainee & Trainer

Training Course Class, Certificate & Trainer

13th January, 2017

Preferable Conditions for Certificate is as under

rev.6 by T. Saito/ JET

Proposal: Certificate of training for O&M personnel by authorized organization *1/ *2

*1 Training Course of No4, No5, from No7, and from No9 to No12, should be certified by Sanoatgeokonteknazorat

*2 All of training course should be certified by New Training Center

Chief Trainer should manage and implement the Training Course
Sub Trainer should be alternative for Chief trainer
Assistant Trainer should help practical training of the Course.
*Recommended Period, Course Period might be extended by Chief Trainer to achieve.

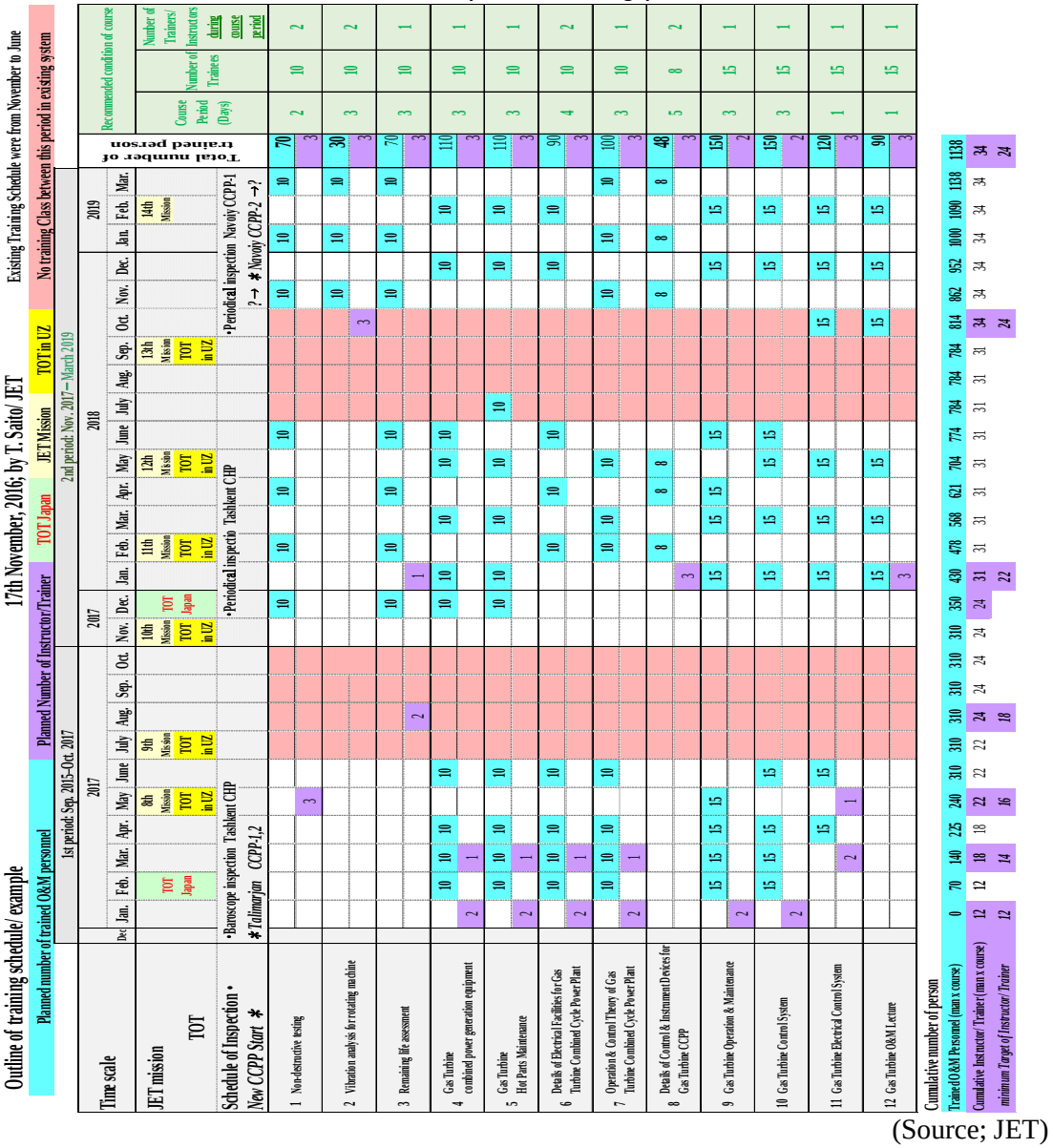
Text No. / Training course		*Certificate of Training Course acknowledged by *1	*Certificate of Training Course acknowledged by *2	Training Level	Target field of trainee		Effect of training at on-site	Course & Step No.	Recomended Period by JET	Trainees Number	JICA Procured Equipment	Required Number of Trainer for each course: Chief Trainer	Sub Trainer	Assistant Trainer
Mechanical Field														
4	Gas Turbine; Combined power generation equipment	*1	*2	Basic Common	Mechanist & Electrician	Maintenance & Operation	effective	A1	3	10	–	1	1	–
5	Gas Turbine; Hot Parts Maintenance	*1	*2	Intermediate	Mechanist	Maintenance	effective	A2	3	10	–	1	1	–
1	Non-destructive testing		*2	Elementary	Mechanist	Maintenance	–	B1	2	10	○	1	1	1
2	Vibration analysis for rotating machine		*2	Intermediate	Mechanist	Maintenance	–	B2	3	10	○	1	1	1
3	Remaining life assessment		*2	Intermediate	Mechanist	Maintenance	–	B3	3	10	–	1	1	–
Equipment Field														
9	Basic Gast Turbine Gas Turbine Operation & Maintenance	*1	*2	Basic Common	Electrician & Mechanist	Maintenance & Operation	effective	C1	3	15	○	1	1	–
10	CCGT Plant Operation & Maintenance Gas Turbine Control System	*1	*2	Basic Common	Electrician & Mechanist	Maintenance & Operation	effective	C2	3	15	–	1	1	–
11	Philosophy of GT electrical system and GT control Gas Turbine Electrical Control System	*1	*2	Basic Elementary	Electrician & Mechanist	Maintenance & Operation	effective	D1	1	15	–	1	1	–
12	Gas Turbine Maintence Pholsophy and its commissioning Gas Turbine O&M Lecture	*1	*2	Intermediate	Electrician & Mechanist	Maintenance & Operation	–	D2	1	15	–	1	1	–
Electrical Field														
7	Operation & Control Theory of Gas Turbine Combined Cycle Power Plant	*1	*2	Basic Elementary	Electrician & Mechanist	Maintenance & Operation	effective	D3	3	10	–	1	1	–
8	Details of Control & Instrument Devices for Gas Turbine Combined Cycle Power Plant		*2	Intermediate	Electrician	Maintenance	effective	D4	5	8	○	1	1	1
6	Details of Electrical Facilities for Gas Turbine Combined Cycle Power Plant		*2	Intermediate	Electrician	Maintenance	–	E	4	8	○	1	1	1
										Total		24+4		

(Source: JET)

The draft CCPP training plan for the UE needs to be reorganized into a form suitable for training the O&M staff of the UE by utilizing the knowledge and knowledge gained in this project. JET discussed preparing the training plan with Director NTC and Head of the Human Resource Department of Navoi TPP, according to the procedure in Figure 2.2.3-1, referring with Table 2.2.6-6 and Figure 2.2.6-1.

Discussion with the trainers of NTC addressed concrete processes for preparing training plan. At first, in November 2016 JET showed an example on the premise of “Japanese Trainer, Japanese trainees” as a reference example about the training plan preparation method. (Refer to Table 2.2.6-7 as follows)

Table 2.2.6-7 Example of training plan outline



(Source; JET)

Regarding to 12 training courses introduced in the project, JET considered the required training course for each job, and proposed to NTC. (Refer to the following Table 2.2.6-8; numbers in the Table are the one of target trainees for each CCPP Unit.) The jobs focused

on in this table were 11 for newcomers and operation staff, 7 for maintenance staff and engineer-technical, related to CCPP directly.

In August 2018, JET proposed to revise or prepare individual training program for each JOB, in order to officialize training courses to take by each job category. JET also recommended preparing the training program for upper position, i.e. for Unit manager etc. However, upper position like these are not O&M staff of the CCPP on an organization basis, JET decided to leave it to the judgment of the Navoi TPP.

It will be expected to expand individual training program to become de facto standard for all UE, by CCPP training programs in UE becoming an official document. In November 2018, JET requested to NTC and NTPP Human Resources Department in writing, so as to register as an official document of the Navoi TPP about total of 18 kinds of individual training program.（Refer Appendix13; Request to confirm the progress of the Project）JET pointed out at the 4th JCC, as the revision of Individual training program and document registration could not be confirmed as of March 2019.

Table 2.2.6-8 Targeted Training Course for each job category

		Proposal to revise or to create Individual Training Program										*Highly recommendation to create Individual Training Program*							
	Job Position of Trainee (O&M Staff)	New Employee	Shift Head	Senior Operator	GT Operator	ST Operator	BOP Operator	GBCS Operator	Ptrol GT	Petrol ST Cooling Tower	Patrol BOP/HRSG	Patrol GBCS	Inspector MetalLab	Fitter GBCS Shift	Fitter CCPP Shift	Engineer Program	Leading Eng. Program	Electronic Engineer	Leading Eng. TME
	Confirmed Individual Training Program (attached document name)	--	En-Rus 2.2.2-4-No7	---	En-Rus 2.2.2-4-No10	En-Rus 2.2.2-4-No6	En-Rus 2.2.2-4-No8	---	En-Rus 2.2.2-4-No3	En-Rus 2.2.2-4-No5	En-Rus 2.2.2-4-No4	---	---	---	---	---	---	---	---
	Staff Number in Navoi CCPP-1		5	5	5	5	5	5	5	5	10	5	1	5	5	2	1	1	1
	Mechanical Field																		
1	Non-destructive testing		○	○									●						○
	Number of Trainee for CCPP unit		5	5									1						5
2	Vibration analysis for rotating machine		○	○	○	○		○								○	○	○	○
	Number of Trainee for CCPP unit		5	5	5	5		5								2	1	1	1
3	Remaining life assessment		○	○									◎						◎
	Number of Trainee for CCPP unit		5	5									1						1
4	Gas Turbine combined power generation equipment	◎	●	●	●	●	●	●	●	●	●	●	●	◎	◎	●	●	●	●
	Number of Trainee for CCPP unit		5	5	5	5	5	5	5	5	10	5	1	5	5	2	1	1	1
5	Gas Turbine Hot Parts Maintenance		●	◎	◎								◎						●
	Number of Trainee for CCPP unit		5	5	5								1						1
	Electrical Field																		
6	Details of Electrical Facilities for Gas Turbine Combined Cycle Power Plant		○	○	○													◎	○
	Number of Trainee for CCPP unit		5	5	5													1	5
7	Operation & Control Theory of Gas Turbine Combined Cycle Power Plant	○	◎	◎	◎	◎	◎	◎	○	○	○	○				◎	●	◎	◎
	Number of Trainee for CCPP unit		5	5	5	5	5	5	5	5	10	5				2	1	1	1
8	Details of Control & Instrument Devices for Gas Turbine Combined Cycle		○	○	○	○	○									◎	●	◎	◎
	Number of Trainee for CCPP unit		5	5	5	5	5									2	1	1	1
	Facility/Equipment Field																		
9	Gas Turbine Operation & Maintenance	◎	●	●	●	●	●	●	●	●	●	●	●	◎	◎	●	●	●	●
	Number of Trainee for CCPP unit		5	5	5	5	5	5	5	5	10	5	1	5	5	2	1	1	1
10	Gas Turbine Control System	○	◎	◎	◎	◎	◎	◎	○	○	○	○				◎	◎	◎	●
	Number of Trainee for CCPP unit		5	5	5	5	5	5	5	5	10	5				2	1	1	1
11	Gas Turbine Electrical Control System		◎	○	◎		○									◎	●	◎	○
	Number of Trainee for CCPP unit		5	5	5		5									2	1	1	5
12	Gas Turbine O&M Lecture		※	※	※	※	※	※									※	※	※
	Number of Trainee for CCPP unit		5	5	5	5	5	5									5	5	5

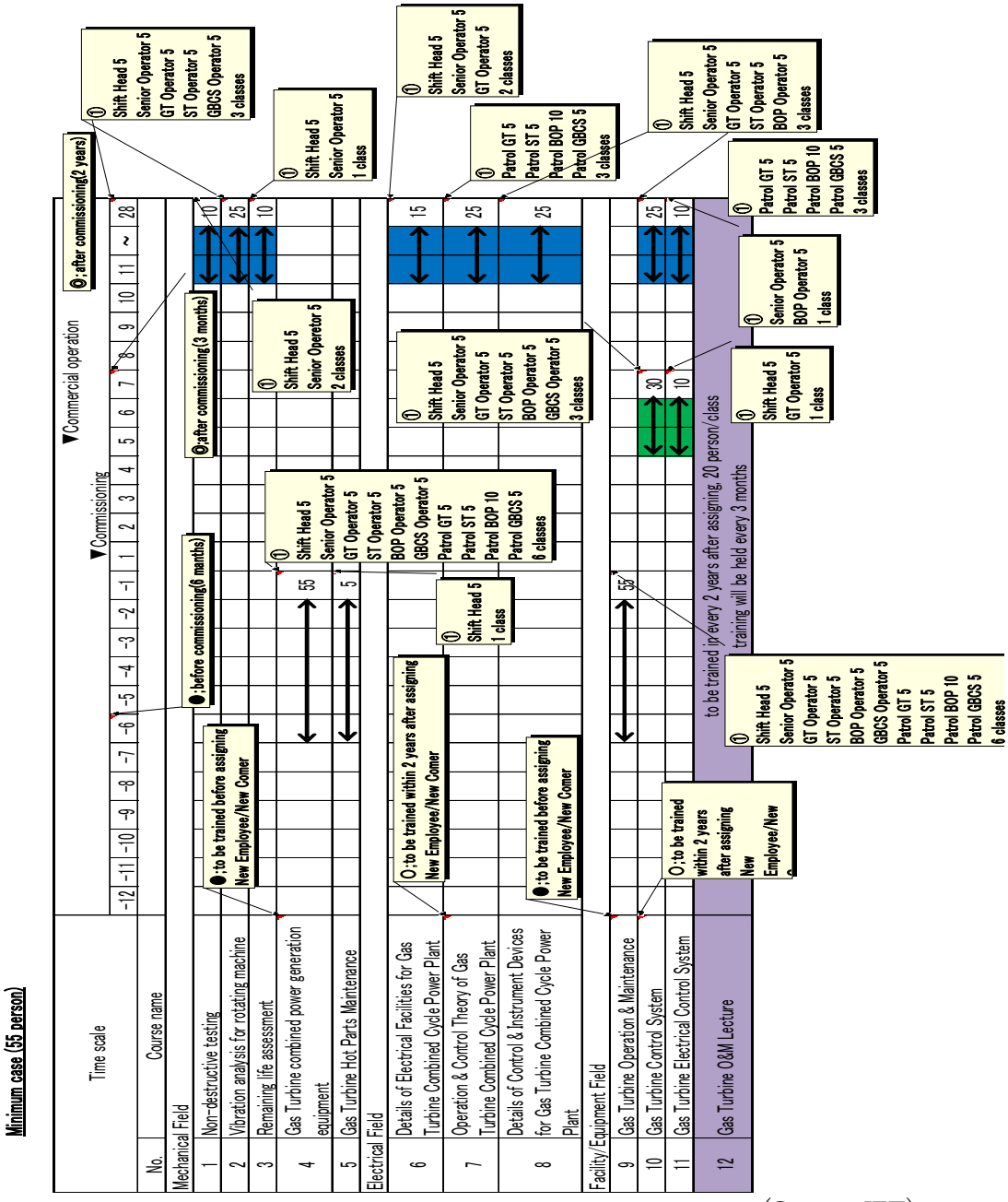
●; to be trained before assigning ◎; to be traned within 3month after assigning ○; to be trained within 2 years after assigning ※; to be trained in every 2 years

(Source: JET)

2) Mid-Term Training Plan by UE

In order to formulate the mid-term training plan, it is necessary to calculate base on the predicted number of trainee related to the CCPP installation plan in Table 2.1.2-2. For the next step, referring to the number of staff in Navoi CCPP-1 in Table 2.1.4-3, and referring to the required course for each job in Table 2.2.6-8, JET estimated and showed the typical training schedule for one CCPP unit, as in Table 2.2.6-9 below.

Table 2.2.6-9 Number of trainees per one CCPP UNIT



(Source: JET)

On the other hand, JET requested the UE HQ to formulate a Mid-term Training Plan for up to the first quarter of 2022. Department of Work with Personnel of UE HQ conducted questionnaires in each TPP on the number of CCPP staff members who needed education

and training, and the result is in the following Table 2.2.6-10. The number of trainees related in this project up to March 2022, are estimated at 532.

Table 2.2.6-10 Mid-term Training Plan by UE (2018 - 2024)

№	Organisation name	Capacity	Operation year	Number of employees to be trained in the context of years and quarters																												Total
				2018				2019				2020				2021				2022				2023				2024				
				I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	
1	JSC "NAVOI TPP"	Navoi CCPP-1, 479 MWt	operating			25	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	280
		Navoi CCPP-2, 479 MWt	2019																													
		Navoi CCPP-3, 479 MWt	being developed																													
2	UE "Talimarjan TPP"	Talimarjan CCPP-1, 450 MWt	operating				2		5	5	5	2	2	4	2	2	4	4	2	2	2	4	4	2	2	2	2	4	2	2	2	69
		Talimarjan CCPP-2, 450 MWt																														
		Talimarjan CCPP-3, 450 MWt	2022																													
		Talimarjan CCPP-4, 450 MWt																														
3	JSC "Tahiatash TPP"	Tahiatash CCPP-1, 250 MWt	2020				39	14	14	15	15	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	117
		Tahiatash CCPP-2, 250 MWt																														
4	JSC "Tashkent TPP"	Tashkent CCPP, 370 MWt	operating				3	3	2	2	3	3	2	2	3	3	2	2	3	3	2	2	3	3	2	2	3	3	2	2	3	63
5	UE "Directorate of construction of Turakurgan TPP"	Turakurgan CCPP-1, 450 MWt	2020				20	20	20	20	20	10	10	10	10	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	220
		Turakurgan CCPP-2, 450 MWt																														
		Turakurgan CCPP-3, 450 MWt	being developed																													
		Turakurgan CCPP-4, 450 MWt	being developed																													
6	JSC "Tashkent CHP (Thermal Electric Central)"									4		3	3	2	2																	14
	TOTAL:					25	79	47	51	56	53	29	28	29	28	21	22	22	21	21	20	22	23	21	20	20	21	23	20	20	21	763

（Source: UE）

JET estimates that the number of target trainees for the Mid-term Training Plan tends to concentrate on the commissioning of the unit and the operation start time. According to the CCPP installation result and plan (Table 2.1.2-2) and based on the number of trainees per unit (Table 2.2.6-9), JET recalculated the number of trainees who will attend the training until March 2022.The draft of the training road map is shown in the following Table 2.2.6 - 11, and JET showed them to NTC, the NTPP Human Resources Department, and the Department of Work with Personnel of UE HQ.

Table 2.2.6-11 Training road map proposed by JET
(Forecast of number of trainees until March 2022)

Time Scale		2018 (Project Period)				2019				2020				2021 (Over All Goal)				2022	55 base Total (~2022.3)	71 base Total 130% of 55base
		1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q		
No.1	Non-destructive testing	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	10	10	30	40
No.2	Vibration analysis for rotating machine	0	0	0	0	0	0	0	0	0	0	0	25	0	0	0	50	0	75	100
No.3	Remaining life assessment	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	10	10	30	40
No.4	Gas Turbine combined power generation equipment	0	0	55	0	0	0	55	55	0	55	0	0	0	0	110	0	0	330	426
No.5	Gas Turbine Hot Parts Maintenance	0	0	5	0	0	0	5	5	0	5	0	0	0	0	10	0	0	30	40
No.6	Details of Electrical Facilities for Gas Turbine Combined Cycle Power Plant	0	0	0	0	0	0	0	0	0	0	0	15	0	0	0	15	15	45	60
No.7	Operation & Control Theory of Gas Turbine Combined Cycle Power Plant	0	0	0	0	0	0	0	0	0	0	0	25	0	0	0	25	25	75	100
No.8	Details of Control & Instrument Devices for Gas Turbine Combined Cycle Power Plant	0	0	0	0	0	0	0	0	0	0	0	25	0	0	0	25	0	50	65
No.9	Gas Turbine Operation & Maintenance	0	0	55	0	0	0	55	55	0	55	0	0	0	0	110	0	0	330	426
No.10	Gas Turbine Control System	0	0	0	0	30	0	0	0	30	30	0	55	0	0	0	25	85	255	330
No.11	Gas Turbine Electrical Control System	0	0	0	0	10	0	0	0	10	10	0	20	0	0	0	10	50	110	150
No.12	Gas Turbine O&M Lecture	0	0	0	0	20	20	20	20	20	20	20	20	20	20	20	20	20	260	340
Trained O&M staff (55 base)		for Navoi- 2		55		for Trukurgan-1		55	55		55	for tashlatashi-1,2				110		0	330	
Trained O&M staff (71 base)				71		for Trukurgan-2		71	71		71		for Talimarjan-3,4			142		0	426	426
UE's Estimation @13th mission				25	79	47	51	56	53	29	28	29	28	21	22	22	21	21	532	

UE Total are 125% from 71 base

（Source: JET）

At the beginning of the project, 4 UNITs for Syrdaryo TPP were included in the installation plan, and it was estimated that around 800 targeted trainees were necessary by the first quarter of 2022. But as the construction plan for Syrdaryo TPP was suspended, the estimated trainees by JET is 426 and also peak number of trainees is 142. (The second row from the bottom in Table 2.2.6-11 above)

Meanwhile, the number of trainees estimated by UE HQ is 56 at the peak in Table 2.2.6-10, and the point that is leveled is ideal for the management of the training center, but the

affiliation and job position of each trainee at each TPP are unclear and incorrect. In order to estimate the necessary number of trainers to implement the training, this detailed information is required.

3) 2019 Annual Training Plan of NTC

The Human Resources Department of UE HQ conducted a questionnaire at each power plant to confirm the number of trainees as above, but the detailed number of trainees for each courses cannot be decided from the replies by each TPP at this moment. It does not lead to the preparation of the next year's annual training plan. For these reason, JET submitted a request letter in November 2018 to NTC, to the Human Resource Department of NTPP and to the Department of Work with Personnel of UE HQ about the necessity to prepare the 2019 annual training plan urgently.（Refer to Appendix 13, Request to confirm the progress of the Project）

4) Preparation of Lecture Plan

In conducting the training, the trainer needs to prepare a Lecture Plan in advance as preparation for implementation of the training course. NTC would have to compile the curricula and annual training plan that includes the training schedule based on the Lecture Plans for each subject prepared by the trainers.

The Lecture Plans should contain the following contents: (a) Name of the course, (b) Standard number of trainees, (c) Number of lesson days and schedule, (d) Lesson details and arrangement of hours, (e) Equipment used, (f) Main points of questions and answers, (g) Test questions and standard answers for final examination, (h) Criteria for evaluating trainees, i.e. attitude during training, also evaluation of questions and answers, and so on.

At first, JET requested to prepare the Lecture Plan for O&M staff and asked the Director of NTC to promote completion of training plan with an understanding of the overall schedule in this project. Regarding this, during TOT in Japan, trainer candidates were trained about the action plan to prepare Lecture Plans. JET also requested executives to support trainer candidates and assist with preparing Lecture Plans. The sample form for a Lecture Plan is shown in the following Figure 2.2.6-2.

During the 2nd Workshop on August 25, 2017, the results of the Action Plan prepared in the 2nd TOT in Japan were reported by the trainer candidates. The contents presented were to hold a trial training for 35 staff of Navoi TPP in April - May 2017, to confirm the hours necessary and conditions for training, and to prepare Lecture Plans based on the result of this trial. As a result of implementing the action plan, trainer candidates completed Lecture Plan drafts for courses No. 4, No. 5, No. 9 and No. 10. Regarding the Lecture Plan of the remaining subjects, the trainer candidate who participated in 3rd TOT in Japanese completed preparation of the drafts.

JET experts commented on the first draft of Lecture Plans based on their own training experience, and pointed out the necessity of strengthening (g) Q & A in order to make it a level used for certification exams for training completion. Based on this advice, trainer candidates completed their draft of Lecture Plans before the 12th mission in July 2018. Ultimately, drafts of the Manual for Lecture-Lesson Plan and the Lecture Plan Draft were agreed during the 12th mission.（Refer to Appendix 16, Manual for Lecture-Lesson Plan and Appendix 25, Lecture Plan Draft）

Sample Form of
Training Plan/ Lesson Plan

* red color character is only for sample
Dated **xx**th January,2017
CCGT Operation & Maintenance Training Center, Navoiy

signature
approved by Mr. Dustovr Shukrat
President of Training Center

1 No & Title of Training Course
No.4 Gas Turbine combined power generation equipment
Responsible Instructor/ Trainer for this course
Main Mr. Musaev Alisher Baxtiyorovich
Sub Mr. Aslonov Aslon
others Mr. Djamolov Bakhodir/ Mr. Maksudov Laziz/ Mr. Boyliev Shukhrat
2 Standard Number of Trainee
10 trainees
Target Trainee
New employee for CCPP/CCGT of UE
3 Course period/ time*
3 days/ 21 hours*
4 Course contents & time

No	Subtitle	date	hours*
1 & 2	Overview of Navoiy TPP	1st	2
3	Basics of Combined Cycle Power Generation	1st	3
4	Basic knowledge of Gas Turbines	1st & 2nd	7.5
5	Periodical and Combustor Inspection	2nd	1.5
6	Heat Recovery Steam Generator	3rd	1
7	Steam Turbine	3rd	1
8	Trouble Example	3rd	5

5 Required equipment for this course
no equipment for this course
6 Check point of this training

No	Check point in detail
1 & 2	
3	
4	
5	
6	
7	
8	

7 Question & typical answer for the completion examination of training

Q&A should be prepared by Instrucotr

8 Evaluation criteria of trainee
(a) Attendance rate of training
(b) Attitudes in training
(c) Aggressiveness, Number of questions etc.
(d) Understanding of lecture, pertinence for course
(e) Results of the completion test
(a) - (e) are examples of criteria
* JET predicted period/time if Japanese Instructor implemented this training.
Instructor should plan the course period/ time by himself including details.

（Source: JET）

Figure 2.2.6-2 Sample form for Lesson Plan

5) On-Site Training utilizing periodic inspection (for Senior Staff training and for Trainer Candidate Training)

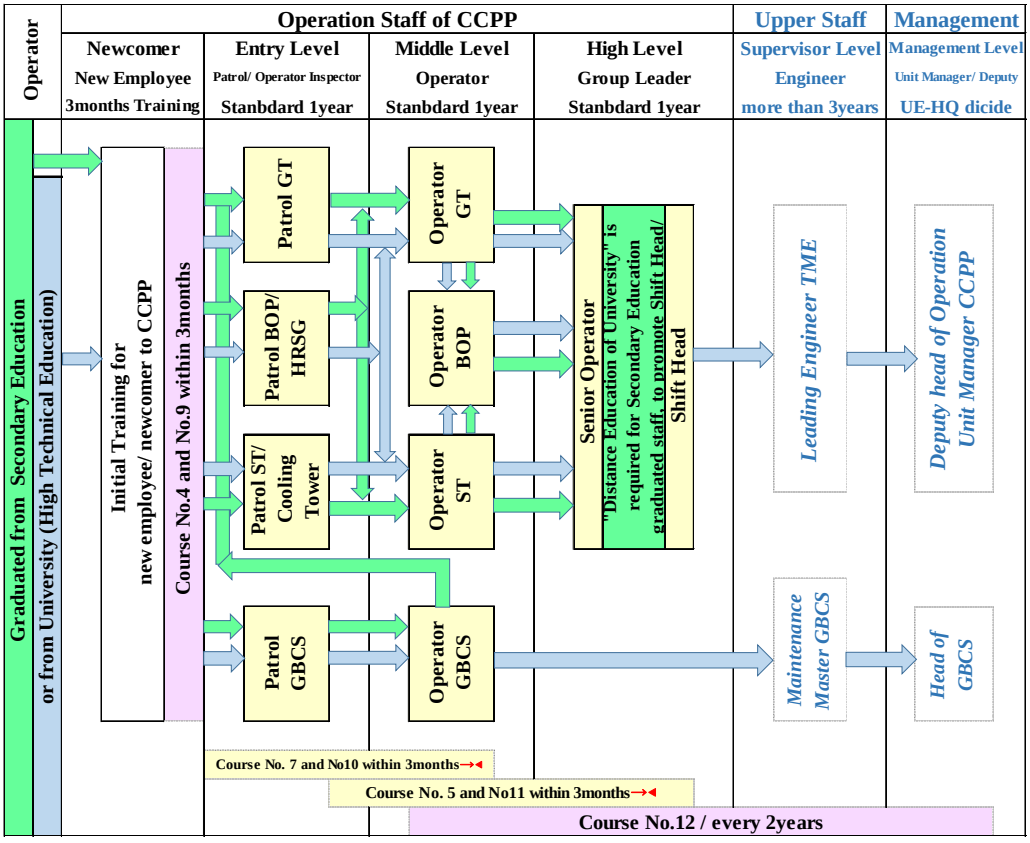
The experience obtained from periodic inspection of CCPP is very important knowledge for senior staff to advise their subordinates, also from the viewpoint of trainer development. JET recommended that the subject No. 4, No. 5, No. 7, No. 8, No. 9, No. 10 and No. 11 are the subjects with a large effect for On-Site training utilizing periodic inspection. (Refer Table

2.2.6-6; Effect of On-Site training) From this point, JET proposed to prepare a Lecture Plan including On-Site Training.

The Lecture Plan Draft, prepared in the previous section 4), i.e. in Appendix 25, Lecture Plan Draft, On-site training is described as a milestone. But concrete implementation details are not described. JET pointed out that it is necessary for NTC to autonomously prepare a Lecture Plan for Senior Staff and Trainer Development Training with detailed contents, as an issue to be addressed in the future and strive to ensure sustainability, and agreed on the direction.

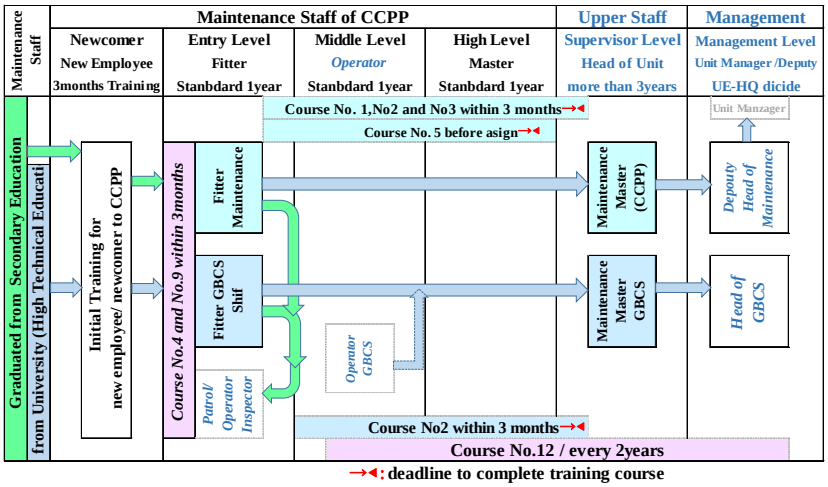
2.2.6.3 Developing an accreditation system for O&M staff and trainers

Based on the Navoi CCPP-1 Staff Promotion Steps shown in Figure 2.2.2-2 in section 2.2.2.1, Accreditation Road Map for Operation staff and Maintenance staff have been clarified. (Refer to Figure 2.2.6- 3 and Figure 2.2.6-4.; Training courses, No. to be trained, related promotion, are including in the Figure.)



(Source: JET)

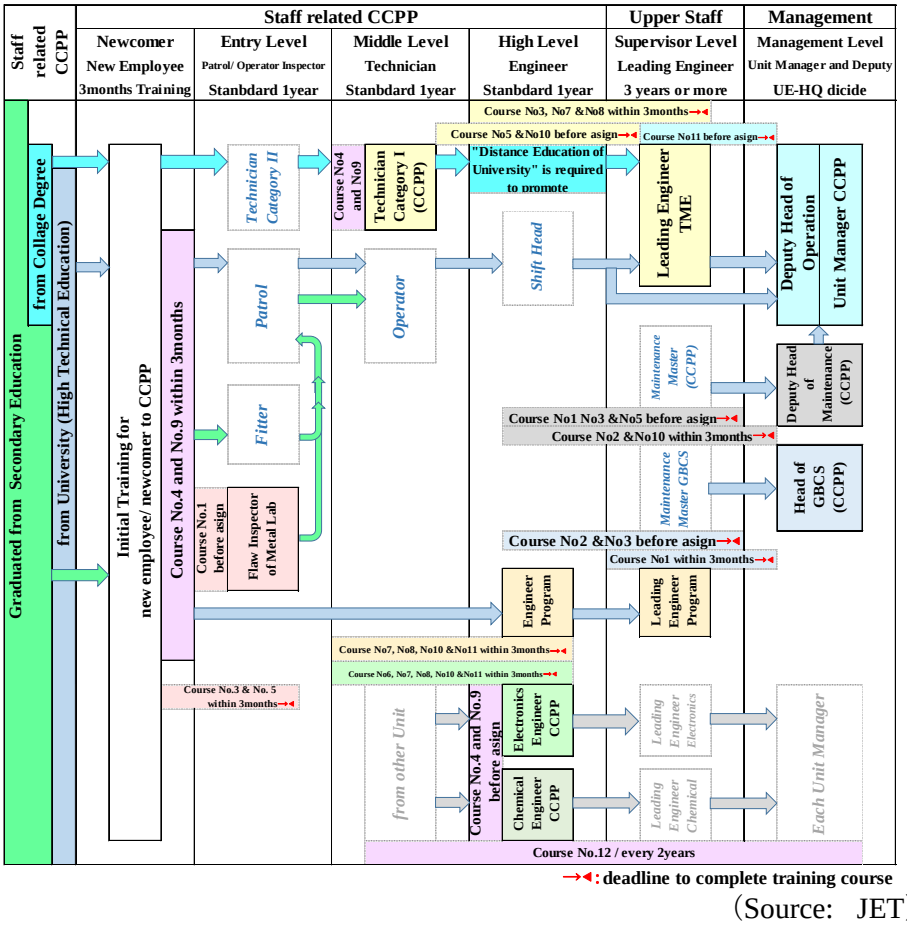
Figure 2.2.6-3 Accreditation Road Map for Operation Personnel



（Source: JET）

Figure 2.2.6-4 Accreditation Road Map for Maintenance Personnel

Also, regarding Engineer-Technical and Technician CAT-I, related to CCPP operation as well as senior staff, other than O&M staff, the accreditation road map is arranged as shown in the following Figure 2.2.6-5.



（Source: JET）

Figure 2.2.6-5 Accreditation Road Map other than O&M Personnel

The project discussed and agreed the above road maps on the based on staff promotion steps.

Regarding accreditation of O&M staff concerning CCPP, the Project agreed on the current approval method of O&M staff of UE, i.e. using the ID card described in Section 2.2.4. A summary of consent items are as follows.

(1) Certification of O&M staff

In accordance with the procedures for certifying the O&M staff of the conventional TPP, the Project agreed to adopt the same procedure.

That is, completing the training course at the new NTC to be established in this project, recording the training result on the personal ID card and certifying completion. Also, after completing OJT and intern training at each TPP, the accreditation of O&M staff with the training result should be described on personal ID cards issued by the TPP. The project discussed and agreed on this procedure. (This procedure is exactly the same as the existing training completion certification procedure, so it is not specifically documented in a manual.)

1) Process of completion confirmation for training of O&M staff at new NTC:

For 12 training courses undertaken by the project, trainers certified by JET will conduct training for O&M staff, and NTC will record the completion of training on personal ID card. 7 subjects require completion confirmation by “Sanoat geokontehnazorat”, as shown in Table 2.2.6-6. The New NTC shall report the result of training as a journal record to the Department of Work with Personnel of UE HQ.

It is noted that, as mentioned in section 2.2.4- (1), the personal ID card for the New NTC needs to issue new ID card corresponding to the TTC. (Photo 2.2.4-1 blue) For ID cards, it is necessary to apply to the local government office and confirm to UE HQ. In addition, it must be noted that submission to the Ministry of Higher Education, such as a drawing of the training center building and training room, a list of accredited trainers, teaching material text books, etc. are required, too.

For this reason, in the meantime, the Project agreed to record the training result on the Navoi TPP's personal ID card. (Photo 2-2 red). This is a provisional measure, because of the main trainee will be staff of Navoi TPP at the beginning. As a measure before the NTC ID card can be issued, NTC must create and manage training records for the staff other than the staff of Navoi TPP. NTC will copy it to ID cards after these are issued, and make it an official training completion record.

Ultimately, it is necessary to get permission for the newly personal card of the NTC in order to accept trainees other than the Navoi power station.

2) Certification of staff by training by power plant at site, and OJT:

At present, Navoi CCPP and Talimarjan CCPP is operating, but only Navoi CCPP could implement training by power plant at site, & OJT. For the time being, it was confirmed that these trainings will be mainly implemented at Navoi CCPP. UE appoints and secures the staff for launching new CCPP, through training at new NTC and on-site & OJT training at Navoi CCPP-1. After the launching new CCPP, new CCPP should prepare the OJT system like Navoi CCPP-1 and manage the certification system like one of conventional TPP. In other words, in the future, each new CCPP should establish an implementation system based on training by power plant at site, and OJT equivalent to Navoi CCPP, and procedures for accreditation of O&M staff should be carried out by ID cards issued by each CCPP.

(2) Appointment / Adoption of trainers:

As described in Section 2.2.5.1, the trainer for conventional thermal power generation at TTC is someone who has university degree, experience of about 10 years or more, has become a trainer candidate of the training center with recommendation of the director of TPP, and is hired as a trainer after a final interview. The trainer for OJT is appointed from among the experienced

staff, having over 30 years' experiences in the field of conventional TPP. Meanwhile in OJT at CCPP/CCGT, an engineer/manager staff member who has worked in conventional TPP and has completed the EPC training by manufacturer was nominated as a trainer.

Even in Japan, trainers for training are appointed from experienced superiors without certain regulations, same as for UE. In Table 2.2.6-12 as follows, the Human Resources Department of a Japanese power company considers the public qualifications such as "B/T Chief Engineer" and "Class I Electric Chief Engineer" as individual ability, but the current situation in UE is different. Therefore, JET introduced information about qualifications in Japan, and recommended their use.

Table 2.2.6-12 Qualifications in Japan (Excerpt)

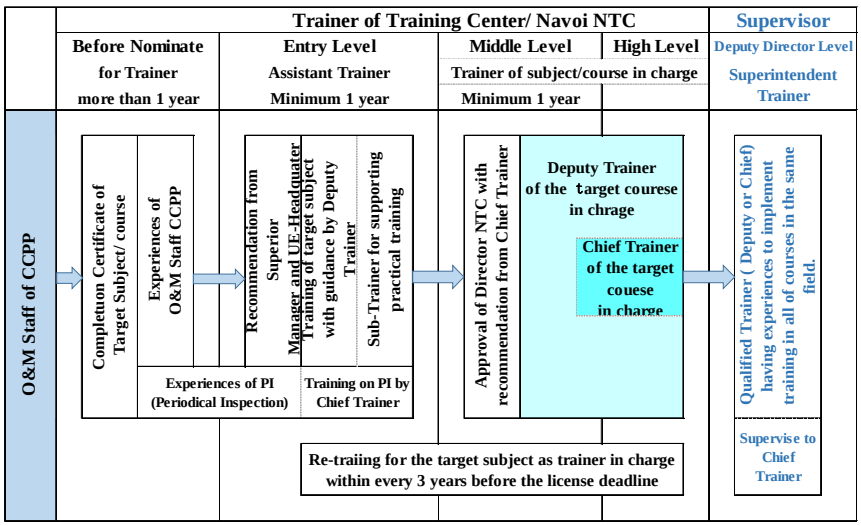
Qualification Title (appointment required for work)	Qualification Acquisition	Condition for acquisition	Target Speciality
1st Class Boiler・Turbine Chief Engineer	Practical Experience	6 years after machinery BS graduation, and 3 years experiences of O&M boilers or turbines for power generation	Safety supervisor of electrical facilities of boilers, steam turbines, gas turbines, fuel cell power plants, for power generation. Refer Attachment-1:"Periodical Operator Inspection Implementation Manual for CCPP Equipment."
1st Class Chief Electrical Engineer	National Exam	3 yeard experiences about electrical facilities for BS Graduates 5 yeard experiences about electrical facilities for any engineer	Safety supervisor of electrical facilities in power company
3rd Class Chief Electrical Engineer	National Exam	Passed National Exam	Safety supervisor of electrical facilities except power company (i.e. consumer)
Energy Management Engineer (Thermal/Electricity)	National Exam or by certified training	1 year experience for energy management or 3 years experience for energy management	Supervisor for rationalization, monitoring and improvement, to save energy
Polution Control Director	Registration Authorization	Qualification holder of Pollution Control Manager	Director for pollution control at site/plant Supervision of pollution control managers in each field
Pollution Control Manager (in field of Air/ Water/Vibration)	National Exam	Passed National Exam	Management and practical work of pollution control
Safety supervisor for High pressure gas production	National Exam or Exempt of examinations	Passed National Exam or by certified training	Disaster prevention as safety supervisor of high pressure gas

(Source: JET)

1) Roadmap for Trainers

Discussed roadmap on the premise of the existing trainer and education staff appointment procedure described in Section 2.2.4 (3). Examined the procedure of appointing trainer of CCPP training, and as a result, JET created and proposed the manual draft for authorization and appointment of trainers. The manual was divided into "Authorization of Trainers under the Project" and "Appointment and Role of Trainer of NTC after the Project" and the contents were agreed.

The agreed manual defined the duties and roles based on the trainer's experiences and abilities. (Refer to Appendix 17, Manual for Authorization of Trainers under the Project and Appendix 18, Manual for Appointment and Role of Trainer of NTC) The Roadmap for Trainers is as shown in Figure2.2.6-6 below.



(Source: JET)

Figure 2.2.6-6 Roadmap for Trainers

Outline of the training certification by NTC after the project, and by JET during the project are shown in points 2) and 3), as below. (The result of the accreditation of the trainers during the project is described in Section 2.4)

In point 4), the implementation of developing trainer training utilizing periodic inspection is described.

2) Accreditation procedure of trainers under the project (Refer to Appendix 17)

(a) Trainer candidates should be recommended by UE HQ.

3 years or more working experience at a CCPP is desirable. However, those who have around 10 years or more experience of O&M work in conventional TPP or job experience in CCGT will also be acceptable.

(b) The trainer candidates were interviewed after confirming their career, etc., by document review. JET implemented interviews with trainer candidates. The members who passed the conditions a) & b) received permission to attend the TOT.

(c) The trainer candidates should complete TOT in Uzbekistan. JET implemented TOT in Uzbekistan for 12 subjects respectively.

(d) Training utilizing periodic inspection

In Section 2.2.6.2 (2) 5), JET pointed out that the experience of periodic inspections for senior staff and trainer was important, and agreed on the direction. Developing trainers under the project, utilizing periodic inspections, is described in Section 2.2.7 (3).

(e) The trainer candidates should pass the completion examinations for the subjects in which they were developed. JET implemented completion examinations for the 12 subjects respectively. Each expert of JET decided the method of completion examinations for each subject, for example, paper test or training simulation trial, etc., according to each subject.

3) Appointment procedure of trainers by UE in future (Refer to Appendix 18)

JET proposed an appointment procedure for trainers by UE itself to implement after completion of the Project, as follows.

(a) Trainer candidates should be recommended by UE HQ.

It is a desirable condition to recommend staff who have 3 years or more experience in O&M work of CCPP. However, those who have around 10 years or more experience of O&M work in conventional TPP or job experience in CCGT will also be acceptable.

(b) Completion of TOT for trainer candidates

For candidates without experience in CCGT, NTC should plan and implement TOT of applicable subjects. Regarding subjects effective in On-Site Training in Table 2.2.6-6, it is recommended TOT utilizing periodic inspection, to develop trainers. For the subjects without recommendation for On-Site Training (subjects No. 1, No. 2, No. 3, No. 6, and No. 12), TOT may be exempted if candidates were already certified in the subject as O&M staff.

(c) Completion examination of training for the subject

For the TOT implemented in point b) as above, NTC should implement completion examinations. NTC will decide the completion examination method for each subject, JET recommends Mock-Up training to evaluate trainers. For the subjects that require it, completion of training needs confirmation by “Sanoat geokontehnazorat”.

(d) Document selection and interview

Trainer candidates who have passed the completion examination will be certified as trainers after confirming his/her career record and the interview result. The interview is carried out by the Head of Human Resources Department of NTPP and the Director of the NTC, also the Chief Trainer in charge the relevant subject, to make a pass/fail judgment.

2.2.7 Implementation of CCPP O&M Training and Training Plan

In this section, the implemented issues in the project, i.e. TOT for trainer candidate, preparation of teaching materials and training equipment procurement are described. It also includes recommendations for formulation of the training plan after the project.

2.2.7.1 Provision of training materials and training equipment and implementation status of TOT

In the training materials/textbooks for 12 subjects, JET provided English originals and Russian translations, trainer candidates received materials, and completed revisions of technical terms of the Russian version with coaching by JET. The actual implementation of TOT, and delivery of training equipment were as follows.

(1) TOT of Mechanical Field（No. 1 - No. 5）

1) No. 4 (completed in July 2016：No training equipment is eligible for procurement.)
2) No. 5 (completed in October 2016：No training equipment is eligible for procurement.) The TOT for No. 4 and No. 5 were completed by former Tashkent trainer candidates. For this reason, JET requested the implementation of technology transfer between former and new trainer candidates, in early 2017. Mock-up training was completed at the 2nd TOT in Japan, and the 3rd TOT in Japan.
3) No. 1 Classroom lecture (completed in May 2017)
Practical training with training equipment for No. 1, Non-destructive Inspection, was completed in January 2018. Mock-up training was completed in March 2018 at the 3rd TOT in Japan. Setting up of training equipment were on March 2019.
4) No.3 (completed in July 2017: No training equipment is eligible for procurement.)
Mock-up training was completed in October 2018.
5) No.2 Classroom lecture (completed in July 2018)
Practical training with training equipment for No. 2, Vibration analysis, was completed in October 2018 at the13th mission. Mock-up training was completed in October 2018. Setting up of training equipment were on March 2019.

(2) TOT of Electric Field (No. 6 - No.8)

1) No. 6 (completed in August 2017) Mock-up training was completed in August 2017. Practical training with training equipment for No. 6, SFC, was completed in September 2018
2) No. 7 (completed in August 2017: No training equipment is eligible for procurement. Mock-up training was completed in August 2017.
3) No. 8 (completed in July 2018)
Mock-up training was completed in July 2017.
Practical training with training equipment for No. 8, Control Box, was completed in September 2018

(3) TOT of Facility/ Equipment Field （No.9 - No.11）

1) No.9 (completed in December 2016)
Mock-up training was completed in July 2017.
Practical training with training equipment for No. 9 <3D Model> was completed in January 2019.
2) No.10 (completed in December 2016: No training equipment is eligible for procurement. Mock-up training was completed in July 2017.

3) No.11 (completed in December 2016: No training equipment is eligible for procurement.)
Mock-up training was completed in July 2017.
4) No.12 (completed in May 2017: No training equipment is eligible for procurement.)
Mock-up training was completed in July 2017.

(4) Delivery of training equipment

1) In February 2017, equipment for the mechanical fields were tendered by the procurement department of JICA Headquarters. They were delivered in July 2017, except the vibration analysis training equipment, which need specific conditions.
2) For the electric field, the equipment list was confirmed in the 7th mission in December 2016, and these were tendered in April 2017. Training equipment "No. 8: Control Box" was delivered in March 2018, and its functionality was confirmed by JET experts. Training equipment "No. 6: SFC" was delivered in May 2018. Installation and function check by manufacturer were implemented in October 2018.
3) Training equipment for the facility field, i.e. the 3D Model which needs specific conditions, and equipment for vibration analysis in the mechanical field were tendered in April 2017. They were delivered in March 2018, and vibration analysis was installed and checked for functionality by the manufacturer at that time.

2.2.7.2 Training plan and Implementation

(1) Staff training during the project

As mentioned in 2.2.4 (2), it takes time for NTC to be formally accredited as a training center. Specifically, NTC should apply after completion of the training center building planned for February 2019, and it seems to require for 3 months to 6 months until approval. Meanwhile, training of staff for the operation of GT of Navoi CCPP-2 in December 2018 is an urgent issue. Staff training has been started by trainer certified by the project, before the official start of the NTC. In order to ensure certification for staff who completed training courses, JET proposed and agreed to steadily leave the training implementation record. This training record is copied to ID card, after the new training center is registered and certified and the official ID card becomes possible to issue. It will be reliable to have the completion of training officially certified by record.

The following Table 2.2.7-1 shows the schedule for the implemented training results and plans, for new employees of Navoi CCPP-2, based on hearings from NTC and trainer candidates. Not all of the trainees will be assigned to Navoi CCGT-2, but some will be assigned to CCPP-1 as successors of staff affixed to the CCGT-2 from CCPP-1. In addition, JET requested the submission of report on the training result (journal record) to confirm the training performance. (Refer Appendix 13, Request to confirm the progress of the Project>)

Table 2.2.7-1 Training plan and results for new employees of Navoi CCPP-2
（from hearing data at NTC）

Механики 30 | Electrical Staff 5 | C&I Staff 5 | ST Staff 15/Mechanical | March 2019, by NTC

Year			2018 (Actual Result)												2019 (Plan)		Course Period	Trainer, Instructor 2018/2019
Month			1	2	3	4	5	6	7	8	9	10	11	12	4	5		
No. Course ＼TOT			TOT UZ		TOT JP				TOT UZ			TOT UZ						
1	Non-Destructive Inspection	Plan	◎		○													
		Actual																
2	Vibnration Analysis for Rotating Machine	Plan			○				◎			◎						
		Actual																
3	Remaining Life Assessment	Plan			○							◎						
		Actual																
4	GT Combined Power Generation	Plan			○		10			10	10					5	10	3 dyas	Mr. Musayev Mr. Bayliev/Mr Khudoykulov
		Actual					10			10	10							
5	GT Hot Parts Maintenance	Plan			○													
		Actual																
6	Details of Electrical Facilities for GT CCPP	Plan								5		◎					4 dyas	Mr. Eshev Mr. Parmanov
		Actual								5								
7	Operation & Control Theory of GT CCPP	Plan								5 5						5	10	3 dyas	Mr. Eshev Mr. Toshov
		Actual								5 5								
8	Details of C&I Devices for GT CCPP	Plan	◎						◎	5		◎					4 dyas	Mr. Toshov Mr. Narziev
		Actual								5								
9	GT Operation & Maintenance	Plan			○		10		◎	5 10	10					5	10	3 dyas	Mr. Khudoykulov Mr. Musaev/Mr Bazarov
		Actual					10			5 10	10							
10	GT Control System	Plan			○		10		◎		10					5	10	1 day	Mr. Pirnazarov Mr. Bayliev
		Actual					10				10							
11	GT Electrical Control System	Plan			○				◎	5								1 day	Mr. Parmanov Mr. Bazarov
		Actual								5								
12	CT O&M Lecture	Plan	◎		○				◎									
		Actual																

(Source: UE)

Besides this, training for 20 staff from Turakurgan has started from November 2018, and also 20 staff for Tahiatash has started from December 2018. The training subjects were No. 4 in the machine field, No. 6 in the electrical field, and No. 9, No. 10 and No. 12 in the field of equipment. Both power plants are scheduled to start operation till 2020, and request letters for training were submitted to Director Navoi TPP from the power station manager.

1) November - December 2018: 20 staff (8 days) of CCGT - 1 & 2 of Turakurgan TPP; Training completed on December 27

2) December 2018: 20 staff (5 days) of CCGT-1 & 2 of Takhiatash TPP; Training completed on December 30

NTC needed to submit the report of above mentioned training to JET, and clarify the results of training. Report aimed to be used for monitoring at the end of the project, but was not delivered.

(2) Training Costs

Permission for NTC as training institution is being prepared as an application to the Ministry of Higher and Secondary Specialized Education, as well as TTC. However, it is impossible to conduct a fee-based training until obtaining a license, as NTC cannot cover the cost of training. UE HQ held a meeting in December 2018 to discuss letting NTC report the training results and to confirm certain funds to NTC. As a result of discussion, the funds will be provided only for trainer's per diem, and training expenses such as travel expenses and accommodation expenses of trainees are not subject to consultation. Since it is necessary to take comprehensive budget measures, JET appealed to Director NTC to that small effect. To date, the NTPP bears the cost of lodging, and requested both TPP to pay accommodations charge for trainees. Even at both TPP, it is impossible to respond to NTPP's request unless there is some ingenuity such as requesting UE HQ for budget measures.

(3) Annual Training Plan 2019

The mid-term training plan created by the UE, i.e. Table 2.2.6-10, is a result of questionnaires to each TPP based on the installation plan of CCPP. In Section 2.2.3 (1), the procedure to create an annual training plan by the TTC, i.e. Figure 2.2.3-1, has been described, it is required to

clarify the jobs and positions of trainees. And to do so, it is necessary to conduct a questionnaire after clarifying the draft of NTC's annual training plan. As mentioned in Section 2.2.6.2 (2) (3), JET requested NTC, Human Resources Department of NTPP and the Human Resources Department of UE HQ to plan a 2019 training plan urgently, in November 2018, and pointed out the same issue in 4th JCC. (Refer to Appendix 13, Request to confirm the progress of the Project)

(4) Points of mid-term training plan

In Table 2.2.6-11 of 2.2.6.2, JET estimated the number of trainees by March 2022 will be 426, and number of trainees will be 40 to 426 for each subject. At first, JET estimated that this number was about 800 people before, but due to the suspension of the Syrdaryo CCPP installation plan, the number of trainees to be calculated decreased.

In the mid-term training plan reported by UE, i.e. Table 2.2.6-10, 532 staff were calculated based on questionnaires of each TPP, a little bit more than in JET's estimation. In that report, while the predicted number of Navoi TPP is larger, staff for Talimarjan CCPP-3 & -4 have not been included. JET pointed out that the employment plan for new CCPP based on the installation plan is unclear, so that the estimation in report is uncertain. JET also pointed out that it is necessary to recalculate based on the number of staff classified to each job.

This also affects the estimate of the number of trainers needed, such as not being classified as number of trainees by each subject, and there is a 25% difference between JET's predicted 426 and UE's pan for 532.

2.2.7.3 Implementation of Training Utilizing Periodic Inspection

Experience and knowledge of CCPP periodic inspection is important for executives and managers of CCPP and trainers who carry out the CCPP training. It is strongly recommended that they plan and carry out the On-Site training which utilizes CCPP periodic inspection in Uzbekistan. These comments also mentioned in Sections 2.2.6.2(2) and 2.2.6.3(2).（Targeted courses: No. 4, No. 5, No. 7, No. 8, No. 9, No. 10, and No.11）

As a periodic inspection in the 1st phase of the project, the combustor inspection of Navoi CCPP-1 was carried out in October 2016. JET planned On-Site Training for trainer candidates, but unfortunately, there was an organization change at UE that caused the On-Site training to be canceled. In addition, although a Major Overhaul Inspection of Navoi CCPP-1 was carried out at the time of 13th mission in October 2018, it was impossible to implement training because prior information could not be confirmed before the mission had arrived. In the future, when NTC develops trainers and train senior staff after the completion of the project, the training plan to utilize periodic inspection should be shared with the Plant Operation Department and the CCPP site with the information on the inspection schedule. Cooperation among related departments to implement On-site training, utilizing periodic inspection, is very important.

Since it could not implement training using periodic inspection in Uzbekistan, in this project, JET implemented training on periodic inspection by utilizing TOT in Japan to develop trainer candidates. The content of the TOT in Japan is observation and learning about periodic inspection at Yanai Power Station and Mizushima Power Station of Chugoku Electric Power Company, and also including management of GT and acquiring necessary knowledge at the manufacturer's GT manufacturing site. JET set up these opportunities to gain experience at inspection sites.

2.2.8 "Monitoring and Evaluation System" on CCPP O&M Training

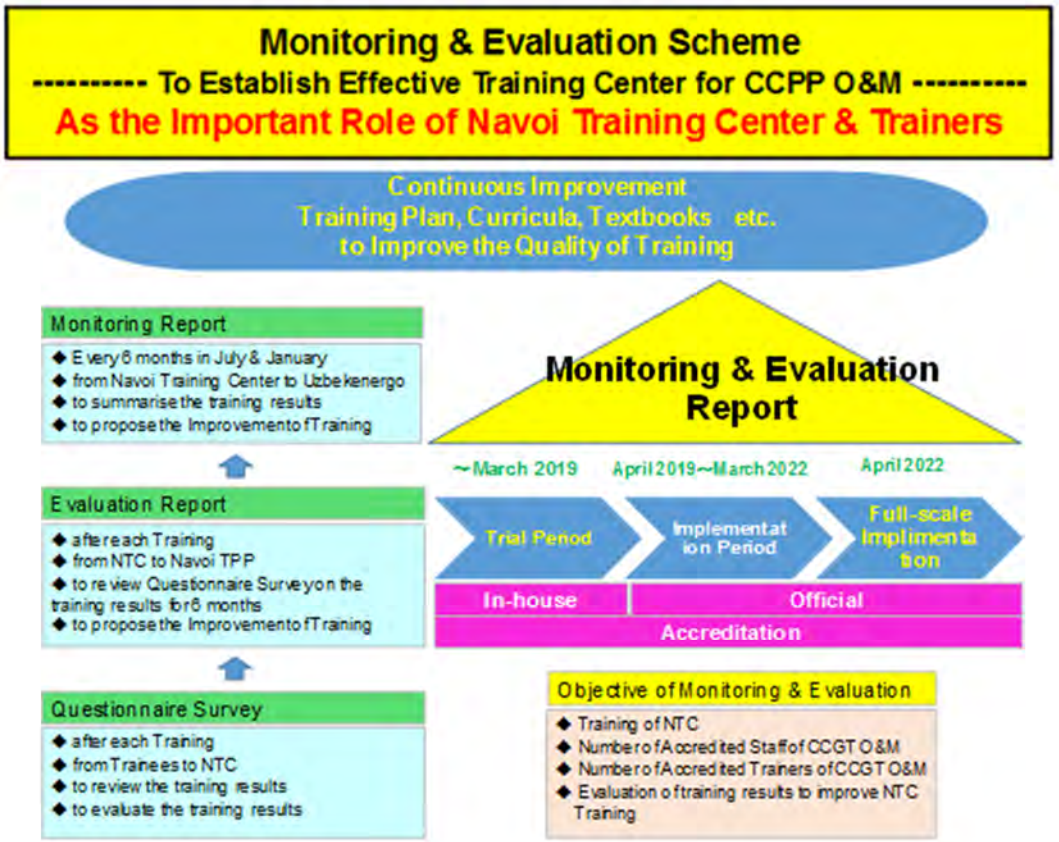
In the 2nd Workshop in Navoi, JET proposed how to evaluate the outcome of training of O&M of CCGT. The system is conducted in two steps, which are the monitoring system to evaluate the project achievement, and the feedback from the questionnaires survey on O&M staff training. After repeated discussion, an improved system was presented by the NTC Director in the 3rd JCC, conducted at the 11th mission.

The monitoring and evaluation system is operated and managed by the Department of Work

with Personnel of UE HQ and by NTC. Additionally, the Head of Foreign Economic Relations and Investment Department of UE HQ agreed to coordinate and manage among UE HQ, Navoi TPP and NTC for the monitoring and evaluation system as a supervisor. It was also confirmed that the head of the Human Resource Department of NTPP will serve as a coordinator to connect between the Director of NTC and NTPP at the practical level.

The above mentioned structure provides superior management of training, together with the periodical improvement of training plan and textbooks and of the management of training center, through the feedback of "Monitoring and Evaluation system", which is based on the questionnaire survey on staff training.

In the 3rd JCC implemented in 12th mission, the concept of the training monitoring and evaluation system was compiled, as a scheme shown in Figure 2.2.8-1 as below.

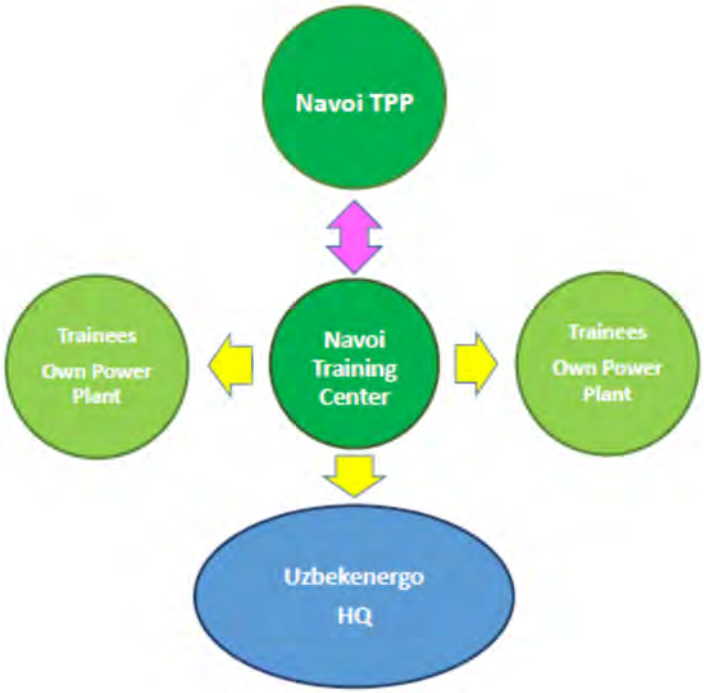


(Source: JET)

Figure 2.2.8-1 Schema of Monitoring and Evaluation system for training

(1) Stakeholders of the System

Monitoring conducted in the project creates monitoring sheets every six months and submits them to related parties to manage progress of the project. In the feedback of the results in the training, a more simplified system should be adopted and cooperation with the stakeholders should proceed as in the next Figure 2.2.8-2.



(Source: JET)

Figure 2.2.8-2 Structure of the Stakeholders for Monitoring

(2) Questionnaire Survey for Trainees

Although the questionnaire survey was conducted a few times intermittently by the Tashkent Training Center in the past, reports were not produced nor was data recorded. Therefore, improvement for the training was focused on only one issue, i.e. targets of questionnaire. So essential improvement of training, i.e. revision of the curriculum and contents were not achieved, because of both of the lack of the procedure for evaluation and the lack of data accumulation. As the UE side has also recognized the necessity of continuous training monitoring and evaluation, NTC decided to introduce a questionnaire, and it was repeatedly discussed among the related parties concerning how to proceed.

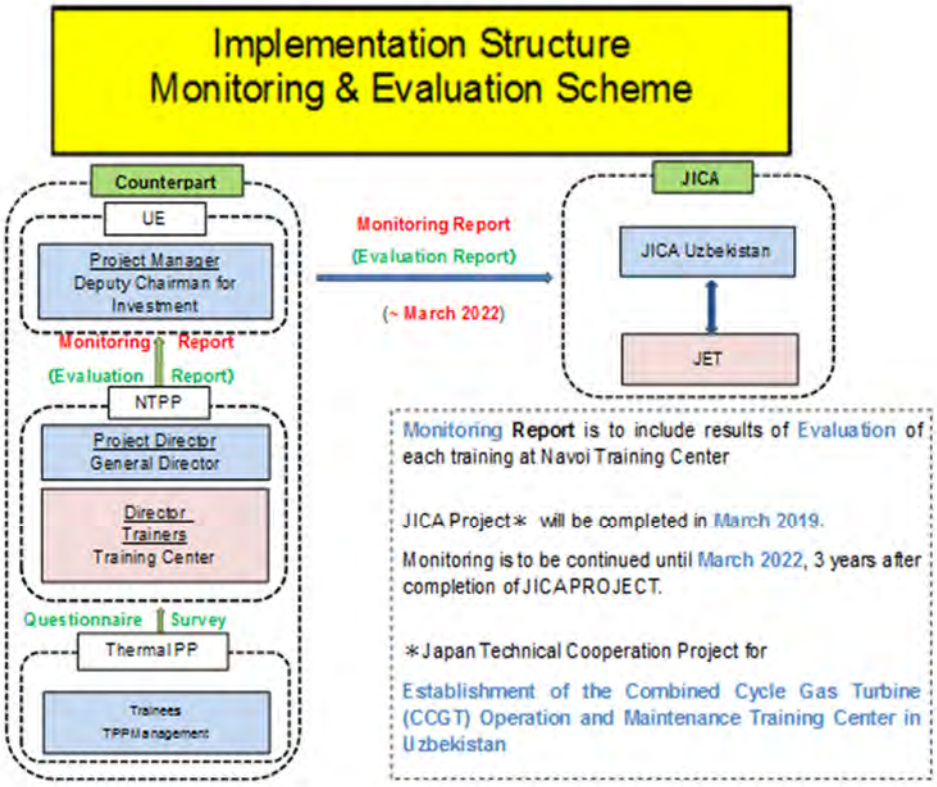
At first for the experience of trainer candidate, JET implemented a questionnaire on the content of training at the 1st TOT in Japan, every day. JET also implemented a questionnaire at TOT in Uzbekistan, but since the respondent of the questionnaire were former trainer candidates in Tashkent, JET decided to treat the result as reference material. JET also implemented a questionnaire at the 2nd TOT in Japan in February 2017, after the construction site of the training building had been decided in Navoi. The collected comments were compiled and utilized for improvement of the 3rd TOT in Japan implemented in March 2018. Finally, JET summarized the result of questionnaires, and the report were provided to NTC as a reference.

In this way, while referring to the questionnaire actually experienced by the trainer candidates in the second phase of the project, discussion has been deepened on the specific procedures and methods of feedback. For the monitoring and evaluation system, JET proposed a questionnaire format to operate concretely. (Refer to Appendix 19, Monitoring report of NTC Training Format)

(3) System Flow

The following Figure 2.2.8-3 simplifies the flow of the monitoring and evaluation system for training, proposed at the 2nd workshop in the 9th mission, and agreed with concerned parties by

consecutive consultation. This flow chart was published at the same time with the system schema of Figure 2.2.8-1, in the 3rd JCC.



(Source: JET)

Figure 2.2.8-3 Monitoring & Evaluation System through the Questionnaire Survey

(4) General of Questionnaire

NTC shall conduct a questionnaire for trainees after every training. The outlines of the questionnaires are as follows.

Objectives and Contents of the Questionnaires

1) Questionnaire contents for trainees
   (a) Questionnaires for subjects for training
   (b) Questionnaires for comprehensive matters on training

2) Objectives of the questionnaires
   (a) To improve textbooks, analyzed by trainers
   (b) To improve training plan, analyzed by staff of the training center

3) Approval process of the result of analysis
   (a) To improve textbooks, proposal by Trainers, Director NTC, and approved by Director NTPP (Project Director)
   (b) To improve Training Plan, proposal by Trainers, Director NTC, and approved by Director NTPP (Project Director)
   (c) To improve duties and operation in NTC, proposal by Director NTC, and approved by Director NTPP (Project Director)

The operation work of the above from 1) to 3) has been simplified, with consideration to decrease the manpower and work volume on NTC side. The questionnaire implemented in each training shall be compiled as a “training evaluation report” and reported from the director of NTC to the director of NTPP. Meanwhile, a “training monitoring report” shall be implemented every 6 months (twice a year from January to February, and from July to August), which compiles the 6 months result to the Training Evaluation Report. It aims at comprehensive evaluation of the training conducted during the same period. The report destination is the UE HQ. The Human Resources Department is responsible for the summarization at the UE HQ, and the final destination is the Deputy Chairman of the board in charge the Foreign Economic Relations and Investment Department. The Head of Foreign Economic Relations and Investment Department shall serve as coordinator. The Training Monitoring Report is used for approval of improvement as follows;

4) Approval Process of Proposals for Improvements (Company level in UE HQ)
   (a) To improve textbooks: Proposal by Director NTPP (Project Director), and approved by UE HQ
   (b) To improve training Plan: Proposal by Director NTPP (Project Director), and approved by UE HQ

2.3 Output 3: Training Curricula, Materials and Equipment of CCPP O&M

2.3.1 Development of Training Curricula

The training curricula are comprehensive plans of the training contents according to the purpose of the training, and depict the training subjects and steps. Table 2.2.6-6 “Training Subject Class, Certificate & Trainer” was prepared as a reference to make the curricula in this project. The New NTC itself should be responsible for organizing training courses and making the curricula, such as the target trainees’ number of years of experience (after starting a job in O&M), the order of course attendance procedure according to the trainees’ experience and the trainer in charge, etc. The detailed Lecture Plan for each training course is the similar to the syllabus for a single subject, in other words, and the (chief) trainer in charge creates a curriculum based on the Lecture Plan. The simplest curriculum is an annual training plan, but considering the target years of promotion of the targeted staff, a curriculum that has a view to taking a multi-year training course is required. The themes that should be taken within two years after assignment as indicated by circle (○) in Table 2.2.2-8 are not only for improvement of staff abilities in their duties, but also are the subjects to be completed before promotion.

When preparing the curriculum, the following two points should be noted as issues:

(1) Trainees are required to take courses in order according to the curriculum. In consideration of their background, the trainer should be able to lecture not only one subject but also on multiple subjects, and the trainer in charge should clarify the target trainee of the course who should take the training of the subjects. It is necessary to develop trainers who can lecture on multiple subjects in the future to make curriculum, referring to Figure 2.2.6-1 and Table 2.2.6-6.

(2) NTC will be established at the Navoi TPP, and large number of trained staff will be required from now on. Against these background, it is useful to consider site visit training by dispatching trainers for training in subjects for which is no need to use training equipment.

2.3.2 Preparation of Training Materials (Textbooks)

2.3.2.1 Process of preparing Training Materials

At the beginning of the Project, the O&M staff of the counterpart, i.e. target trainers, had a prerequisite that English could be understood, therefore, JET decided to prepare textbooks in English only. Starting the project, JET realized that there are few staff who understand lecture in English. In the 3rd mission on February 2016, UE requested textbooks in Russian as well.

JET agreed with the request of UE, preparing textbooks not only in the English version drafted by Japanese experts, but also in Russian versions. It was necessary for trainer candidates to check through the proofreading and revision of the Russian version, because the contents of the Russian version translated under JET arrangement might not be perfect. And then JET handed over all drafts for 12 subjects in the English version and Russian version as editable software data.

Hard copies of the English version were handed over at the workshop of the 13th mission in September 2018, with 5 copies each for all 12 subjects. For the Russian version, as NTC themselves needs to manage textbooks used in training, it was agreed that bookbinding and printing should be done under NTC management.


Photo 2.3.2-1 Handover ceremony of English textbooks,
on October 5, 2018 at the workshop

Regarding the roadmap, for preparing training materials and TOT, the actual results of implementation were described in 2.2.7 (1), and also shown in Table 2.2.6-5. The implementation process, in the mechanical field, in electrical field and in facility field, is comprised of (1) offering English materials, (2) offering Russian translated materials, (3) implementation of TOT to understand the materials, (4) revision of the Russian versions by trainer candidates, with advice of Japanese expert, (5) practical training with training equipment (subject Nos.1, 2, 6, 8, 9), (6) Mock-up training by trainer candidates for evaluation by JET.

In the mechanical field, TOT were completed for Tashkent's former trainer candidates about No. 4 "Gas Turbine, Combined Power Generator" and about No. 5 "High Temperature Parts Maintenance", so that training material and technology transfer could be completed earlier before changing the site of the training center. For this purpose, JET requested implementation of technology transfer within UE, i.e. from former trainer candidates of Tashkent to new trainer candidates of Navoi. Mock-up training for these subjects to certify candidates of Navoi were conducted during the 2nd and 3rd TOT in Japan instead of TOT in Uzbekistan, respectively.

In the electrical field, training materials were considered upon requests from trainer candidates. The requests were to clearly describe the characteristics of a CCPP generation facility and there was no substantial content change, but in revision the following points were made by a Japanese expert. For the subject No. 6, "Details of CCGT Electric Facility", as the UE staffs have experience of O&M in conventional steam power generation, description of contents of training materials placed an emphasis on specific CCGT-related matters. As a specific example, since the GT cannot be activated by itself, due to its structure, it is necessary to start up using the external driving force. There is a Static Frequency Converter, (here in after referred to as SFC) as one of the GT start-up methods, and Navoi's GT also adopts this SFC method. In the training materials, this SFC was focused on and many pages were assigned to describing it in detail. Training material for No. 7, "Theory of CCGT Operation Control", outlined the facilities that make up the CCGT generation facilities and explained the operation method of each facility, and the operation method of the entire plant from the view point of control. Course No. 8, "Details of C&I Devices for GT CCPP" is advanced and has detailed contents.

For training subjects No. 9 to No. 12 of the facility field, since the content is diverse and large, JET implemented TOT in Japan, including questions and answers to experts of the manufacturers of each equipment, and deepened their understanding thereof.

2.3.2.2 Confidentiality of Training Materials

The content of the textbooks provided by JET to NTC includes know-how of Japanese electric utilities and gas turbine manufacturers in order to enhance the quality of the training contents. These contents of materials are sophisticated and higher than normal technical

cooperation carried out under JICA. If the technical information in their contents accidentally leaked out, the Japanese electric power company and gas turbine manufacturer would suffer a great loss. JET explained the necessity and importance of the confidentiality obligation to UE during the 4th mission on May 2016, and agreed to describe it as “confidential handling of teaching materials provided in this project” in a Confirmation Note (C/N). After that, when confirming the 8th mission in May 2017, this was confirmed in the documents of the R/D revision dated June 19, 2017 between the JICA Uzbekistan office and Uzbekenergo, and JET reconfirmed again in during the 13th mission in October 2018. (Refer to Appendix 28, C/N 4th, 8th and 13th Missions, and Appendix 20, Confidentiality Signed)

2.3.3 Procurement Plan of Necessary Training Equipment for O&M

With regards to training equipment required for practical training, each field expert prepared a draft list of training equipment, and discussed with the trainer candidates to review the contents for each field of mechanical, facility and electrical. Regarding training equipment for the fields of mechanical and facility, UE and JET agreed with the list contents during the 5th mission in July 2016.

For the electrical field, Japanese experts prepared the draft list of training equipment as well, but at the TOT conducted at the 4th mission, there was a proposal for changing the contents of the course from trainer candidates, and in accordance with this, the list was revised in following period. For these reasons, JET aimed to reach mutual agreement in the 6th mission on a draft list of training equipment for the electrical field. Unfortunately, at the end of September 2016 in the 6th mission, the new training center construction site was changed from Tashkent to Navoi. Therefore, the final agreement and confirmation of the draft list for the electrical field was delayed to December 2016 in the 7th mission.

Training equipment lists are shown in Table 2.3.3-1 and Table 2.3.3-2.

Table 2.3.3-1 List of Training Equipment Procured by JICA（1/2）

Equipment /No.	Equipment name	Model number	Manufacturer name	Brand specification	Necessity of dispatched installation engineer	Equipment application (Detailed description)	Particularly necessary specifications (Important functions required upon procurement of equipment)*1	Special accessories (Including instruction manuals and other required documents (specified language)	Quantity	Unit	Delivery Date
Equipment for training course No.1 "Non Destructive Testing"											
2-1	Non-destructive inspection DVD	DVD Introduction of Non-Destructive Inspection	The Japan society for Non-Destructive Inspection	Specified brand	Not required	DVD used for teaching general non-destructive inspection methods.	Definition and importance of non-destructive inspection, test method selection, and explanation of outline of each method. (MT, PT, ET, RT, and UT, etc.)	-	1	Set	2017/7/27 delivered
2-2	Digital flaw detector for UT	USM36	GE	Specified brand	Not required	Practicing ultrasonic flaw detection tests as part of the non-destructive inspection training. This is the main unit of the inspection device for this type of test. (UT: Ultrasonic Testing)	Measurement range: 0 to 9,999 mm (in steel) Sonic speed: 1,000 to 15,000 m/sec Language: Japanese / English / Other Power source: Lithium ion battery AC adapter: 220 V compatible Weight: 2.2 kg (including battery) Dimensions: 177 x 255 x 100 mm (H x W x D)	Instruction manual (Japanese and English)	2	Set	2017/7/27 delivered
2-3	Couplant to provide acoustic coupling between the transducer and the test piece	BSL-150 Sonicoat(10pieces)	Taiyo Nissan (Japan)	None	Not required	Practicing ultrasonic flaw detection tests as part of the non-destructive inspection training. In this case, this is the Couplant that allows ultrasonic waves to be transmitted to the test piece.	150 g/piece x 10 pieces 150 g x 10 Viscosity (51 Pa S) 51PaS	-	1	Set	2017/7/27 delivered
2-4	Ultrasonic thickness meter	MX-1	Dakota Japan	None	Not required	Practicing ultrasonic thickness measurement as part of the non-destructive inspection training. This is the main unit of the device for this type of test.	Measurement range: 0.63 to 500 mm Display resolution: 0.01 mm Sonic speed measurement range: 1,250 to 13,998 m/s Power source: AA alkaline battery Includes the following: Calibration certificate, test report, traceability system chart	Instruction manual (Japanese and English)	1	Set	2017/7/27 delivered
2-5	Transducer for Ultrasonic thickness meter	TT-D5-14	Dakota Japan	None	Not required	Practicing ultrasonic thickness measurement as part of the non-destructive inspection training. The setup consists of the ultrasonic thickness meter, the flaw detector body, and its connecting cable.	Frequency: 5.0 MHz Diameter: 12mm	Instruction manual (Japanese and English)	1	Set	2017/7/27 delivered
2-6	N1 test piece for UT	JIS-STB-N1	AIT (Japan)	None	Not required	Practicing ultrasonic flaw detection tests as part of the non-destructive inspection training. This is a sample test piece for instrument calibration.	Equivalent product with dimensions that are exactly the same as jis-stb-n1. Includes the following: Storage case, certificate of acceptance	-	2	Set	2017/7/27 delivered
2-7	A1 test piece for UT	jis-stb-a1	AIT (Japan)	None	Not required	Practicing ultrasonic flaw detection tests as part of the non-destructive inspection training. This is a sample test piece for instrument calibration.	Equivalent product with dimensions that are exactly the same as jis-stb-a1. Includes the following: Storage case, certificate of acceptance	-	2	Set	2017/7/27 delivered
2-8	Level II UT training set	Test piece for vertical tests and angled flaw detection tests RB-41 No.2 test piece	AIT (Japan)	None	Not required	Practicing ultrasonic flaw detection tests as part of the non-destructive inspection training. This is a sample test piece used for this training.	Manufacturer: AIT The following set is provided for ultrasonic flaw detection level II practical test exercises. (Test piece for vertical tests, test piece for angled flaw detection tests, RB-41 No.2 test piece)	-	2	Set	2017/7/27 delivered
2-9	Test piece set for Visual Testing (VT)	KT-CS87	Dakota Japan	None	Not required	Practicing visual testing as part of the non-destructive inspection training. This is a sample test piece used for this training.	Material: Carbon steel T-joint x 3, plate x 7 Includes the following documents: Flaw location details Inspection certificate	-	1	Set	2017/7/27 delivered
2-10	Test piece set for Penetrant Testing(PT)	KT-CS89	Dakota Japan	None	Not required	Practicing penetrant testing as part of the non-destructive inspection training. This is a sample test piece used for this training.	Material: Carbon steel T-joint x 3, plate x 7 Includes the following documents: Flaw location details Inspection certificate	-	1	Set	2017/7/27 delivered
2-11	Test piece set for Magnetic particle Testing(MT)	KT-CS86	Dakota Japan	None	Not required	Practicing magnetic particle testing as part of the non-destructive inspection training. This is a sample test piece used for this training.	Material: Carbon steel T-joint x 3, plate x 7 Includes the following documents: Flaw location details Inspection certificate	-	1	Set	2017/7/27 delivered
2-12	Test piece set for Ultrasonic Testing(UT)	KT-CS86	Dakota Japan	None	Not required	Practicing ultrasonic flaw detection tests as part of the non-destructive inspection training. This is a sample test piece used for this training.	Material: Carbon steel T-joint x 1, plate x 9 Includes the following documents: Flaw location details Inspection certificate	-	1	Set	2017/7/27 delivered
2-13	Dye penetrant for Penetrant Testing(PT)	FP-S	TASETO (Japan)	None	Not required	Practicing penetrant testing as part of the non-destructive inspection training. This is the penetrant used for this training.	UP-ST 450 type aerosol 12 pieces (one box)	-	1	Set	2017/7/27 delivered
2-14	White developer for Penetrant Testing(PT)	FD-S	TASETO (Japan)	None	Not required	Practicing penetrant testing as part of the non-destructive inspection training. This is the developer used for this training.	UD-ST 450 type aerosol 12 pieces (one box)	-	1	Set	2017/7/27 delivered
2-15	Remover for Penetrant Testing(PT)	FR-Q	TASETO (Japan)	None	Not required	Practicing penetrant testing as part of the non-destructive inspection training. This is the penetrant remover used for this training.	UR-ST 450 type aerosol 12 pieces (one box)	-	3	Set	2017/7/27 delivered
2-16	Dye penetrant for Fluorescent Penetrant Testing(FPT)	OD-2800-II	TASETO (Japan)	None	Not required	Practicing fluorescent penetrant testing (FPT) as part of the non-destructive inspection training. This is the penetrant used for this training.	OD-2800-2 450 type aerosol 12 pieces (one box)	-	1	Set	2017/7/27 delivered
2-17	White developer for Fluorescent Penetrant Testing(FPT)	FD-S	TASETO (Japan)	None	Not required	Practicing fluorescent penetrant testing (FPT) as part of the non-destructive inspection training. This is the developer used for this training.	DN-600S 450 type aerosol 12 pieces (one box)	-	1	Set	2017/7/27 delivered
2-18	Butt welded test piece for Penetrant Testing(PT)	Test piece for training Level1	Japan Welding Technology Center	None	Not required	Practicing penetrant testing as part of the non-destructive inspection training. This is a sample test piece used for this training.	Material: SUS304 Dimensions: 6 x 300 x 400 mm Surface roughness: No.1 (equipment material) Includes the following documents: Flaw location details	-	3	Set	2017/7/27 delivered
2-19	Fillet Welded test piece for Penetrant Testing(PT)	Test piece for training Level2	Japan Welding Technology Center	None	Not required	Practicing penetrant testing as part of the non-destructive inspection training. This is a sample test piece used for this training.	Material: SUS304 Dimensions: 6 x 200 x (300 + 100) mm Surface roughness: No.1 (equipment material) Includes the following documents: Flaw location details	-	3	Set	2017/7/27 delivered
2-20	Test piece to compare between PT and FPT	TSC Test piece	Japan Welding Technology Center	None	Not required	Practicing the difference between PT and FPT as part of the non-destructive inspection training. This is a sample test piece used for this training.	Material: SUS304 Dimensions: 85 x 55 x 3 mm Weight: 106 to 108 g Surface roughness: No.1 (equipment material)	-	6	Set	2017/7/27 delivered
2-21	Fluorescent magnetic powder for Magnetic particle Testing(MT)	F-330E	TASETO (Japan)	None	Not required	Practicing fluorescent magnetic inspection testing as part of the non-destructive inspection training. This is the fluorescent magnetic powder used for this training.	LY-10 sol (oil based) 450 type aerosol 12 pieces (one box)	-	1	Set	2017/7/27 delivered
2-22	Magnetic yoke to induce a magnetic field	NC-21	Nihon Denji Sokki (Japan)	None	Not required	Practicing fluorescent magnetic inspection testing as part of the non-destructive inspection training. This is the main unit of the device for this type of test.	Input voltage: 220 V specification Rated current: 3. 5 A (50 Hz) Total magnetic flux: 0. 57 mWb (50 Hz) Magnetic pole inside dimensions: 110 mm Magnetic pole cross-sectional dimensions: 20 mm x 20 mm Body weight: 2.0 kg or less Yoke: Variable type Connect	Instruction manual (Japanese and English)	3	Set	2017/7/27 delivered
2-23	Black light for Magnetic particle Testing(MT)	LB - 104	DENSHIJIKI INDUSTRY (Japan)	None	Not required	Practicing fluorescent magnetic inspection testing as part of the non-destructive inspection training. This is the light source to show the fluorescent magnetic powder for this type of test.	Power supply: 220 V, 50 Hz Light source: LED (With halogen spot lighting) Re-lighting time: Instantaneous UV intensity: Center UV intensity: 4,500 μW/cm2 or higher (Irradiation distance: 381 mm) Peak wavelength: 365 mm Lamp cable: 5.0 m Power cable: 2.0 m	Instruction manual (Japanese and English)	3	Set	2017/7/27 delivered
2-24	Welded test piece for MT	Level Test piece for welding No.3	Eishin Kagaku (Japan)	None	Not required	Practicing fluorescent magnetic inspection testing as part of the non-destructive inspection training. This is a sample test piece used for this training.	Dimensions: 300 mm x 400 mm x 8 mm (flat plate) Belt-shaped weld line along the center Material: SS Includes the following documents: Flaw location details	-	3	Set	2017/7/27 delivered
2-25	Test piece for Magnetic particle Testing(MT)	Test piece A1-7/50	Eishin Kagaku (Japan)	None	Not required	Practicing fluorescent magnetic inspection testing as part of the non-destructive inspection training. This is a sample test piece used for this training.	A1 test piece Flaw depth: 7 μm/ Test piece thickness: 50 μm Circular type	-	1	Set	2017/7/27 delivered

（Source: JET）

Table 2.3.3-2 List of Training Equipment Procured by JICA（2/2）

Equipment /No.	Equipment name	Model number	Manufacturer name	Brand specification	Necessity of dispatched installation engineer	Equipment application (Detailed description)	Particularly necessary specifications (Important functions required upon procurement of equipment)*1	Special accessories (Including instruction manuals and other required documents (specified language)	Quantity	Unit	Delivery Date
Equipment for training course No.2 "Vibration analysis for rotating machine"											**2017/7/27 delivered**
1-1	Portable balancer	Model-7200A	Syowa Sokki (Japan)	Specified brand	Not required	Used to perform vibration adjustment of a model rotor (balancing) during vibration training. It measures unbalanced phases.	Input voltage: AC 220 V compatible Rotational speed display: 600 to 10,000 rpm (1 rpm resolution) With FFT function With printer function Includes the following: Two electrodynamic sensors, stroboscope	Instruction manual (Japanese and English)	1	Set	2017/7/27 delivered
1-2	Portable vibration meter	1332B	Syowa Sokki (Japan)	None	Not required	Used to measure the amount of vibration generated by the model rotor during vibration training.	Hi/Lo switching measurement range: Acceleration (peak): 0.01 to 199.9 m/s2 Speed (rms): 0.01 to 199.9 mm/s Displacement (p-p): 0.001 to 19.99 mm Power source: AA alkaline battery Includes the following: Piezoelectric acceleration sensor, sensor ca	Instruction manual (Japanese and English)	1	Set	2017/7/27 delivered
1-3	Vibration analyzer	VA-12	Rion (Japan)	None	Not required	Used to investigate the cause of vibration generated by the model rotor during vibration training. It carries out frequency transformation of the vibration waveform.	Voltage: DC 12 V (AA alkaline battery) x 8) Measurement channels: 1 channel Sensor: Piezoelectric acceleration pickup Display language: Japanese, English With FFT mode function Includes the following: Round bar attachment (x2)	Instruction manual (Japanese and English)	1	Set	2017/7/27 delivered
1-5	High precision compact weight scale	HT-120	A&D (Japan)	None	Not required	Measures the mass of the weight attached to the vibration training and analysis equipment.	Weighing capacity: 120 g Minimum display: 0.01 g Weighing tray dimensions: φ70 mm Power source: AA battery x 4	-	1	Set	2017/7/27 delivered
1-6	Transformer	SU-550	Swallow Electric (Japan)	None	Not required	As the portable balancer is specified for 100 V, this transforms local voltage (220 V).	Input voltage: AC 220 V Output voltage: AC 100 V Capacity: 550 VA or more Input plug shape: C	-	1	Piece	2017/7/27 delivered
Equipment for training course No.6 "SFC Training Equipment"											
6-1	SFC Practice Equipment	Specific Specification	FUJI enterprise (Japan)	Specified brand	Required	To understand the detail starting control measures of Gas Turbine Generator	Details: See attached circuit diagram · 2.0 kW synchronous motor with VVVF inverter: 1 unit · 2.0 kW induction motor with VVVF inverter: 1 unit · Power supply: Three-phase AC 380V Control device with control panel: 1 type · Protective equipment: 1 type	Instruction Manual (English / Russian) Production process chart (English or Japanese) Approval diagram (English or Japanese) Test Procedure (English or Japanese) Test report (English, Russia) Completion drawing (English, Russia)	1	Set	End of April/ 2018 delivered Installed and checked by Maker on September 2018
Equipment for training course No.8 "Control Box for Electrical and Instrumentation Control Training"											
A	8~1	Control Box for Electrical and Instrumentation Control Training	TOYO corporation (Japan)	Specified brand	Required	Install the bug in advance and the trainee will fix the bug. This practical training aims to getting used to operation with the digital technology applied to the latest instrumentation equipment.	(1) Circuit configuration: See attached circuit diagram (2) CPU: Q 03 UDVCPU (Mitsubishi Electric Corporation) (3) Base unit: Q 38 B (Mitsubishi Electric) (4) Power supply unit: Q63P (Mitsubishi Electric) (5) Digital input unit: QX 40 (Mitsubishi Electric) (6) Analog input unit: Q64ADH (Mitsubishi Electric) (7) Analog output unit: Q64DAH (Mitsubishi Electric) (8) Remote master unit: QJ61BT11N (Mitsubishi Electric) (9) Remote output unit: AJ65SBTB1-8T (Mitsubishi Electric) (10) Remote communication cable: FANC-110SBH (Mitsubishi Electric System System Service) (11) AC / DC converter: Input: 220 VAC, output: 24 VDC, rating: 300 W or more (12) Circuit protector: AF: 30 A, number of poles: 2, IEC 60934, both AC / DC (13) Momentary switch: Contact configuration: 1a, color: SW1CU: blue, SW1R + SW2R: red, SW2A: green (14) Alternate switch: Contact composition: 1a, color: yellow (15) Lamp: voltage: DC 24 V, color: L 2 K A: green, L 2 FL: yellow (16) 7 segments: positive logic, anode common (17) Fixed resistance: 4.7 kΩ, 1/4 W (18) Variable resistance: range of motion: 0 kΩ - 5 kΩ (19) Proportional control solenoid valve: 4-20 mA or 0 - 10 V / 0 - 100%	Instruction Manual (English / Russian) Production process chart (English or Japanese) Approval diagram (English or Japanese) Test Procedure (English or Japanese) Test report (English / Russia) Completion drawing (English / Russia)	9	Set	End of April/ 2018 delivered checked by NK on 28 June 2018
A	8~2	USB Cable	Mitsubishi Electric Engineering	FA-CBL30USB	Required	Connect the PLC in the control box to the notebook PC. It is necessary to write the program.	Can be mechanically and electrically connected to Q03UDVCPU	Instruction manual (English)	9	Set	
A	8~3	Sequencer Engineering Software	Mitsubishi Electric	GX Works 2	Required	Provide software development environment	The program of the Q series sequencer can be developed	Instruction manual (English)	9	licens e	
A	8~4	Spare Unit for Sequencer	Mitsubishi Electric	Q Series	Required	Emergency reserve at the time of unit failure of the sequencer included in the control box	CPU unit: Q03UDVCPU (Mitsubishi Electric): 1 unit Power supply unit: Q63P (Mitsubishi Electric): 1 unit Digital input unit: QX 40 (Mitsubishi Electric): 1 unit Analog input unit: Q64ADH (Mitsubishi Electric): 1 unit Analog output unit: Q64DAH (Mitsubishi Electric): 1 unit Remote master unit: QJ61BT11N (Mitsubishi Electric): 1 unit Remote output unit: AJ65SBTB1-8T (Mitsubishi Electric): 1 unit	Instruction manual (English)	2	Set	
A	8~5	Battery for CPU Unit	Mitsubishi Electric	Q6BAT	Required	Drive Q03UDVCPU	Can be mechanically and electrically connected to Q03UDVCPU	Instruction manual (English)	9	Set	
Equipment for training course No.2 "Vibration analysis for rotating machine"											
1-4	Vibration training set	Specific Specification	Shinkawa Censer Technology (Japan)	Specified brand	Required	A set of analysis equipment using a model rotor for reproduction of various vibration phenomena and vibration adjustment (balancing) training.	Complete set including model rotor (2 units: Large sliding bearing type, rolling bearing type) + analyzer + PC for monitoring + color printer. (installation with adjustment) Provide technical guidance to Japanese experts before on-site installation.	Instruction manual (Japanese and English)	1	Set	Feb. 2018 delvered & Checking by Maker on Mar.
Equipment for training course No.9 "Gas Turbine O&M"											
9~1	3D model of Gas Turbine Blade and Vane #1-4	Specific Specification 3D model	MHPS	Specified brand	Not required	A plastic model for understanding the structure of blades and vanes of gas turbines. (8 Pieces)	Plastic model based on blade and vane design of Navoi CCGT.	-	1	Set	Feb. 2018 delvered & Checked on Mar.

（Source: JET）

2.3.4 Procurement of Necessary Training Equipment for O&M

(1) Delivery and Inspection of Training Equipment

JET submitted the agreed list of training equipment for procurement to JICA Headquarters Tokyo, and considered and clarified the reason of designation for some of the equipment, as needed.

For the training equipment in the field of mechanical, a procurement public announcement, a bid, and an open invoice were executed in February 2017, except for the vibration training set (Table 2.3.3-2 (2/2) Nos. 1-4). The same training equipment arrived at the Navoi International Airport in July 2017. In July 2017, JICA-UZ confirmed the arrival at the Navoi International Airport. Next, NTC received and transported the training equipment to NTPP, and the Director of NTC implemented the acceptance inspection with an attendant of JET at the NTPP site, and the delivery to NTC was completed.

Meanwhile, for the vibration training set training equipment in the mechanical field and for the training equipment in the electric field, a procurement notice was announced in April 2017. Bid and an open invoice were executed in May of the same year. Training equipment of the facility field (Table 2.3.3-2 No. 9) and the remaining training equipment of the mechanical field (Table 2.3.3 2 No.1-4) were delivered February 2018. For the vibration training set (Nos. 1-4), the function check of equipment was carried out by the manufacturer in March 2018. Training equipment of the electrical field (Table 2.3.3-2 No. 6 and No. 8) was delivered to NTC at the end of April 2018, and the function check for No. 8 was completed by a JET expert in July 2018. No. 6 installation by the manufacturer and function check were completed in September 2018.

(2) Temporary storage of training equipment

After the delivery of training equipment, JET confirmed that the condition of the temporary storage house in the Navoi conventional TPP was adequate for storage. In October 2018, for the training center building, it was decided to use the building at CCPP-2 just under construction. The project tentatively transferred the temporary storage place to the training room on the adjacent CCPP-1 side. For the training equipment of the electrical field, control box No. 8 was moved, at the same time as the installation and function check for SFC No. 6 by the manufacturer in September 2018. The other training equipment, i.e. No. 1, No. 2 and No. 9, was moved from the temporary storage house in existing conventional TPP to the training room on the adjacent CCPP-1 side, in October 2018. For the training equipment in the mechanical fields, they were moved to training center building in CCPP-2 on March 2019 with/ under participation of JET. For the training equipment in the facility fields, they will be moved by NTC, after completion of construction CCPP-2 training center building, i.e. after March 2019. JET will cooperate in the transfer of equipment as far as possible.

2.3.5 Advice for Building and Improvement of Facilities of UE

(1) New CCPP Training Center in Tashkent

At the beginning of the project, the building, which is the property of UE near the UE HQ in Tashkent, was intended to be renovated for use as the Training Center. (The building itself was built in the 19th century, and had been used as a substation. Currently the sales department occupies part of the second floor and the third floor. In the case of CCPP training center expansion, it was expected to be given priority and some space presently occupied by the sales department which is to be relocated.)

For this plan, JET has given various advice regarding the building and layout, in each mission in Uzbekistan and during the 1st TOT in Japan. As a training institution of Chugoku Electric Power in Japan, the main content of this advice was based on experience of their PET building with a proven track record, and construction was proceeding according to the advice. However,

during the 6th mission in October 2016, UE notified that the location of the new training center was changed from Tashkent to Navoi.

(2) The decision about the building at the Navoi Training Center

As mentioned above, after the decision to move the location for the new training center to Navoi, it was confirmed that the existing building in CCPP-1, the former PR facility next to the entrance to the premises, is to be used as a training room. However, since the Project was forecasting an increasing number of future trainees and training classes, this building was too small in scale. So JET stressed the needs and requirements of the building, which should have sufficient space for the lecture room, practice room and with other facilities for requirement as a training center. (Refer to Appendix 28, Confirmation Note of 6th mission) As a result of consultations with Navoi TPP and NTC about the idea of new buildings or renovation of existing buildings, it was determined to renovate the building used in the medical office in the existing TPP site, and advice about layout continued to be given. For renovation of this building, there was re-consideration of the public notice of renovation work, caused by the problems that occurred due to the bidding of a company other than the UE group, such as permission to enter the TPP site. This led to delays in installation of training equipment also occurring, due to delayed preparation.

As a result of a proposal from the Navoi side in the 3rd JCC on July 2018, the project discussed using a building being prepared in CCPP-2 construction site for the training center building. Finally, the necessary space and number of rooms, for the electrical field, were determined to be in the available building on the CCPP-1 site.

In other words, the location of the training center building was changed twice, in October 2016 and July 2018, resulting in an inefficient task of performing advice three times on layout etc. (Final Layout proposal by JET; Refer to the following point(4).)

(3) Consideration of Layout and Advice

In the 7th mission, the building for the new NTC was introduced to JET, as a candidate. The building was under auditing by the government authority to check the quality of the building structure, etc., and to certify the safe use of the building for training. JET had an internal discussion to re-design the layout to have an appropriate size and room structure for the convenience of practical training and proposed layouts with detailed comments to the management of Navoi TPP. JET reorganized the advice for the new training center in Tashkent, and gave basic advice for improvement of the building in the existing Navoi TPP.

The details of advice are as follows:

1) The current plan seems to have rooms that are too small. Please take care regarding how many trainees attend each training subject. Having one or two large lecture rooms might be useful and flexible for various kinds of use.
2) When you discuss the size of each room, please put desks and equipment in the drawings, which makes it easy to discuss.
3) Please take reflected light from window etc. into account, so that trainees can easily see the white board and take notes.
4) Each room should have a slidable screen for projection on the large wall, which can be motor-driven. Please arrange electric wall plugs and air conditioner sensors carefully so as not to disturb the projector’s screen.
5) Please make every room soundproof.
6) The toilets should be clean and hygienic without odor, and there should be a sufficient number of toilet fixtures.
7) Please prepare sufficient capacity of air conditioners.
8) Please arrange cable cords under the flooring to make the room simple. The flooring system should have flexibility for layout change.

9) An overhead projector on the ceiling might be preferable. Please consider the strength of the ceiling and cable arrangement.
10) Luminous intensity should be over 500 lx. Please arrange carefully the placement of lights, switches, and lighting areas to be covered by each switch.
11) Loading weight design of floors should cover both staff and equipment.
12) Secure more than three entrances for escaping in case of disaster.
13) Secure the horizontality of the floors.
14) Put doors near the corners of the room, which makes it easier to arrange desks and equipment.
15) Please pay attention to the ventilation capacity for the metal lab room, (i.e. to use volatile chemicals for non-destructive inspection training).
16) SFC training equipment weighs about 350 kg, and the loading entrance port into building needs a space of 1.5 m x 1.5 m x 1.5 m or more.
17) Connect a power supply of 3φ 380 V / 50 Hz to the terminal board of SFC with round Y type 18 - 10 clip terminal with M4 screw. The SFC equipment size is 0.7 m × 2.2 m × 1.5 m.

Navoi TPP had planned to be involved in the design drawing based on the layout proposed by JET, and to carry out renovation work, based on the results of the audit of the construction standards. However, the construction site was changed again in July 2018 as described in (2) above. After this, as the advice for the building of CCPP-2 to be newly constructed, and for the training building of CCPP-1, JET added advice to point out the following.

18) The building of CCPP-1 shall be used exclusively for the electrical field training of NTC.
19) The entrance door of CCPP-1 building needs to be renovated to be secure and robust.
20) In the space on the north side of the entrance hall in CCPP-1 building, storage for equipment and separate toilets for men and women shall be set up.
21) Fire protection equipment /sprinkler, for the simulator room and the vibration test practice room, shall be gas-type sprinklers.
22) NTC need to consider establishing an office room for the Director of NTC.
23) Training equipment stored in CCPP-1, provided by JICA, will be relocated to the training center building in CCPP-2, by NTC itself under NTC's responsibility. However, electrical field equipment shall be kept installed in CCPP-1.
24) NTC also prepare the 3.3φ 380 V AC connection as a power supply in the building on the CCPP-2 side, in case the SFC will move.

Based on the above advice, JET confirmed the construction status of the CCPP-2 building in the 14th mission, and the following final advice was implemented.

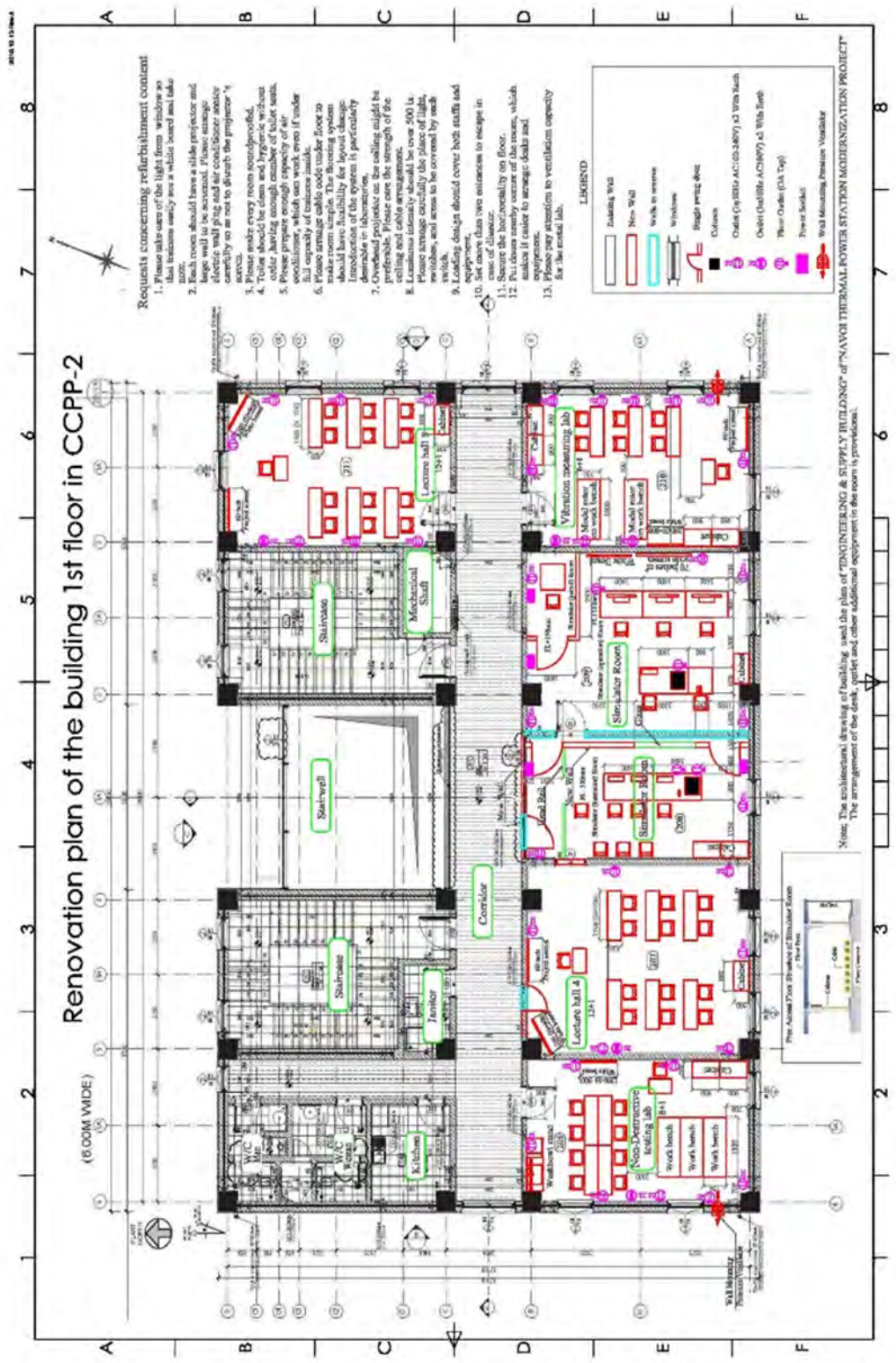
25) There is insufficient ventilation in the practical training room for "Non Destructive Testing", remodel the window frame sash and install a fan for ventilation.
26) The installed table for the "Vibration analysis equipment" should be replaced to robust table, without occurring vibration resonance.
27) 3 φ 380 V of each training room need to complete terminal processing as a connector.
28) Since the fire protection equipment described in 21) above was not gas type, prepare a separate fire extinguisher separately.
29) In the simulator room, take off shoes during training and wear slippers (prepare slippers)

(4) Final Layout of Navoi Training Center

Final Layout and advice for Navoi Training Center are shown in the following Figure 2.3.5-1 to 2.3.5-3.

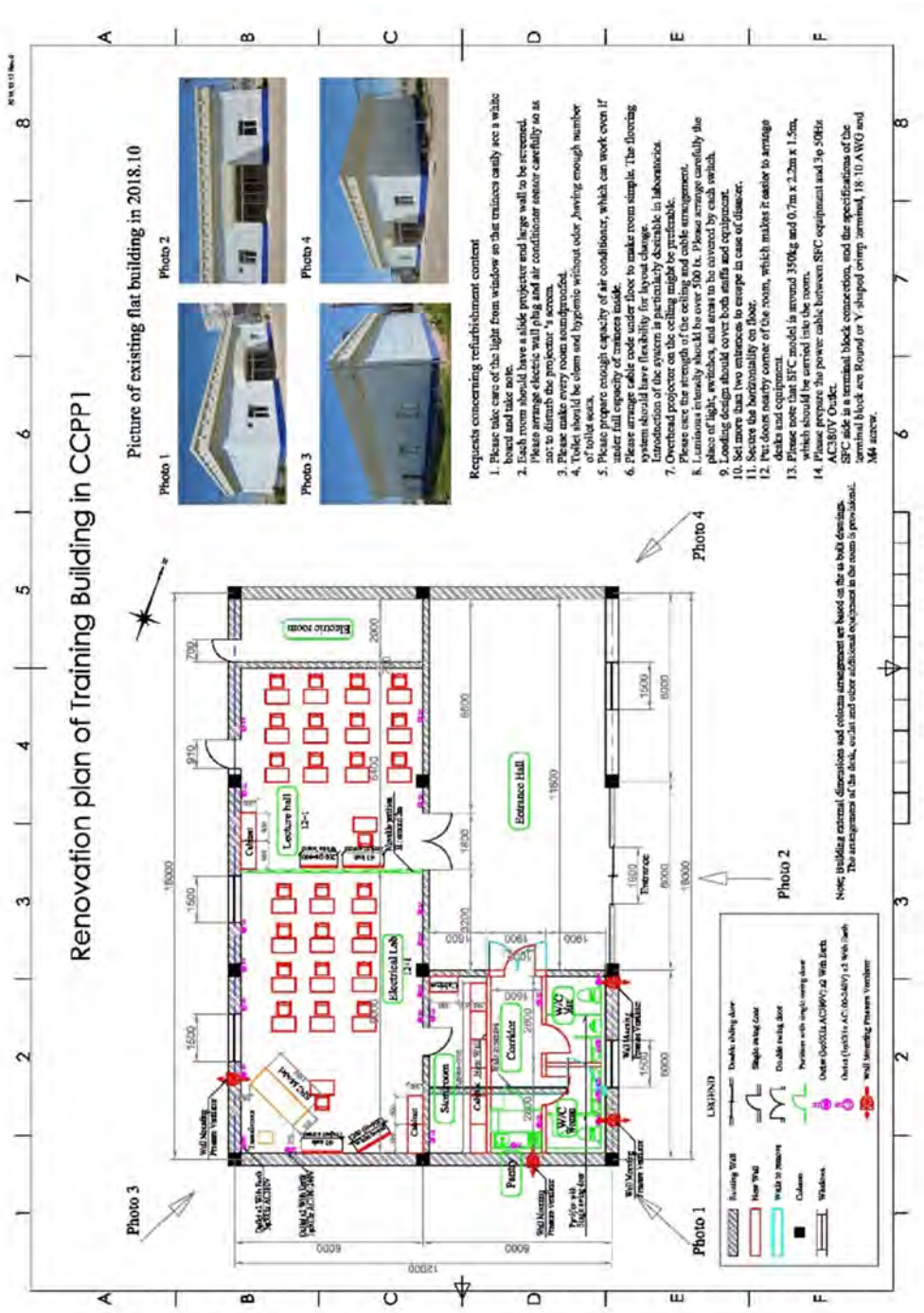
（Source: JET）

Figure 2.3.5-1 Layout of the ground floor in NTC CCPP-2 Building



（Source: JET）

Figure 2.3.5-2 Layout of the 1st floor in NTC CCPP-2 Building



（Source: JET）

Figure 2.3.5-3 Building Layout in NTC CCPP-2

(5) Related facilities for NTC and appearance of training center

In the building used as a clinic and for gymnastics in Navoi TPP, the clinic is located on the ground floor, and the other 2nd floor part etc. will be used as accommodation facilities for trainees. The number of guests who can be accommodated are around 35 staff, and the interior is also aging. Therefore, in the future, it seems necessary to consider renovation according to forecast of the increasing number of trainees planning to attend the training. Placement of related facilities for

training in Navoi TPP are shown in Figure 2.3.5-4.

（Source: JET）

Figure 2.3.5-4 Site Map of NTC

The building appearance on the CCPP-2 site under construction is shown in the next picture 2.3.5-1, and the building appearance on the CCPP-1 site, with a training room in the electrical field, is shown in the next picture 2.3.5-2.

Photo 2.3.5-1 NTC building under construction
(Main building on CCPP-2 site: photographed in October 2018)

Photo 2.3.5-2 NTC building in CCPP-1
(used for electrical training room: photographed in October 2018)

2.4 Output 4: Training of Trainers and Securing of Human Resources

In the development and training the CCPP trainers for new NTC, JET selected appropriate candidates with cooperation from UE HQ. JET has completed the selection of trainer candidates through interviews at first, and completed the technology transfer, deliver of training equipment and implementation of TOT. JET implemented mock-up training (simulator training) in order to certify candidates as trainer, after lecture training and practical training using training equipment. Through these TOT, JET confirmed the degree of comprehension of candidates, and 14 candidates became authorized trainers based on the results. The gross number of trainers certified in this project was 40 (person-subjects), due to the fact that 14 staff were in charge of multiple subjects. Below is described the securing of trainer candidates, transfer of teaching material and knowledge, training by TOT in Uzbekistan and in Japan, On-Site training, authorization of trainers by the project, accreditation of trainer by NTC after the project, and the possibility of inviting outside trainers.

2.4.1 Securing Trainer Candidates

Significant replacement occurred due to the change in the establishment site of the new training center, and the trainer candidates were finalized in August 2017. In addition to CCPP staff, a total of 16 trainer candidates including staff of existing Navoi TPP were officially nominated. In either case, the jobs such as O&M of the TPP are kept in charge as they were, and they participated in TOT in Uzbekistan for technology and material transfer for the requested training subjects.

On the other hand, as employee of New NTC, 4 staff of the existing TPP including the Director of NTC were officially appointed. In this section, the securing of trainer candidates is described.

2.4.1.1 Nomination and Interview of Trainer Candidates for the new Training Center at Tashkent

At the start of the project, JET thought it would be appropriate for technology transfer to 10 trainers for the 12 target subjects in three technical fields, and an agreement was made to select around 10 trainer candidates in the 3rd Mission to Uzbekistan. With 5 Japanese experts acting as interviewers, the candidates who had been recommended by UE were selected based on discussions among the interviewers about the evaluations resulting from interview.

As a result of the interviews in the 3rd Mission, it was decided to select five trainer candidates, and two other candidates on hold. Table 2.4.1-1 shows the results of these interviews.

The 5 trainer candidates selected were invited to participate in the 1st TOT in Japan implemented in April 2016, and they learned about CCPP and its peripheral technologies in Japan.

Table 2.4.1-1 Results of Interviews

Judgement		Reason of judgement	Interviewees name	Number of person
A	To be expected as a CCPP Trainer candidate.	・Qualified as a CCPP instructor, based on experiences in O&M and PIU at CCPP ・With Instructor experiences at existing Tashkent Training Center, and with experiences in conventional O&M	Bakhrom Sobirov	5
			Sadriddin Khodjaev	
			Rasul Shamsiev	
			Nozimkhodja Tokhtayev	
			Askar Khudayberganov	
B	On hold	・Qualification as a instructor, but with not so much knowledge of CCPP.	Ulugbek Makhmudakhunov (1)*	2
			Zakhidov Oybek (2)*	
C	Other classification	・To recommend manager course for TOT in Japan, because deputy director.	Gayrat Mamadjanov	1
		・He is a candidate other than the UE group company, and it is inappropriate on the JICA project scheme.	Shaimov Muzaffar	1

* (1) (2) indicate for the priority of "On hold"

(Source: JET)

2.4.1.2 Additional Nomination of Trainer Candidates

Since only 5 trainer candidates plus 2 on hold were selected in the 3rd mission, and additional candidates selection was conducted in 4th mission in May 2016. Interviewees requested by JET are other outstanding candidates who had performed well in the JICA country-focused training, and the one is a candidate "on hold" in the 3rd mission who reconfirmed.

Accordingly, 5 more trainer candidates were added to the list in the 4th Mission. Table 2.4.1-2 shows the list of additional trainer candidates.

Table 2.4.1-2 Interviewee Results of additional trainer candidates

No.	Name	Affiliation	Specialty	Interview on	Result	Why JET requested to interview
1	Mr. Anvarov S. Erkinovich	Tashkent CHPP	Machinist	13&16May 2016	Passed	selected with high ability impression of the other training result in Japan
2	Mr. Yusupov F. Mirvasilovich	Tashikent TPP	Machinist	16May2016	Passed	selected with possibility from 1st interview on Feburuary 2016
3	Mr. Musaev Alisher Baxtiyorovich	Navoiy TPP	Machinist	16May2016	Passed	selected with high ability impression of the other training result in Japan
4	Mr. Saidov Kamol	Navoiy TPP	Electric Control	23May2016	Passed	selected with high ability impression from the 1st & 2nd Mission
5	Mr. Zakhidov Oybek	Angren TPP	Electric Control	16May2016	Passed	Backupper from 1st interview on Feburuary 2016

(Source: JET)

2.4.1.3 Securing New Trainer Candidates at Navoi

Former trainer candidates in Tashkent gave up on becoming trainer, in the 6th mission, since the new TC site was changed from Tashkent to Navoi. JET interviewed new trainer candidates who had been recommended by Navoi TPP in the same mission, with cooperation of UE HQ. The results of the interviews are shown in Table 2.4.1-3.

Table 2.4.1-3 Results of Interviews with New Trainer Candidates

Alternative selection result of New Trainer/Instructor for CCPP training center recommended by Navoiy TPP CCPP-1, inteviewed on October 2016

No.	Name	Specialty	Result	Remark
1	Mr. Badridinov Djamshid	Deputy Head CCPP (Machinist)	Passed > but Manager	No experiences of Japan Training
3	Mr. Khasanov Latif	Engineer Programm Electric Control	Passed	No experiences of Japan Training
5	Mr. Djamolov Bakhodir	Maintenance Master	Passed	JICA Training Country focused
6	Mr. Aslonov Aslon	Shift Head	Passed	JICA Training & MHPS/EPC Training
7	Mr. Maksudov Laziz	Senior Machine Operator	Passed	JICA Training Country focused
8	Mr. Boyliev Shukhrat	GT Operator	Passed	No experiences of Japan Training
9	Mr. Toshov Istam	C&I Engineer	Passed	MHPS/EPC Training in Japan
10	Mr. Parmanov Azim	Engineer Electric	Passed	No experiences of Japan Training
2	Mr. Musaev Alisher Baxtiyorovich	Senior Engineer Machinist	Already passed on 4th mission May 2016	JICA Training Country focused
4	Mr. Saidov Kamol	Engineer Programm Electric Control		No experiences of Japan Training

(Source: JET)

2.4.1.4 Additional Nomination of the New Trainer Candidates

The director of Navoi TPP mentioned the consideration of periodic rotation and additional interviews of trainers for the new CCPP Training Center. Accordingly, interviews were held with additional trainer candidates, and 13 trainer candidates and 7 observers were selected in the 7th mission in December 2016. Table 2.4.1-4 shows the list of additional new trainer candidates and observers who attended TOT in the 7th mission in Uzbekistan.

Table 2.4.1-4 List of Additional Trainer Candidates

No.	Name	Interview on Mission	2nd TOT	Employed Site	Department, Section, and Role	Major	Education Graduated Univ.	Start working at	age	English
1	Mr. Musaev Alisher Baxtiyorovich	4th Mission	O	CCPP	CCPP operational Principal engineer of CCPP	Mechanical	Navoi State Mining Institute electrical energy in industry	July. 2010	28	Good
2	Mr. Khasanov Latif Bamoevich	6th Mission	O	CCPP	Principal engineer programmer	Programming	Tashkent University of Information technologies	July 2011	28	Good
3	Mr. Aslonov Aslon Mo'minjonovich	6th Mission	O	CCPP	Shift Superident of CCPP	Mechanical				
4	Mr. Bayliev Shukhrat Tashpulatovich	6th Mission	O	CCPP	Gas Turbine operation	Mechanical	Navoi State Mining Institute	December 2013	29	Poor
5	Mr. Parmonov Azimjon	6th Mission	O	CCPP	Principal engineer electrical	Electrical	Navoi State Mining Institute electrical energy in industry	July 2004	33	Poor
6	Mr. Toshov Sanjar Shukhratovich	7th Mission	O	Navoiy TPP	Electro technical Laboratory foreman	Electrical	Navoi State Mining Institute electrical energy in industry	July 2006	34	Fair
7	Mr. Narziev Akmal Abdullaevich	7th Mission	O	CCPP	Electronics engineer	Electrical (Electronic)	Navoi State Mining Institute electrical energy in industry	February 2012	26	Fair
8	Mr. Djamalov Bakhodir Dilmuradovich	6th Mission	O	CCPP	Service and Maintenance foreman	Mechanical	Navoi Industrial College	jun 2012	31	Poor
9	Mr. Badridin Jamshid Saidkomilovich	6th Mission	sub	CCPP	Deputy Head of Operation / Dept. of CCPP	Mechanical				
10	Mr. Primanov Jasur	7th Mission	sub		Process Engineer	Electrical				
11	Mr. Toshov Istam	6th Mission	sub	CCPP	Metering instrumentation and automation Engineer	C&I	Navoi State Mining Institute electrical energy in industry	July. 2002	36	Poor
12	Mr. Saidov Kamdjon	4th mission	sub	CCPP	Engineer Programmer	Programming	Tashkent Turin Polytechnic University	August 2014	25	Good
13	Mr. Maksudov Laziz	6th Mission	sub	CCPP	Senior Machine Operator	Mechanical	Navoi State Mining Institute	August 2012	28	Good
Observer for TOT in Uzbekistan, as below										
14	Mr. Namozov Jakhongir	7th Mission		Navoiy TPP	electrical	Electrical	Navoi State Mining Institute electrical energy in industry	August 2012	27	Fair
15	Mr. Nabiev Fazliddin	7th Mission		Navoiy TPP	electrical	C&I	College	July 2012	25	Poor
16	Mr. Eshev Hamdam	7th Mission		Navoiy TPP	Electrical engineer	Electrical	Tashkent State Technical University	September 1991	50	Poor
17	Mr. Khudoyberdiev Akbar	7th Mission		Navoiy TPP	I&C master	C&I	College	October 1996	36	no
18	Mr. Rajabov Xurshid	7th Mission		Navoiy TPP	I&C fitter	I&C	Industrial College	September 2010	26	Poor
19	Mr. Makhumov Aziz	7th Mission		Navoiy TPP	Non-distructive inspector	Metallurgy analysis	Navoi State Mining Institute	January 2014	28	Poor
20	Mr. Khamnev Istam	7th Mission		Navoiy TPP	Information Service	Mechanical	Tashkent Polytechnic Institute	October 1976	63	Fair

(Source; JET)

2.4.1.5

In the trainer candidates list, Table 2.4.1-4, there is a duplication of job duties between the trainer candidates and staff who decided to study abroad, etc. Therefore, in the 8th and 9th mission, JET considered replacing the candidates through an additional interview conducted, and finally all 16 interviewees were selected and confirmed as trainer candidates. As a result, participants for the 3rd TOT in Japan was finalized in the 9th mission. Table 2.4.1-5 below shows the final list of trainer candidates for new NTC. (In the Table, Mr. Saidov of No. 12 canceled his participation in the 3rd TOT in Japan due to the study abroad after the interview. Also, Mr. Aslon of No. 3 participated in the 2nd TOT in Japan, but after that he decided to study abroad and was out of consideration as a candidate for trainer)

Table 2.4.1-5 List of Trainer Candidates for New NTC (Final)

Trainer Candidate list, already trained on TOT in Japan

No.	Name	Interview on Mission	Training in Japan	Employed Site	Department, Section, and Role	Major
1	Mr. Musaev Alisher Baxtiyorovich	4th Mission	2nd Training in Japan	Navoi CCPP	Leading Engineer TME CCPP	Mechanical
2	Mr. Khasanov Latif Barnoevich	6th Mission	2nd Training in Japan	Navoi CCPP	Leading Engineer Programmer	Programming
3	Mr. Aslonov Aslon Ma'murjonovich	6th Mission	2nd Training in Japan	Navoi CCPP	Shift Head CCPP	Mechanical
4	Mr. Bayliev Shukhrat Tashpulatovich	6th Mission	2nd Training in Japan	Navoi CCPP	Gas Turbine Operator	Mechanical
5	Mr. Parmonov Azimjon G'ulomovich	6th Mission	2nd Training in Japan	Navoi CCPP	Leading Engineer Electrical	Electrical
6	Mr. Toshov Sanjar Shukhratovich	7th Mission	2nd Training in Japan	Navoiy TPP	Master Electro technical Laboratory	Electrical
7	Mr. Narziev Akmal Abdullaevich	7th Mission	2nd Training in Japan	Navoi CCPP	Electronics Engineer	C&I (Electronics)
8	Mr. Djamalov Bakhodir Dilmuradovich	6th Mission	2nd Training in Japan	Navoi CCPP	Maintenance Master	Mechanical

Trainer Candidate confirmed on 9th mission

11	Mr. Toshov Istam	6th Mission	3rd Training in Japan	Navoi CCPP	Leading Engineer C&I Instrumentation & Automation	C&I
12	Mr. Saidov Kamoljon Komiljon Ugli	4th mission	not attend	Navoi CCPP	Engineer Programmer	Programming
15	Mr. Eshev Hamdam Hazratovich	8th mission	3rd Training in Japan	Navoi TPP	Leading Engineer Electrical	Electrical
16	Mr. Makhudov Aziz Aminovich	8th mission	3rd Training in Japan	Navoiy TPP	Non-distructive Inspector 4th Rank worker Metal Lab	Metallurgy analysis
31	Mr. Ismoil Islamov	8th mission	3rd Training in Japan	Navoi CCPP	Maintenance Master	Mechanical
33	Mr. Bozorov Fakhriddin	8th mission	3rd Training in Japan	Navoi CCPP	BOP Operator	Mechanical
34	Mr. Pirnazorov Nurali	8th mission	3rd Training in Japan	Navoi CCPP	Local Operator Gas Booster Compressor Station	Mechanical
35	Mr. Kudoykulov Lutfullo	9th mission	3rd Training in Japan	Navoi CCPP	GT Operator	Mechanical

(Source: JET)

Ultimately, the breakdown of trainer candidates were 9 staff in the mechanical field (including 1 in Metal) and 7 staff in the electrical field (including 2 in programming and 2 in C&I).

2.4.2 Development of Trainers through Activities for Output 3

From the perspective of ensuring autonomous continuity and sustainability on the Uzbekistan side, and the effective implementation of the project by JET, the following steps have been followed when implementing the technology transfer and development of trainers.

(1) Technology transfer from JET to the Trainer candidates

Technology transfer (TOT) was promoted based on training materials prepared by JET. Trainer candidates were also participating in securing the capacity for autonomous and sustainable development, through the review and revision of Russian-translated training materials with an understanding of their contents.

(2) Technology transfer from former Tashkent trainer candidates to Navoi trainer candidates

Technology transfer in TOT in Uzbekistan was completed by October 2016, and was conducted over 12 days for 8 former trainer candidates, in the technology of the subjects No. 4 and No. 5. (total of 66 person-days). For this reason, from the viewpoint of maintaining and promoting progress, the project avoided implementing again the same content as for the trainer candidates in Tashkent. JET requested and NTC implemented the relaying of content from former trainer candidates to new trainer candidates in Navoi inside the UE. Its implementation was promoted after January 2017 when the 7th mission in December 2016 was completed.

(3) Implementation of TOT, including technology transfer and accreditation process of trainers under the project.

As described in the section 2.2.7, the TOT was completed sequentially. Namely, technology transfer, in the form of the process of proofreading and revision of the Russian version textbook by trainer candidates, and with mock-up training by trainer candidates were completed, as shown in the following Table 2.4.2-1.

Table 2.4.2-1 Technology Transfer list with completion date

Course No.	Classroom Training／座学	Practical Training 実技実習	Mock-Up Trainig 模擬講義/認定	Supplementary Training ／補講	Note
No.1	May-2017	Jan-2018	Mar-2018	― ― ―	Mock-UP @Training in Japan
No.2	Jul-2018	Oct-2018	Oct-2018	― ― ―	
No.3	Jul-2017	― ― ―	Oct-2018	Oct-2018	
No.4	Jul-2016	― ― ―	Mar-2018	Dec-2016	Mock-UP @Training in Japan
No.5	Oct-2016	― ― ―	Mar-2018	― ― ―	Mock-UP @Training in Japan
No.6	Jul-2017	Sep-2018	Aug-2017	Sep-2018	Supplementary training include practial
No.7	Aug-2017	― ― ―	Aug-2017	― ― ―	
No.8	Jul-2018	Jul-2018	Jul-2018	Sep-2018	Supplementary training include practial
No.9	Dec-2016	Jan-2019	Jul-2018	Jan-2019	Supplementary training include practial
No.10	Dec-2016	― ― ―	Jul-2018	Jul-2017	
No.11	Dec-2016	― ― ―	Jul-2018	Feb-2017	Supplementary training @Training in Japan
No.12	May-2017	― ― ―	Jul-2018	Feb-2018	

（Source: JET）

The steps in technology transfer are as follows;

1) Task 1: TOT in Uzbekistan by JET

Implemented technology transfer via TOT to the trainer candidates using the English training materials that were provided by JET. Technology transfer was advanced in considering the situations of trainer candidates, while paying attention to compensate for and cover the following points:

(a) Items in which the trainer candidates have no requisite knowledge at all.
(b) Items in which they have O&M experience but do not understand the theoretical background.
(c) Items in which they understand the theoretical background but have no O&M experience.
(d) Items in which they have no O&M experience and do not understand the theoretical background.

2) Task 2: Review and Revise the Russian Training Materials

Based on the prepared training materials, the trainer candidates made modifications to make them easier to understand for UE engineers. (Review and revision of the Russian translations) In conducting the review and revision, JET advised to pay attention to the following points.

(a) Concerning plant operation, differences exist between Japan and Uzbekistan in terms of grid system composition, generation capacity, daily load fluctuation, power generation

cost, and approach to economical operation and so on, in consideration of these viewpoints, items related to plant operation have to be corrected according to the situation in Uzbekistan from the original training materials based on Japanese conditions.

(b) Due to the differences in elementary and secondary education, higher education and in-house company education systems, it is possible that differences will arise between Japanese and Uzbek trainees in terms of understanding the difficulty of each item. Since the parts that the trainer candidates feel are difficult are also likely to be difficult for most UE staff, the trainer candidates need to revise the contents themselves so that it becomes easier to understand for the Uzbek staff.

3) Task 3: Practical Training

Using training equipment provided by JICA, JET's experts in charge of each subject conducted practical training. Experts instructed trainers how to use the training equipment, points of practical training, and training instruction methods. (There are 5 applicable subjects: No. 1, No. 2, No. 6, No. 8, No. 9)

4) Task 4: Appointment of trainers

The trainers are accredited based on completion examinations in consideration of the TOT implementation results. The method of the completion examination carried out in the "simulated lecture training (mock-up training)" method where trainer candidates became teachers and conduct the lesson. JET staff in charge of each course checked the lecture method, how the class was conducted and responses during questions and answers.

(4) Technology transfer to O&M staff implemented by trainers of the new NTC

Training education for O&M staff in UE will be achieved through the implementation of training by the trainers accredited in Task 4, using the training materials and equipment of this project, etc. In this section, the procedure of training implemented by trainer candidates is described. Trainer candidates conducted the training for the new employees of CCPP-2 shown in Section 2.2.7 (2) 1. (The results of trainer certification under the project is described in Section 2.4.5.)

1) Task 5: Lecture Plan (Preparation for training)

The trainers accredited in Task 4 should prepare a Lecture Plan for each subject by themselves. Lecture Plans need to contain the 8 conditions. (Refer to section 2.2.6.2 (2) 4)

2) Task 6: Implementation of Training

The trainers should implement training for O&M staff according to the Lecture Plans by using training materials and training equipment. In order to ensure sustainability, JET has proposed that the New NTC examine On-Site training on its own, as described in point 2.2.6.3 (2) and Table 2.2.6-6.

3) Task 7: Certificate for training completion

As described in 2.2.6.3(1), JET proposed that NTC record information on the individual ID card it issues based on the results of evaluation for trainees who have completed the training. JET also pointed out that the subjects which require completion confirmation by "Sanoat geokhontehnazorat" are the seven subjects shown in Table 2.2.6-6 (No. 4, No. 5, No. 7, No. 9, No. 10, No. 11 and No. 12).

2.4.3 Training of Trainer (TOT) in Uzbekistan and in Japan

2.4.3.1 Implementation of TOT in Uzbekistan

It is also described in Section 2.2.7 and 2.4.2(3) (in relation to the technology transfer of textbooks) how trainer candidates are being developed in each subject through implementing TOT

in Uzbekistan. In order to eliminate the effects of reshuffling the trainer candidates, JET requested UE to implement explanations from the previous trainer candidates to the new trainer candidates. Moreover JET implemented technology transfer on TOT, and new trainer candidates started revising information in Russian training materials, beginning on the 7th mission.

2.4.3.2 Implementation of TOT in Japan

As was also mentioned in Section 2.2.7 (3), it is important for trainer candidates to have experience and knowledge of CCPP periodic inspections. The necessary knowledge for trainers cannot be obtained from the aforementioned TOT in Uzbekistan or by review & revision work of training materials. It is extremely effective to implement On-site training for developing trainer candidates. In this Project, it is the most autonomous and sustainable way to utilize periodic inspections in UE CCPP. However, since opportunities to implement On-Site training are limited in Uzbekistan, it was decided to include site tours of periodic inspections in TOT in Japan from the beginning of the Project. The technical contents were more substantial than the country-focused training conducted by JICA. Its special contents included EPC training by manufacturers and Japanese electric power company's experiences, and also included the latest technical content on CCPP installed in power plants of UE. In addition, in the training in Japan, the contents of training included not only technical knowledge but also the way of thinking about human resources development in Japanese power companies and the positioning of the training center. In both cases, the training contents and training system that Japanese engineers learn in Japan are incorporated, and these training programs could be expected to have equal effects or more than the actual periodic inspection experience. Also, in order to cover the installation delay of training equipment, JET implemented practical training for non-destructive inspection and vibration test within the period of TOT in Japan.

The 1st TOT in Japan was completed in April 2016; the 2nd TOT in Japan was completed in March 2017; and the 3rd TOT in Japan was completed in March 2018. A total of 20 trainer candidates participated in TOT in Japan, including 5 from Table 2.4.1-1 and 15 from Table 2.4.1-5. (3 managers participated in managers' training) 14 trainer candidates from 15, excluding the 5 participants in 1st TOT in Japan, were certified to become trainer, and prepared Lecture Plan draft which is basis of Training Plan. (Refer to Appendix 36 "Summary Report of TOT in Japan", and 2.2.6.2 (2) for Lecture Plan)

By the way, since 5 staff, who completed the 1st TOT in Japan, are positioned to have periodic inspection experience and knowledge for adopting as trainers, they are possible to certify as trainers through NTC's additional TOT training. So, JET pointed out that they are important human resources as trainers.

2.4.3.3 Implementation of On-Site training in Uzbekistan

Periodic inspection of CCPP, available in Uzbekistan, is conducted in Navoi CCPP-1, and the similar CCGT of Tashkent CHPP. Periodic inspection of newly-installed Talimarjan CCPP cannot be utilized yet. Utilizing Tashkent CCCP of Tashkent CHPP could be considered, if there were periodic inspections.

The project planned to implement On-Site training utilizing the Combustor Inspection of Navoi CCPP-1 in October 2016, but at that time, there was a project organization change on the UE side, so On-Site training could not be implemented as a result. At the 2nd Workshop in July 2017, trainer candidates who had participated in the 2nd TOT in Japan, requested On-Site training at the time of periodic inspection of CCPP-1.

A major inspection of Navoi CCPP-1 was scheduled from January to March 2018. However, this major inspection was postponed and carried out in October 2018. This change in the timing of inspection, was discovered during the 13th mission of the project, but there was no advance information, so that JET could not perform On-site training.

On the other hand, UE and JET both understand the usefulness of on-site training for

developing trainers by UE, so JET proposed to create curricula and a Lecture Plan for on-site training, utilizing CCPP periodic inspection.

Trainer candidates have a thorough understanding about the implementation method of on-site training by experiencing the periodic inspection and utilization training at the training in Japan as described in 2.4.3.2. So trainer candidates created and added a description of on-site training in the Lecture Plan Draft, as a key point of training.

The difference between on-site training and general lecture training is that training is conducting while observing the real thing. And it is necessary to pay attention to safety aspects at the site, but specific skills, like as handling skills of training equipment, are not needed. Therefore, if there is a problem to implement On-Site training, it is estimating the time taken for training, and it is pointed out that the trainer needs to revise the Lecture Plan from this point.

2.4.4 Considering Trainers from External Resources

On investigating the situation regarding utilization of external trainers for training at the existing training centers and power stations, it was found that UE hardly invites external trainers at all.

As described in Section 2.2.4 (3), concerning the appointment of trainers for conventional power generation, the existing TTC employs trainers from Tashkent TPP. Meanwhile, senior persons or retirees who have very abundant experience of working in power stations are utilizing as on-site trainers and/or OJT trainers in the power stations. All such trainers or OJT trainers are current or former UE employees, and external staff are almost never recruited. In the on-site CCPP training, as described in Section 2.2.4(3) , O&M high level/senior staff are assigned as trainers, while external trainers are recruited only for EPC training as technical advisers based on contracts with manufacturers.

With such a background, there is little chance that UE will request external trainers, although they could be invited to conduct training only for specific technical issues.

According to the Mid-Term Plan by the Department of Work with Personnel of UE HQ (Table 2.2.6-10), it is assumed that the number of O&M staff required for the CCGT in the near future will exceed 750 in 2024. To invite professors and teachers such as from colleges and engineering universities in Navoi as candidates for external trainers, it is necessary to proceed with deliberations inside the UE including NTC and the Human Resource Department of NTPP. Depending on the results of these deliberations, it is necessary to assume consultation with Navoi University, technical universities and so on. Particularly when training on special technical issues are necessary, it is customary to invite external experts.

For another resource of trainers, JET proposed the staff who completed 1st TOT in Japan. They are not considered external resources, but 5 trainer candidates have already completed both the 1st TOT in Japan and TOT in UZ. They are the former trainer candidates in Tashkent described in section 2.4.1.1 (Result “A” staff in Table 2.4.1-1). JET proposed to utilize these 5 staff as human resources to carry out the dispatch training mentioned in Section 2.3.1.

2.4.5 Settlement of Accreditation/Appointment System of Trainers

Concerning the accreditation of trainers, procedures by the Project and the procedure after the Project, the manual draft compiled according to the road map for trainer and the procedure, are described in 2.2.6.3 (2) (Refer to Appendix 17, Manual for Authorization of Trainers under the Project, Appendix 18, Manual for Appointment and Role of Trainers of NTC). Regarding trainer certification by the project, in order to ensure that trainers can be accredited, JET proposed issuing a certificate at the 2nd JCC during the 8th mission and in the 2nd workshop during the 9th mission, and held discussions and reached agreement with the NTC and NTPP.

2.4.5.1 Staff and accredited trainers necessary for training center

In order to operate the training center, there need to be trainers and training staff, and

preparations need to be made, according to the number of training courses and the estimated number of trainees. Details of each issue are as follows;

(1) Staff of Training Center

Staff other than trainer is necessary for the training center. Currently, as the staff of NTC in Table 1.7-1, one Director and three staff have already been appointed from NTPP staff. In the existing TTC, as shown in Figure 2.2.5-1, it is operated by 16 staff and the Director. It is obvious that the number of staff for NTC is insufficient compared to the TTC system. Also, there are no staff corresponding to Engineer for Personnel Training (Table 1.7-1) responsible for handling and coordinating office work on human resource development at NTPP. In order to secure the autonomy and sustainability of NTC, JET pointed out the need for increased staff and requested it.

(2) Full time trainers

The training of 12 subjects introduced in the project divided into three fields of mechanical, electrical and facility, and each field includes three to five subjects. Each training course is professionally distinct; it is difficult for a trainer to be in charge of training in subjects other than his own field or to prepare a lecture plan. For the training management of 3 fields respectively, a chief or supervisor is necessary, and JET proposed the appointment of full time trainers familiar in each field, in the manual. In the Manual for Appointment and Role of Trainers of NT (Appendix 18) and Road Map for Trainers (Figure 2.2.6-8), promotion and the role of trainers are defined. Regarding the courses in charge, essentially one full time trainer for each field, that is, three full time trainers in total are necessary. They have the responsibility to manage for Lecture Plan in their field, and the preparation of the next fiscal year training plan (draft). The Chief Trainer is qualified in specific issues and has much knowledge of training content, and so is suitable as a full time trainer. On the other hand, the Engineer for Personnel Training, described in point 1) above, is difficult to have as a technical coordinator, i.e. a full-time trainer for technical aspects.

(3) Trainers in charge of training

The trainer in charge of training shall use the prescribed Lecture Plan to implement training in accordance with the annual training plan. Trainers are asked to make an effort to upgrade their scope, so that they can conduct training on multiple subjects in their field. In addition, the trainer's certification has set a deadline within 3 years for a mandatory periodic upgrade of the knowledge level to the latest technology for the subjects in question.

In the manual and the road map, three levels of trainer, Chief Trainer / Deputy Trainer / Assistant Trainer, are defined. They are the same with regard to implementation of the training, except the Assistant Trainer is required to receive guidance from the more senior trainers.

2.4.5.2 Accreditation of trainers under the project

Certification of trainers under the project was carried out in accordance with the manual described at the beginning of 2.4.5. (Refer to Appendix 17, Manual for Authorization under the Project) JET decided whether the trainer certification is possible by mock-up training, after securing trainer candidates, conducting TOT, technology transfer / TOT in Japan. (Refer to Table 2.4.2-1; Technology Transfer List with completion dates) The results of the interviews, participation in TOT, participation in TOT in Japan, and overview of mock-up training and evaluations are shown in Table 2.4.5-1 below.

Regarding the subjects of No. 4 and No. 5, as describe in paragraph 2.4.2 (2), the Tashkent trainer candidates implemented technology transfer to the Navoi new trainer candidates.

Mr. Djamalov Bakhodir of subject No.1 was evaluated as excellent also in mock-up training, but he cannot participate in UT practical training, because of his work duties, and he is assigned as an Assistant Trainer only. As a first example of NTC developing a trainer, it is expected that he

will receive Deputy Trainer certification earlier, after completing UT practical training by the certified Chief Trainer or certified Deputy Trainer for this subject, i.e. by Mr. Aziz or Mr. Ismail. It is expected to be the first certification by NTC.

Table 2.4.5-1 Outline of evaluation of trainer certification by JET
(by training subjects / by individuals)

Course No Course Level	Trainer's Name	Interview Passed Date	TOT in UZ Attend days	TOT in Japan	Mock-UP training (Date & Evaluation)	Conclusion
Machanical Field						
No 1	Djamalov Bakhodir	Oct. 2016	3 days	Feb. 2017	2017/2/9 Excellent, but *need Practical Training*	*Assistant Trainer*
Elementary	Islamov Ismail	May. 2017	3 days	Mar. 2018	2018/3/27 passed	Deputy Trainer
	Makhmudov Aziz	May.- 2017	4 days	Mar. 2018	2018/3/27 Excellent	Chief Trainer
No 2	Djamalov Bakhodir	Oct. 2016	3 days	Feb. 2017	2018/10/19 Excellent	Deputy Trainer
	Islamov Ismail	May. 2017	3 days	Mar. 2018	2018/10/19 Excellent	Chief Trainer
Intermediate	Toshov Istam	Oct. 2016	3 days	Mar. 2018	2018/10/19 Excellent	Deputy Trainer
No 3	Djamalov Bakhodir	Oct. 2016	2 days	Feb. 2017	2018/10/22 Excellent	Deputy Trainer
	Bayliev Shukhrat	Oct. 2016	2 days	Feb. 2017	2018/10/22 Excellent	Chief Trainer
Intermediate	Makhmudov Aziz	May.- 2017	2 days	Mar. 2018	2018/10/22 Excellent	Deputy Trainer
No 4	Musaev Alisher	May. 2016	*Handover from Tashkent to Navoi*	Feb. 2017	2018/2/9-10 Excellent	Deputy Trainer
	Bayliev Shukhrat	Oct. 2016		Feb. 2017	2018/2/9-10 Excellent	Deputy Trainer
Basic Common	Khudoykulov Lutfillo	Jul. 2017		Mar. 2018	2018/3/23 Excellent	Chief Trainer
No 5	Djamalov Bakhodir	Oct. 2016		Feb. 2017	2017/2/14-15 Excellent	Chief Trainer
	Bayliev Shukhrat	Oct. 2016		Feb. 2017	2017/2/14-15 Excellent	Deputy Trainer
Intermediate	Islamov Ismail	May. 2017		Mar. 2018	2018/3/22-23 Passed	Deputy Trainer
Electrical Field						
No 6	Toshov Sanjar	Dec. 2016	6 days	Feb. 2017	2017/7/31 Excellent	Deputy Trainer
	Parmonov Azim	Oct. 2016	4 days	Feb. 2017	2017/7/31-8/1 passed	Deputy Trainer
Intermediate	Eshev Khamdam	May. 2017	3 days	Mar. 2018	2017/8/1-2 Excellent	Chief Trainer
No 7	Khasanov Latif	Oct. 2016	7 days	Feb. 2017	2017/8/2 passed	Deputy Trainer
	Toshov Istam	Oct. 2016	6 days	Mar. 2018	2017/8/2-3 passed	Deputy Trainer
Basic Elementary	Narziev Akmal	Dec. 2016	7 days	Feb. 2017	2017/8/1-2 Excellent	Chief Trainer
	Eshev Khamdam	May. 2017	6 days	Mar. 2018	2018/10/3 Excellent	Deputy Trainer
No 8	Khasanov Latif	Oct. 2016	8 days	Feb. 2017	2018/7/5 passed	Deputy Trainer
	Toshov Istam	Oct. 2016	12 days	Mar. 2018	2018/7/4-5 Excellent	Chief Trainer
Intermediate	Narziev Akmal	Dec. 2016	4 days	Feb. 2017	2018/7/6 passed	Deputy Trainer
Facility/ Equipment Field						
No 9	Musaev Alisher	May. 2016	6 days	Feb. 2017	2018/7/18 Excellent	Deputy Trainer
	Bazarov Fakhriddin	May. 2017	7 days	Mar. 2018	2018/7/16-17 Excellent	Chief Trainer
Basic Common	Khudoykulov Lutfillo	Jul. 2017	5 days	Mar. 2018	2018/7/16-17 passed	Deputy Trainer
No 10	Musaev Alisher	May. 2016	6 days	Feb. 2017	2018/7/18 Excellent	Deputy Trainer
	Bayliev Shukhrat	Oct. 2016	7 days	Feb. 2017	2018/7/17-18 Excellent	Deputy Trainer
Basic Common	Pirnazarov Nurali	May. 2017	3 days	Mar. 2018	2018/7/18-19 Excellent	Chief Trainer
No 11	Pirnazarov Nurali	May. 2017	3 days	Mar. 2018	2018/7/19 Excellent	Deputy Trainer
	Toshov Sanjar	Dec. 2016	3 days	Feb. 2017	2018/7/18 Excellent	Deputy Trainer
	Parmonov Azim	Oct. 2016	2 days	Feb. 2017	2018/7/18-19 Excellent	Chief Trainer
	Bazarov Fakhriddin	May. 2017	7 days	Mar. 2018	2018/7/19 Excellent	Deputy Trainer
Basic Elementary	Eshev Khamdam	May. 2017	6 days	Mar. 2018	2018/7/18-19 Excellent	Deputy Trainer
	Musaev Alisher	May. 2016	6 days	Feb. 2017	2018/7/20 Excellent	Deputy Trainer
No 12	Musaev Alisher	May. 2016	5 days	Feb. 2017	2018/7/20 Excellent	Chief Trainer
	Islamov Ismail	May. 2017	1 day	Mar. 2018	2018/7/20 Excellent	Deputy Trainer
Intermediate advanced	Khudoykulov Lutfillo	Jul. 2017	6.5days	Mar. 2018	2018/7/20 Excellent	Deputy Trainer

(Source: JET)

Evaluation of mock-up Training was conducted by a Japanese expert in charge of target subjects using an evaluation format. (Refer to Appendix 20, Evaluation Format of Mock-up) Evaluation points are 100 points maximum, more than 70 points is passing and 80 points or more is excellent. Chief Trainer for each subject are nominated and appointed from those receiving excellent evaluations.

The trainers who are qualified for each subject are arranged easily, and are shown in the following Table 2.4.5-2 from the Table 2.4.5-1 above.

Table 2.4.5-2 Certification result of trainers (by each training course)

№	The name of the course / subject	Main Trainer/ Chief Train	Deputy Trainer/ Assistant Trainer
1	Non-destructive Inspection	MAKHMUDOV Aziz	Islamov Ismail/ DJAMALOV Bakhodir
2	Vibration analysis for rotating mechanisms	ISLAMOV Ismail	TOSHOV Istam, DJAMALOV Bakhodir
3	Remaining Life Assessment	BAYLIEV Shukhrat	DJAMALOV Bakhodir, MAKHMUDOV Aziz
4	Gas turbine (GT) Combined Power Generation Equipment	KHUDOYKULOV Lutfillo	MUSAEV Alisher, BAYLIEV Shukhrat
5	Gas Turbine (GT) Hot Parts Maintenance	DJAMALOV Bakhodir	ISLAMOV Ismail, BAYLIEV Shukhrat
6	Details of Electrical Facilities for GT Combined Cycle Power Plant	ESHEV Khamdam	PARMONOV Azim, TOSHOV Sanjar
7	Operation & Control theory of GT Combined Cycle Power Plant	NARZIEV Akmal	TOSHOV Istam, KHASANOV Latif, ESHEV Khamdam
8	Details of Control & Instrument Devices for GT Combined Cycle Power Plant	TOSHOV Istam	KHASANOV Latif, NARZIEV Akmal
9	GT Operation and Maintenance	BAZAROV Fakhriddin	KHUDOYKULOV Lutfillo, MUSAEV Alisher
10	GT Control system	PIRNAZAROV Nurali	BAYLIEV Shukhrat, MUSAEV Alisher
11	GT Electrical Control system	PARMONOV Azim	PIRNAZAROV Nurali, TOSHOV Sanjar, MUSAEV Alisher, ESHEV Khamdam, BAZAROV Fakhriddin
12	GT O&M Lecture	MUSAEV Alisher	KHUDOYKULOV Lutfillo, ISLAMOV Ismail

(Source: JET)

Table 2.4.5-2 shows the results of multiple trainers being certified for each subject. Flexible correspondence is available for management of the training center currently, by certifying more than two trainers in a single subject. Each individual trainer received trainer certification in multiple subjects, and this is arranged to Table 2.4 .5-3 for easier list at glance.

Table 2.4.5-3 Certification results for trainers (by trainer individual)

№	Trainer's Name	Position	Machanical Field					Electrical Field			Facility/ Equipment Field			
			No.1	No.2	No.3	No.4	No.5	No.6	No.7	No.8	No.9	No.10	No.11	No.12
1	Musaev Alisher	Leading Engineer TME				○					○	○	○	◎
2	Aslonov Aslon	Former Shift Head	Abroad to Japan for master degree study under JICA Project											
3	Djamalov Bakhodir	Maintenance Master TME	△	○	○		◎							
4	Bayliev Shukhrat	Operator GT			◎	○	○					○		
5	Islamov Ismail	Maintenance Master TME	○	◎			○							○
6	Bazarov Fakhriddin	Operator BOP									◎		○	
7	Pirnazarov Nurali	Senior Engineer Power Unit										◎	○	
8	Khudoykulov Lutfillo	Operator GT				◎					○			○
9	Khasanov Latif	Leading Engineer Programmer							○	○				
10	Toshov Istam	Leading Engineer C&I		○					○	◎				
11	Narziev Akmal	Engineer Electrical							◎	○				
12	Toshov Sanjar	Master Electro Technical Lab.						○					○	
13	Parmonov Azim	Leading Engineer Electrical						○					◎	
14	Eshev Khamdam	Leading Engineer Electrical						◎	○				○	
15	Makhmudov Aziz	Laboratory assistant Metal-Lab	◎		○									

◎ Chief Trainer, ○ Deputy Trainer, △ Assistant Trainer

(Source: JET)

As a result of developing trainers under the Project, 14 trainer candidates were certified as trainers, resulting in a total of 40 (person-subject) trainers being certified. (Mr. Aslon of No. 2 was removed as a candidate because he went to Japan separately under the JICA-JDS system)

As trainers are in charge of multiple subjects, improvement of the adaptability of individual trainers has been indicated, and project directionality was secured. Certified trainers received a certification testimony for each subject, from the Project.

Since trainers are required to upgrade their level sustainably, they have agreed that the expiration date of certification is less than the 3 years stated in the manual. Based on this agreement, the expiration date of certification issued under the Project was set as the end of 2021.

The format of the certificate is different from the sample form presented in manual, but it was issued with the signature of the Project Director on the UE side and JICA Chief Advisor by agreement. (See photo 2.4.5-1 below)


Certificate of Trainer

under The Project for Establishment of the Combined Cycle Gas Turbine (CCGT) Operation and Maintenance Training Center in Uzbekistan

This is certify that

Mr. BAYLIEV Shukhrat Tashpulatovich

has successfully completed the training to become Trainer for the subject of "No.3: Remaining Life Assessment".
His ability is enough to become Chief Trainer, and valid of certification is till the end of 2021.

Mr. Kahramon H. GANIEV
Project Director of the project
General Director of
Navoi Thermal Power Plant

Mr. Yukihiro MURATA
Chief Advisor of the project
JICA Expert Team


Certificate of Trainer

under The Project for Establishment of the Combined Cycle Gas Turbine (CCGT) Operation and Maintenance Training Center in Uzbekistan

This is certify that

Mr. DJAMALOV Bakhodir Dilmuradovich

has successfully completed the training to become Trainer for the subject of "No.2: Vibration Analysis for Rotating Machine".
His ability is enough to become Deputy Trainer, and valid of certification is till the end of 2021.

Mr. Kahramon H. GANIEV
Project Director of the project
General Director of
Navoi Thermal Power Plant

Mr. Yukihiro MURATA
Chief Advisor of the project
JICA Expert Team

（Source: JET）

Photo 2.4.5-1 Certification for Trainer under the project (actual example)

2.4.5.3 Increasing number of accredited lecturers required after the Project

In order to facilitate the operation of the training center, it is necessary and appropriate to estimate the number of certified trainers by counting the number of training courses to be implemented. In order to predict the appropriate number of trainers, it is necessary to have a more accurate grasp of the number of trainees. As mentioned at the end of 2.2.6.2 (2) 2), for the mid-term training plan, i.e. Table 2.2.6-10, created by the Department of Work with Personnel of UE HQ, JET requested a detailed review of the plan. (Refer to Appendix 13, Request to Confirm the Progress of the Project)

On the other hand, JET estimated the number of trainers required as follows based on the training road map draft (Table 2.2.6-11) that it had created by itself.

First of all, in order to estimate the number of required trainers, the necessary number of training execution groups is decided from the number of trainees, and then trainers are assigned accordingly. So, concretely, the number of trainees is based on Table 2.2.6-11, and 10 trainees can participate in one training group, (except No. 12 can have 20 trainees). The number of groups were thus calculated as shown in 2.4.5-4 below. Assuming that the lecturer conducts training only in the field of expertise that uses his/her special field training, JET calculated the number of training execution groups in the 3 fields of mechanical, electrical, and facility, respectively.

Next, as a precondition for calculating the number of training groups of which the trainers can be in charge, it is assumed that the preparatory period before the training is 1 week, the training is 1 week, and preparation of the report after training requires 1 week. Then one trainer can manage 4 groups over a period 3 months. (Refer to Table 2.4.5-5) For example, as can be seen from this table, it is said that two trainers are required for conducting 5 groups of training in 3 months. (If the operation of the training center gets on track, training can be considered to be carried out by raising the efficiency more than this calculation. But this condition above is adopted assuming that it will not be applicable before the starting of the training center.)

Finally, the number of trainers were estimated from Table 2.4.5-5 by the number of training execution groups for each of the three fields calculated in Table 2.4.5-4. (The training accompanied with practical skills, course numbers No. 1, No. 2, No. 6, and No. 8 required the Chief Trainer and an Assistant Trainer, so the number of trainers for training one group was calculated as two.)

The results of calculation are listed in the lower three lines of Table 2.4.5-4. The number of trainers required as calculated by JET is a maximum. According to the premise that the training will concentrate before starting the plant, based on the UE's Mid-Term Training Plan, the number of trainers will be 18 to 20 people from the required period.

From the above estimation, it is concluded as follows;

(1) Within the project period until the end of March 2019, it is possible to conduct training with 14 trainers certified under the project.
(2) NTC needs to nurture more than 4 trainers at the latest even before the first half of 2020. And, when supposing change of trainer etc., it is necessary to nurture necessary number in advance.

The conclusion of above 1) and 2) is based on the figures of the current mid-term training plan. As mentioned at the beginning of (3), it is a premise that "to grasp more accurately than the number of students" is said.

Table 2.4.5-4 Number of training execution groups

Time Scale		2018				2019				2020				2021				2022	Total (~2022.3)
		1 2 3 4 5 6 7 8 9 10 11 12				1 2 3 4 5 6 7 8 9 10 11 12				1 2 3 4 5 6 7 8 9 10 11 12				1 2 3 4 5 6 7 8 9 10 11 12				1 2 3	
		1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	
No.1	Non-destructive testing	0	0	0	0	0	0	0	0	0	0	0	1Gr	0	0	0	1Gr	1Gr	
No.2	Vibration analysis for rotating machine	0	0	0	0	0	0	0	0	0	0	0	3Gr	0	0	0	5Gr	0	
No.3	Remaining life assessment	0	0	0	0	0	0	0	0	0	0	0	1Gr	0	0	0	1Gr	1Gr	
No.4	Gas Turbine combined power generation equipment	0	0	6Gr	0	0	0	6Gr	6Gr	0	6Gr	0	0	0	0	11Gr	0	0	
No.5	Gas Turbine Hot Parts Maintenance	0	0	1Gr	0	0	0	1Gr	1Gr	0	1Gr	0	0	0	0	1Gr	0	0	
No.6	Details of Electrical Facilities for Gas Turbine Combined Cycle Power Plant	0	0	0	0	0	0	0	0	0	0	0	2Gr	0	0	0	2Gr	2Gr	
No.7	Operation & Control Theory of Gas Turbine Combined Cycle Power Plant	0	0	0	0	0	0	0	0	0	0	0	3Gr	0	0	0	3Gr	3Gr	
No.8	Details of Control & Instrument Devices for Gas Turbine Combined Cycle Power Plant	0	0	0	0	0	0	0	0	0	0	0	3Gr	0	0	0	3Gr	0	
No.9	Gas Turbine Operation & Maintenance	0	0	6Gr	0	0	0	6Gr	6Gr	0	6Gr	0	0	0	0	11Gr	0	0	
No.10	Gas Turbine Control System	0	0	0	0	3Gr	0	0	0	3Gr	3Gr	0	6Gr	0	0	0	3Gr	5Gr	
No.11	Gas Turbine Electrical Control System	0	0	0	0	1Gr	0	0	0	1Gr	1Gr	0	2Gr	0	0	0	1Gr	5Gr	
No.12	Gas Turbine O&M Lecture	0	0	0	0	1Gr	1Gr	1Gr	1Gr	1Gr	1Gr	1Gr	1Gr	1Gr	1Gr	1Gr	1Gr	1Gr	
Trainer's Number for Mechanical Field (55base)		0	0	2	0	0	0	2	2	0	2	0	3	0	0	3	5	2	max 5
Trainer's Number for Electrical Field (55base)		0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	5	3	max 5
Trainer's Number for Facility Field (55base)		0	0	2	0	2	1	2	2	2	3	1	3	1	1	3	2	3	max 3
Total Trainer's Number (55base)		0	0	4	0	2	0	4	4	2	5	0	11	0	0	6	12	8	max 12
Total Trainer's Number (71base=130%*55base)		0	0	6	0	3	1	6	6	3	7	1	15	1	1	8	16	11	max 16
UE's Estimation @13th mission (125%*71base)		0	0	7	0	4	1	7	7	4	9	1	18	1	1	10	20	13	max 20

(Source: JET)

Table 2.4.5-5 Number of training groups that trainers can implement in 3 months

Trainer's Group	Training Group in Quarter Period (Gr=Number)											
	1st Month				2nd Month				3rd Month			
	1wk	2wk	3wk	4wk	5wk	6wk	7wk	8wk	9wk	10wk	11wk	12wk
1st trainer	1Gr			2Gr			3Gr			4Gr		
2nd trainer		5Gr			6Gr			7Gr			8Gr	
3rd trainer			9Gr			10Gr			11Gr			12Gr
4th trainer	13Gr			14Gr			15Gr			16Gr		
5th trainer		17Gr			18Gr			19Gr			20Gr	
6th trainer			21Gr			22Gr			23Gr			24Gr
7tht trainer	25Gr			26Gr			27Gr			28Gr		
8th trainer		29Gr			30Gr			31Gr			32Gr	

(Source: JET)

2.4.6 Information Disclosure of the Training and Improvement of O&M Training

The annual training plan for existing thermal power generation conducted by the existing Tashkent Training Center (TTC) follows the procedure shown in Figure 2.2.3-1. From around August every year, it will announce next year's plan to each power plant, summarize requests such as the number of participants, and decide to submit proposals for approval to UE head office as the next fiscal year training plan in December. Through these procedures, the training plan for the next fiscal year will be announced publicly, and the actual courses will be implemented from January to December according to the established training plan. In this project, the Navoi Training Center (NTC) has not been officially established as of December 2018. As described in 2.2.7 (2) 2), since the draft training plan for NTC's 2019 training plan has not yet been prepared, JET asked that the Department of Work with Personnel of UE, the Human Resources Department of Navoi TPP and NTC shall cooperate to create a 2019 annual plan and to carry it out. As opportunities for the starting of NTC, JET recommended following the procedures already undertaken by TTC for the annual training plan and training curriculum as information that can be shared in the UE. So that NTC information can be notified to related companies and related personnel in the future, it is necessary to construct such a mechanism.

The existing Tashkent training center has already begun to introduce the training course of electric maintenance repair in the field of transmission and distribution, using an e-learning system as contents related to improvement of training contents. In addition, they are considering plans to implement conventional power generation training using an e-learning system. In this project, JET initially planned to provide teaching materials and practical training equipment only for the training of the vibration test training, but in order to deepen the understanding of the practical training, JET added software-based teaching material using PCs, so that training becomes more effective.

As for improving the training of O&M staff to be implemented in the future, promotion of the training monitoring / evaluation system in Section 2.2.8 is a subject, so it is important that NTC’s implementation after the project shall be done autonomously/voluntarily and continuously.

2.5 Implementation of JCC and Workshop etc.

(1) Confirmation Notes:

In starting the project, when the mission was implemented in Uzbekistan, JET prepared Confirmation Notes (C/N) to be signed and exchange during each mission, aiming to confirm mutual understandings with UE.（Refer to Appendix 28, Confirmation Notes）

The C/N confirmed the project outline, the human resources development plan, the project evaluation indicators, the accreditation system, the training plan, advice for the CCPP maintenance service contract, the progress regarding training materials and equipment for CCPP O&M training and so on, and work was advanced based on agreement on said contents.

(2) Monthly Meeting:

JET also proposed to have regular monthly meetings as the monitoring tool to control and manage the progress of the TOTs and for comprehensive purposes of the project. The management of Navoi TPP agreed with the regular monthly meeting proposal. As the main participants, on the NTC side was the Director NTC, on JET side were Mr. Wakabayashi, the monitor in charge and local coordinator, and as far as possible Head of Human Resource Department of NTPP and JET Vice Advisor attend as well. Except when on a mission with Japanese members, JET held a monthly meeting between NTC and the local coordinator, promoting the Project as Mr. Wakabayashi's remote work. (Refer to CD-ROM data in Appendix 32, Record of Monthly Meeting)

(3) JCC and Workshop

In February 2016, the 1st JCC was held during the 3rd mission of the project. In the 1st JCC, the project work plan, training plan (target subjects and TOT schedule), and baseline survey/monitoring were explained and agreed upon (Refer to Appendix 22, MM 1st JCC). In the Workshop that was conducted after the JCC, the Human Resources Development Plan, training subjects and other topics were explained. The 12 training subjects prepared in the project were decided in the JCC and Workshop. The outline of the project schedule was also agreed including the implementation of the 1st TOT in Japan.

The Chairman of the Board for Uzbekenergo changed in October 2016, and the project counterpart was changed as well. The target construction site of the new training center was also changed from Tashkent to Navoi. Therefore, the project needed to recognize the change officially under the JCC. The 2nd JCC was held at the 8th mission in May 2017 and agreed upon the change of the PD, the change of the project site, etc. (Refer to Appendix 23, MM 2nd JCC).

The 2nd Workshop (WS) was held during the 9th mission on August 2017 on a schedule different from the 2nd JCC. In the WS, the Navoi side presented their progress on the project, and JET proposed the issues for the future, specifically, confirmation of the construction of the training center building and layout, the final decision of the trainer candidates, preparation progress of the Lecture Plan, and so on. Also, it was agreed upon to propose trainer certification and training monitoring, and to promote these.

The 3rd JCC was held in July 2018 and approved the replacement of the Director of NTC, the accreditation system before NTC establishment, construction of NTC training center building, and monitoring and evaluation system. (Refer to Appendix 24, MM 3rd JCC)

The 3rd Workshop was also held in October 2018, and the project content; the training plan, the road map of the accreditation system, and the training monitoring and evaluation system were confirmed with a view to the stage after Project completion.

The 4th JCC was held in March 2019. Agreement was reached on the contents of the Project accomplishments and issues to be tightened towards effective operation of NTC. There are more than 30 issues pointed out specifically, and the outline of the indicated issues is described in Section 5.1. (Refer Appendix 29, MM 4th JCC)

In addition, since the CCPP-2 training center building has not been completed, and JET will follow up the completion of building construction, within the Project for simulator procurement.

Chapter 3

3. Project Management Issues, Ideas and Lessons

3.1 New Organization of UE

The Project objective is to establish a training system of operation and maintenance for CCPP of UE. This project was started in order to establish the new NTC and strengthen the training for O&M staff for the cumulative 19 sites including newly installing CCPP.

At the beginning of the project in September 2015, the new CCPP Training Center had been planned to be constructed in Tashkent, and the site for construction was decided on around 20 minutes from UE HQ.

However, the construction site of the new CCPP Training Center was changed from Tashkent to Navoi, under instructions by the New Chairman of the Board, at the 6th mission. The decision of the relocation had an adverse impact on the Trainer Candidates, Project Director and Director of new CCPP O&M Training Center who resided in Tashkent.

After that the technology transfer had been promoted, but Director of Navoi Training Center (NTC), who appointed in May 2018, was replaced to a new Director, because of his worse physical condition after 3rd TOT in Japan. Additionally, in July 2018, Head of Department of Work with Personnel was retired after 3rd TOT, and Deputy Chairman of UE HQ was also replaced in September 2018, therefore, the project organization was forced to reorganize.

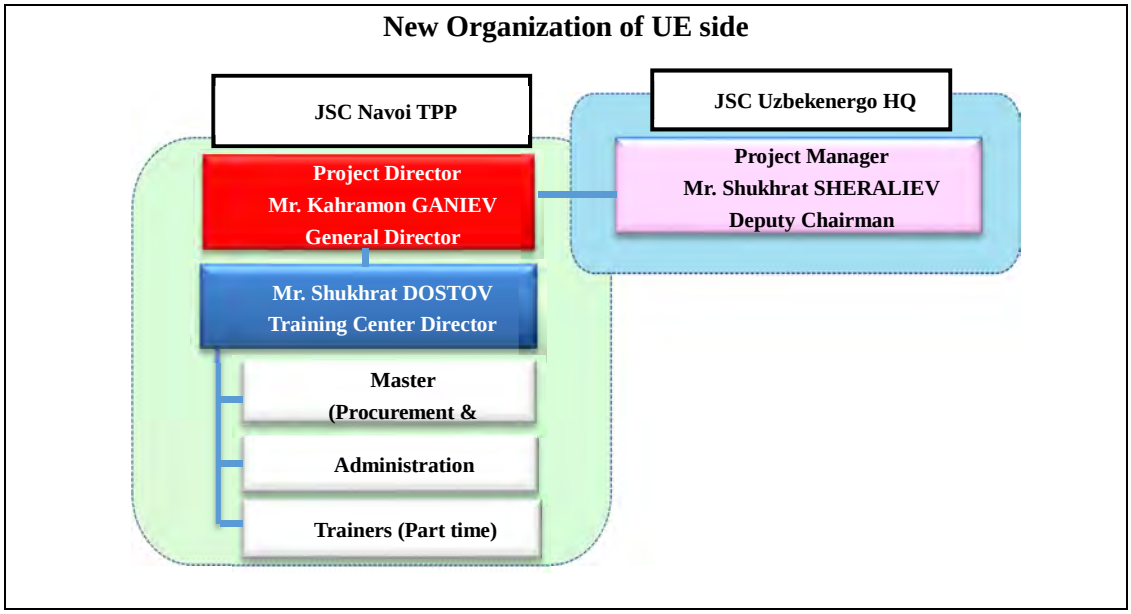
Technology transfer of training materials and training equipment, and nurturing of trainer candidates were completed in the project, successfully in the period. However, regarding the establishment of organization of NTC, it is really important to maintain the good relationship among UE HQ, NTPP and NTC for the future, each other.

(1) Correspondence to the change on project organization

Since the site change to Navoi on October 2016, it was more needed to maintain the strengthen cooperation with UE HQ. In order to maintain and promote the communication and cooperation with Department of Foreign Economic Relation and Investment, Power Plant Operation Department and Department of Work with Personnel in UE HQ, JET proposed to gain the cooperation from Deputy Director of Navoi TPP who lives in Tashkent and is in charge of PIU manager of Navoi CCPP -2, and recognized.

Figure 3.1-1 shows the project implementation structure of UE side determined at JCC on May 2017. Until the relocation of the NTC on September 2018, JET promoted to technology transfer under this organization

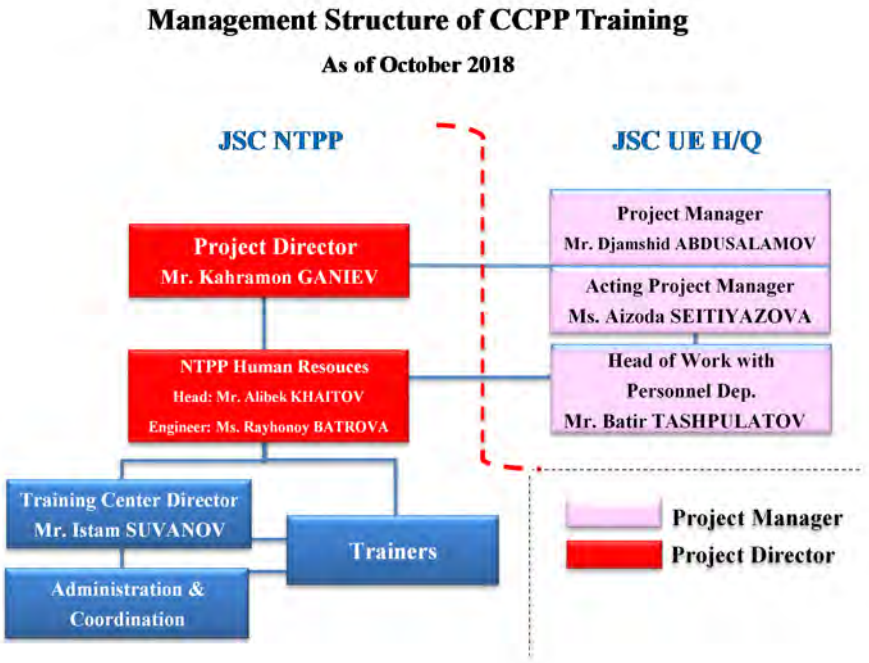
In addition, JET followed up the project progress with the Monthly Meeting, described in 2.5 (2), during the project implementation period.



（Source: UE）

Figure 3.1-1Management structure for new NTC (As of May 2017）

Though JET promoted the project under the above management structure. Although as mentioned in preamble of point 3.1, it was necessary to reconsider that structure in September 2018. The project agreed on the management structure described in Figure 3.1-2, at 9th mission.



（Source: 13th Confirmation Notes）

Figure 3.1-2 Management structure for new NTC (Agreed on September 2018)

As a key point for the management of NTC after completion of the project in March 2019, it is important that getting the official approval from “Ministry of Higher and Secondary Specialized Education” of the government of Uzbekistan, in cooperation with Department of Work with

Personnel of UE HQ, Human resource department of NTPP, and NTC.

For the early training of staff, it is necessary to make sure the involvement from UE HQ, so that training activities should have proceeded smoothly under the confirmation and instruction of the progress by the project manager. JET appointed the Head of Foreign Economic Relations and Investment department UE HQ, as an Acting Project Manager on behalf of Deputy Chairman of UE HQ, and positioned her to supervise the project with cooperation of Director of NTC, and also Project Director, i.e. Director NTPP.

Regarding the staff structure of NTC, the Director and 3 staff were appointed as staff of NTC as of December 2018. However, as mentioned in 2.4.5 (1), the number of NTC staff is obviously insufficient compared to TTC. Also, it is supposed to be in shortage of manpower when making Annual Training Plan in cooperation with “Department of Work with Personnel” of UE HQ. On the basis of TTC organization and work scope shown in Figure 2.2.5-1, JET pointed out and requested that the reinforcement of the number of NTC staff is necessary, according to the existing TTC as a model.

(2) Issue, for accreditation of NTC and for staff arrangement

As mentioned in above (1), the project had agreed with the management structure of UE HQ, and had promoted the project. Although, NTC has not been approved by the “Ministry of Higher and Secondary Specialized Education”, yet. At this moment, many issues are remaining to be solved regarding the future operation of NTC, including the staff positioning of NTC.

1) Issue for accreditation of NTC

(a) ID card issuance of NTC is not approved without accreditation of NTC. In other words, there are no function to train O&M staffs as a training center. If the ID card cannot issue for the training, it cannot be certified at a later date by copying the training record implemented before accreditation. In other words, training record will be invalid to be certified for the trainee, and NTC cannot certify the trainees of early training implemented before establishing NTC. It is required to certify the trainees of preliminary training to achieve the goal. For the overall goal and for the project goal, the project promoted all operations that can be implemented, but these cannot be completed without official accreditation of NTC at an early date.

(b) It is required to establish the CCPP O&M Training Center, as a UE wide training center with ability of certifying by ID card. It is also necessary to have authority on taking application of trainees, obligation to attend O&M staff. Without authority, it is difficult to continually implement taking applications of trainees, because it draws the misunderstanding that <extension of training of TPP>.

(c) If NTC is the section under the NTPP Human Resources Department, NTC cannot secured the budget, and it leads dependence of management. In other words, there is no authority regarding the recruitment and treatment of trainers, part-time trainers, convocation of external instructors, etc. Similarly, there is restriction for preparing the necessary equipment and consumables reservation etc. It will be deficiency of flexibility of management.

(d) Regarding the preparing of annual training plan etc., the information exchange to UE HQ needs through Human resource department of NTPP. It is required at startup of NTC according with section (1) as above, but direct communication will be better after the organization of NTC is stabilized.

2) Issue for staff allocation and others

(e) There are lack of staff for summarizing and documentation, such as annual training plan like etc. Advancing with the cooperation of NTPP staff cannot maintain independence as a training center, and cannot respond in promptly with adequate manner.

(f) There is no staff to officially issue the manual agreed upon in the project. Manuals are i.e. <Manual for Training Plan> <Manual for Lecture Plan> <Manual for Appointment and Role of Trainers of NTC> <Manual for Authorization of Trainer under the Project>.

(g) There are no staffs who issue and manage the NTC official documents that will be needed in the future, such as "Lecture plan", "Individual training program", and "Training monitoring and evaluation report".

(3) The correspondence to the replacement of trainer candidates

As mentioned in 2.4, the trainer candidates were selected; 5 staff from Tashkent in 3rd mission, and 3 staff from Tashkent and 2 staff from Navoi in 4th mission. JET have steadily transferred the technologies through TOT, and trainer candidates advanced the development of abilities for training implementation. However, due to the site change of the training center mentioned at the beginning of point 3.1, 8 trainer candidates declined to become trainers because they were forced to relocate to Navoi. JET interviewed and selected new trainer candidates from NTPP staffs at the 6th and 7th mission. (Refer to 2.4.1).

As already mentioned in 2.4.2 (2), in order to prevent duplication of technology transfer and secure the continuity of revision of training textbook, JET required to conduct the technology transfer within UE group.

After that, as described in 2.4.2. (3), JET promoted implementation of TOT / technology transfer for new 15 trainer candidates, and finally, 14 trainers were accredited., as shown in Table 2.4.5-3.

3.2 Issues of Development of O&M Policy of CCPP

Although the C/P in this project is UE HQ, direct beneficiaries are NTC, trainer candidates, trainees and Navoi TPP. Meanwhile, since the O&M policy of CCPP, regulation of plan etc. relate to all newly constructed CCPPs, not only Navoi CCPP - 1 and the NTC, but also UE HQ should be deeply involved in development of these documents. For this issues, responsibility of UE HQ is very important. As mentioned in the preceding paragraph, the Head of Foreign Economic Relations and Investment of UE HQ is Ms. Ayzada Seitniyazova. And JET requested her, as direct subordinate of the Project Manager (PM) Mr. Djamshid Abdusalamov, to become Acting PM as comprehensive coordinator. This request was agreed in Confirmation Notes of 13th mission.

As described in Section 2.1.6, the periodic inspection of Navoi CCPP - 1 had scheduled in September 2016 (the combustor inspection,) was postponed for one month. Although major overhaul inspection of CCPP - 1 had been planned before and after January 2018, it was postponed until October 2018 too.

Periodic inspections scheduled in advance should be carried out according to the schedule, and JET considers the changing of schedule for periodic inspections to be an unusual exception in O&M. The policy concerning the O&M of CCPP is formulated from the viewpoint of maintaining plant quality, therefore, the Power Plants Operation Department (which has the authority to instruct the periodic inspections,) must deepen their overall understanding of this. In the viewpoint of human resources development, a deep understanding of CCPP O&M is also required for “Department of Work with Personnel” of UE HQ too, which has authority over assignment of newly employed engineers and managing promotion training.

Regarding the development on CCPP O&M policy, JET proposed the manual described in 2.1.4 to 2.1.5, (refer to Appendixes 6 to 9), and discussed about the direction on O&M policy and plan

with Power plant operation department and NTPP. As a concrete way of this discussion, not only the results of discussion with Director of NTPP, i.e. PD, and Director of NTC, including the results of monthly meeting, but also JET discussed with Power plant operation department UE HQ as whole issues of UE group. After that, due to the change of the manager of Power Plant Operation Department, discussion was needed again. The project agreed the necessity of manuals, but have not reached determination on the department in charge to officialize the document.

3.3 Issues of Human Resource Development Plan

The Department of Work with Personnel in UE HQ is deeply relevant to the Human resource development plan, and their responsibility is very important. JET discussed with Department of Work with Personnel, Power plant operation department in UE HQ, and NTC, for the documentation of proposed manuals <Human resource development planning> and <Positioning plan of O&M staff> for CCGT O&M staff, described in 2.2.6.1. Similarly as in 3.2, it was discussed the necessity of the documentation, but have not reached determination on the department in charge to officialize the document.

3.4 Issues, Ideas and Lessons in Training Plan and Curriculum

(1) Implementation of training before the establishment of NTC

The installation schedule of the new CCPP has been more delayed than the initial information during this project period. The target trainees for O&M personnel were assumed to be new employees of new installed CCPP, but training should be started after the employment contract. On the other hand, for employment procedure of UE, employment of new CCPP staff will start sequentially six months prior to the completion of plant construction, i.e. commissioning. So, training plan targeted a new employee cannot make at that moment.

Training education for new employees of Navoi CCGT - 2 which was under construction, has been started, but official accreditation for NTC has not been approved. As described in 2.2.7 (2), regarding the training plan and result for new employees of Navoi CCPP-2 before the opening of NTC, JET requested to record the training results, and make the reports. (Refer to Table 2.2.7-1; to Appendix 13 [Request to confirm the progress of the Project]). As well as the training of Navoi CCGT-2 staff, for the training education for 20 staff from Turakurgan and 20 staff from Takhiatash, JET also requested to NTC to make the reports about results.

(2) Lecture Plan（ Syllabus for each single course）

As already mentioned in 2.2.6.2 (2) 4), in order to create the training plan, it is necessary to preparer the lecture plan for each training course. The trainers, certified under this project, have already completed the drafts of lecture plan, already. JET requested NTC to finalize the lecture plan for all courses officially. (Refer to Appendix 13 [Request to confirm the progress of the Project]) At the same time, JET also pointed out to take cares on creating the lecture plan for senior staffs or for nurturing trainers, as described in 2.2.6.2 (2) 5) .

(3) Preparation for training plan

As described in 2.2.6.2 (2) 2), “Department of Work with Personnel” of UE HQ prepared mid-term training plan based on the questionnaire to each TPP. However, this plan described only the targeted number of trainees, so that the training course details cannot be decided until just before implementation of training, because the specialty and job assignment were unclear only with the number of trainees.

From this point, in order to prepare annual training plan 2019 with clarifying the details of course, JET requested NTC, Human resources department of NTPP and Department of Work with Personnel of UE HQ, that "NTC prepares draft of annual training plan", " Department of

work with Personnel of UE HQ” compiles application from each power station, and finalize the annual training plan. (Appendix 13 [Request to confirm the progress of the Project])

It is emphasized that these tasks should be implemented as routine work among the NTC, Human resource department of NTPP and Department Work with Personnel of UE HQ, after NTC has been officially authorized.

(4) Curriculum

Showing Table 2.2.2-6 and Figure 2.2.6-5 to 2.2.6-7, JET clarified training course recommended training subject required for each O&M staffs, and suggested timing of training with road map. So it becomes easier to understand whole training steps. Meanwhile, as described in 2.1.3.1 (1), UE staffs are required the training, including "Labor Safety" "Operation" "First Medical Aid" "Fire Safety" by Company Standard. In addition, cooperation with OJT implemented in Navoi CCGT is also necessary to create curriculum, so JET asked NTC to organize and complete the whole image of CCGT training in preparing the training curriculum.

In addition, as contents related to curriculum development, as a concrete measure to be dealt with initially in Attachment 13, the revision of the individual training program according to duties described in (b) (c) in section 2.2.2 (3) 2) pointed out the needs for.

(5) Points to be noted for training implementation

1) On the implementation of training for O&M staffs prior to the official approval of NTC, it was carrying out for only new employees for Navoi CCGT-2, because there is no provision of travel expenses to take training course from other CCPP. Training has started for 20 Turakurgan staffs and 20 Takhiatash staffs as of December 2018, but those expenses were unknown. Regarding the training before the official approval of NTC, it is extremely important to discuss about financial source with UE HQ for NTC.

2) It is necessary to realize the management of training costs by Department of Work with Personnel of UE HQ when NTC officially opening.

3) In order to make effective use of NTC early, it is important to not only train new employees of new CCPPs, but also to train and nurture nominees of existing TPP to become CCPP staffs.

4) It is necessary to consider the middle-term and wide scope of training; OJT which can be implemented immediately after the new plant construction period, such as commissioning or after commercial operation starting. (To consider as an On-site training)

3.5 Issues, Ideas and Lessons related in Accreditation System for O&M Staff and Trainer

The accreditation system has been promoted to develop the procedure in this project; certification of training for O&M staff, accreditation of trainers at NTC and appointment of trainers.

As a point to be noted, it is stipulated that national accreditation by "Sanoat geokontehnazorat" is necessary, for pressure equipment and its handling work, for pipeline and related work, and for heavy load handling work. Table 2.2.6-6 points out that the 7 from 12 subjects of CCGT O&M adopted in this project are subjects to this accreditation.

(1) Certification of training completion for O&M staff

As described in 2.2.4 and 2.2.6.3, the requirements for the certification of training completion are 1) confirmation of training completion by training center (ID card) and 2) Both of training by

power plant at site, and OJT. And it was agreed that the results should be recorded officially in their ID card for certification of the staff.

As for issuing the official ID card of NTC, it is necessary to promote the issuing new ID card in cooperation with director of NTC, Human resource department NTPP and Department of Work with Personnel of UE HQ. (Refer to 2.2.6.3) It is impossible to operate NTC in surplus without official ID card.

(2) Accreditation of trainer of NTC

JET proposed that NTC trainer selected from experienced staff by interview, and that they should be nurture by training of trainer if necessary, and agreed these procedures. As already mentioned, the project also agreed that accreditation under the project and by NTC after the project will be done by different procedures.

The appointment of trainers under the project is certified with agreed manual, Appendix 17. As the results are described in 2.4.5 (2), and the certificate document of trainers, nurtured under the project, were issued and validated expiration date by the project. Also, regarding the appointment of trainers by the UE after the project, JET proposed manual, Appendix 18, and agreed that necessary training would be considered by introducing On-site training utilizing periodic inspection. (Refer to section 2.2.6.3)

Manual/ guideline on certification of trainers for existing TTC are not currently documented, but for NTC, manuals related to these agreed qualification systems should be issued as official documents.

3.6 Project Issues, Ideas and lessons in Training Material and Technology Transfer

As NTC intends to carry out training for O&M staffs in Russian language, JET has prepared English training materials for subjects and translated those into Russian. Trainer candidates have corrected errors such as translation and technical terms in the Russian edition, by referring to the English edition and advice from Japanese Experts.

In order to complete the training materials suitable for the content of the actual facilities, it is desirable for curricula and training materials based on the contents of Operation and Maintenance Manual (OMM). However, in general, OMMs have copyrights and Non- Disclosure Agreement (NDA) as confidential documents, and that exactly it the same in Uzbekistan. It is desirable to use actual photographs etc., into training materials with, however, entering the premises and taking pictures is strongly restricted. So, it is difficult to take actual photographs and use them for training materials.

As for confidential information, JET suggested the direction of description to avoid confidential troubles, and urged trainer candidates to do correction work by themselves.

For technology transfer, it was needed that trainer candidates work for the revising textbooks, so that one of the issues was securing the schedule for them. And so to promote this project, these following points were taken cared.

(1) To show UE the TOT implementation plan prior, and have secured the schedule of trainer candidates for attending TOT in Uzbekistan. If necessary, JET conducted the Mock-Up Training and supplementary trainings during TOT in Japan. (Refer to 2.2.7(1).) It was decided certification of trainer candidates, in considering the attendance status including TOT in Uzbekistan and others. (Refer to 2.4.5(2).)

(2) To supervise the correction work of the Russian edition by trainer candidates themselves, the local coordinator checked the progress of work in monthly meetings as a regular report.

(3) The trainer candidates have to understand the confidentiality rules, to use on-site photographs

and confidential information of CCPP. JET stressed in confidentiality that NTC need to ensure that strict information management should be done so that the contents are not leaked to third parties. (With regard to information management of confidential matters stated in textbooks etc., supplementing RD dated January 27 2015 was confirmed between UE and JICA Uzbekistan office, and was as an attached document dated June 19, 2017)

(4) Although it is not the perfectly same training equipment as JICA installed, in order to accelerate the progress of the project, JET conducted a practical training which can be implemented at TOT in Japan. For the practical training of subject No. 1 and No. 9, at the 2nd TOT in Japan in March 2017, and for No. 2 and No. 9, the practical training were conducted at the 3rd TOT in Japan in March 2018.

3.7 Project Issues, Ideas and Lessons in Procurement Plan of Training Equipment for O&M of CCPP

As described in 2.3.3 and 2.3.4, all training equipment list was confirmed, and all the procurement steps such as bidding, opening-up, inspection and delivery were completed and handed over to NTC.

The storage place of training equipment is the classroom in the CCPP-1 area, have been already transported from storage house in TPP. Training equipment, other than electric field i.e. No.6 and No.8, will be moved from the classroom in the CCPP-1 to the main training center building in CCPP-2 as soon as ready for preparation.

NTPP considering the request to relocate these electrical training equipment to the main training center building, too. In SFC equipment, it is required the considering the relocation measures, preparation for 3φ380V power supply and installation in the viewpoint of the weight. Naturally, in the case of that some troubles or failure will occur, it is responsible for NTC. JET would like to stress to above attention here again.

3.8 Project Issues, Ideas and Lessons to Construction and Renovation of New Training Center by UE

As for the building of the new training center, the initial plan proceed to construct in Tashkent city at the beginning of the project, but the policy was changed to the building renovation in the Navoi TPP afterwards. Finally it was decided to use the building under construction at the Navoi CCGT - 2 site and the building on the entrance side of the CCGT - 1. Following these reasons, JET gave the advice on the interior layout of the building three times, and the advices as described in 2.3.5.

The building on the CCGT - 2 side is currently under construction, and JET heard that the completion was planned in the end of March in 2019. As mentioned in 2.2.4 (2), NTC approval by Ministry of higher and secondary specialized education of government of Uzbekistan, will require the condition of "building", "teaching material", "trainers", "bank account" and etc., and need to check and pass as a training institute.

Even after the completion of this project, JET point out UE HQ and NTC to share information with JICA on the following contents.

(1) Periodical report on usage of training room
(2) The status of relocation and installation of training equipment and the training room facilities prepared by NTC such as desks, chairs, white boards, projectors, etc.
(3) Application status to the Ministry of higher and secondary specialized education for the official accreditation of NTC

3.9 Project Issues, Ideas and Lessons in the Training and Securing of Trainers for CCPP O&M

Nurturing the trainers and securing the trainers were described in 2.4, and securing the trainers by this project was achieved. Regarding the accreditation and appointment of the lecturer after completion of the project, as mentioned in 3.5, it was agreed to the Manual [Appendix 18] <Manual for Appointment and Role of Trainer of NTC>. In order to secure trainers by NTC, the issues are following:

(1) Judgement of adequacy / competency for trainer candidates

Basically, adequacy and competency of trainer candidates will be judged according to the carrier background and positions. When UE HQ recommends the trainer candidates, it should be required to select the persons highly focused on who have an experience of O&M CCGT and periodic inspection. NTC decide adoption of trainer by implementation of interview from recommended candidates.

(2) Work location

As a management system of UE group, each power plant is independent as a separate company, and when employees cannot expect appropriate merit, they tend not to accept re-location.

In order to avoid refusing re-location, UE HQ should consider the acceptable staff condition for trainers.

(3) Personnel condition for full-time/part-time trainer

When inviting a part-time trainer from a far distance, just now it is required that the trainer pays the traveling expenses and accommodation expenses by themselves. If it is necessary to invite an excellent trainer, it need to consider to pay sufficient expenses such as traveling expenses and accommodation expenses.

For personal career improvement, full-time trainers are recommended to replace regularly. It is needed to promise the treatment for his promotion as a whole UE group, even when NTC employs a full-time trainer.

(4) Implementation of TOT

Training education for trainer candidates was implemented through TOT based on the method of revising the Russian textbooks from the English one which were presented by JET. The trainers who were accredited by this project well understood the contents of 12 courses textbooks. When NTC newly develops trainers, it is premised that the training of certification target courses has been completed, and if necessary, deepening the understanding of training material contents of trainer candidates by implementing TOT, and it will contribute to securing the qualities of trainers. At the final stage where certification is decided as a trainer, JET recommend that trainers make a lecture plan (refer to 2.2.6.2 (2)) and implement Mock Up training.

(5) Implementation of On-site training and TOT in Japan

It is effective to implement the On-Site training utilizing the periodic inspection for nurturing trainers. Table 2.2.6-6 states the effectiveness of implementation of On-Site training and recommends the On-Site training targeted for trainer candidates. Regarding the implementation of TOT above described in (4), some of the course need this condition. From the viewpoint of training human resources, implementation of On-Site Training is strongly recommended not only for the purpose of nurturing trainers but also for participation of CCGT engineers and managers.

3.10 Others, Issues and Ideas of JCC

The activities and results related in JCC and workshop were mentioned in 2.5. “Discussion on project policies” was conducted in JCC, and “Confirmation of the progress of technology transfer in this project and considering the correspondence measures” was implemented in workshop. Both were held in once annually, so that it is difficult to discuss for practical problems, occurred in irregularly, in JCC or workshop.

It is necessary for to confirm the progress and problems of the project at every mission, the project held the final meeting at UE HQ and agreed matters were officially recorded as a confirmation (C/N) at the end of every mission. In Japanese side, the signers were Chief Representative of JICA Uzbekistan and Chief advisor of the project. And Uzbekistan side, the signer was the chairman of the board of UE until 6th mission, after the change of UE organization in October 2016, the signer has changed to the deputy-chairman of the board of UE since 7th mission. (The deputy chairman was replaced between the 12th and the 13th mission)

Because of the site change of training center building which was far from UE HQ, it was supposed to take time to get the sign for C/N. In order to solve above matters and promote the confirmation of progress, as described in 2.5 (2), Monthly Meeting was held between the director of NTC and the person in charge of monitoring. Also, minutes of this meeting has been taken compensate the delay of C/N.

Chapter 4

4. Level of Achievement in the Project

The Project was originally planned to build the new CCPP Training Center in Tashkent. However, the construction site for New CCPP Training Center was announced, in October 2016, to change from Tashkent to Navoi. Such rework as to re-select trainer candidates in Navoi, and to appoint new Project Director, were intended against our intentions. Therefore, the special coordination to re-arrange the TOT scheduling was required to achieve the further promotion of the Project within the limited time.

For the training center buildings, initial draft of the renovation of welfare buildings in Navoi conventional TPP was suspended until June 2018, because contractor selected by NTPP was refused by the government agencies (NAPM), according to rules of contract. However, based on the proposal of General Director of NTPP, the building of training center became to be constructed in the site of Navoi CCGT-2. Thus the construction of the training center was restarted finally.

Although having unexpected circumstances as above, the Project was implemented along the plan. Achievements of the Project and its activities will be described in this chapter.

4.1 Level of Achievement by indicators of PDM

4.1.1 Overall Goals

Overall Goals are the Project objective to be achieved after three years from the Project completion, i.e. March 2022. Uzbekenergo (UE) should achieve Overall Goals through the knowledge and experience, which have been obtained during the Project activities. Updated information in PDM are shown in the table 4.1-1 as below;

Table 4.1.1-1 Updated information in PDM for Overall Goals

Means of Verification				
Record of NTC Training				
Overall Goals	**Verifiable Indicater**	**Baseline Value**	**Project Result**	**Target Value**
Capacity of Operation and Maintenance of Combined Cycle Power Plant (CCPP) is strengthened.	Number of assigned trainers who were trained	Nil	14 Accredited by JICA Project in October 2018	20 (Estimated by JET)
	Number of O&M Trainees accredited as CCPP O&M Staff	Nil	65 Not accredited but trained by NTC trainers by December end 2018	530 (Estimated by NTC)

(Source: UE)

Overall Goals, "Capacity of O&M of CCPP is strengthened", is verified with the data collected in the Record of NTC trainings. There are two Verifiable Indicators as follows;

(1) Number of assigned trainers who were nurtured
(2) Number of O&M Trainees accredited as CCPP O&M Staff

Target value of "Number of assigned trainers who were nurtured was estimated by JET based on the data calculated by Department of Work with Personnel of UE. The Department of Work with Personnel of UE submitted the questionnaires survey, for data collection, to each TPP which requires staff training of O&M of CCGT.

"Number of assigned trainers who were nurtured" was set as "20". "Number of O&M Trainees accredited as CCPP O&M Staff" was established as "530". Those values were discussed between JET and, UE HQ and NTC since the first phase of the Project. The values were finally determined in December 2018. Those values is to be officially confirmed and approved by the 4th JCC. The 14 trainers and the 65 trainees are recognized as the actual figures as of December 2018.

"Monitoring and Evaluation System", i.e. "2.2.8 Construction and Operation of Monitoring and Evaluation System on CCPP O&M Training", describes the method of post assessment and improvement on trainings, to be conducted by NTC, NTPP and UE HQ. "Monitoring and Evaluation System" is the effective mechanism to enhance the output from the NTC trainings in the future, which aims to lead UE to have successful results of "Overall Goals".

4.1.2 Project Purpose

"Project Purpose" is the target to be achieved by March 2019, the Project completion, which aims "Training system of operation and maintenance for CCPP is established". Updated information in PDM are shown in the table 4.1.2-1 as below;

Table 4.1.2-1 Updated information in PDM for Project Purpose

Means of Verification				
Training Record of Training Center and Power Plants				
Project Purpose	**Verifiable Indicator**	**Baseline Value**	**Project Result**	**Target Value**
Training system of operation and maintenance for CCPP is established	Number of new training courses regularly operated for CCPP O&M	Nil	・Textbooks of 12 courses are fully completed for Russian version. ・Whole training equipment, No1,No2, No6, No8 & No12 were delivered and handed over to NTC.	12 Courses
	No. of assigned trainers who were trained	Nil	・15 trained by TOT both in Japan & Uzbekistan. ・14 candidate trainers out of 15 were accredited within the Project except one, who were awarded to study master course in Japan by the JICA program.	10 Trainers
	Number of O&M Trainees accredited as CCPP O&M Staff	Nil	・Out of 40 staffs of Navoi-2 GT, 25 were trained by NTC in March, May and July. ・In November and December 2018, 40 staffs of Turakurgan and Takhiatash CCPP.	40 Trainees of Navoi-2 ・Mechanical : 10 ・Electrical : 5 ・I&C :5

(Source: UE)

After starting the Project, JET and related departments of UE discussed and agreed with 12 subjects in 3 fields. Whole textbooks of 12 subjects are compiled both in English and Russian; Hardcopies of English version was delivered to NTC/NTPP in October 2018. The training equipment for 5 subjects were delivered and completed for handover to NTC.

4.1.3 Outputs

"Project Purpose" are achieved with realizing the following 4 Outputs;

(1) Output 1: Operation and maintenance policy of CCPP is developed.

(2) Output 2: Human resource development plan, training plan, and accreditation system of CCPP O&M are developed.

(3) Output 3: Training curricula, materials and equipment of CCPP O&M are developed.

(4) Output 4: Trainers of CCPP O&M are trained and secured.

Updated information in PDM are shown in Table 4.1.3-1 (Output 1~2) and 4.1.3-2 (Output 3~4), as follows;

Table 4.1.3-1 Updated information in PDM for Output 1 and Output 2

Output 1～2					
Outputs	**Verifiable Indicator**	**Baseline Value**	**Project Result**	**Achieved rate**	**Target Value To be Advised**
1. Operation and maintenance policy of CCPP is developed.	Operation and maintenance policy (Internal Regulation)	• "Company Standard" recognized the practical use as fundamental Regulations & Policy of CCGT O&M.	• For the reference of Uzbekenergo, JET introduced and proposed "O&M Policy of CCPP" developped in Japan. • "Company Standard", i.e. most important Internal Regulation, should have been discussed for the improvement among UE & NTC/NTPP and JET.	80%	• Operation and maintenance policy of CCPP is to be discussed internally in UE & NTC for practical use. • UE did not disclose the person and department in charge of "Company Standard" because of no NDA exchanged. UE did not have further action for NDA.
2. Human resource development plan, training plan, and accreditation system of CCPP O&M are developed.	Human resource development plan	"The Rules of Organization of Work with the Personnel at the Power Generation Enterprise(Guideline)" identified not	• Human Resource Development Plan in Japan was introduced, proposed and agreed including Roadmap.	100%	Development plan for Human Resources for CCPP is to be discussed internally in UE & NTC/NTTP for practical use. • Further internal discussion in UE & NTC/NTPP are to be completed to achieve "Overall Goal" after the termination of the Project in March 2019.
	Training plan of CCPP O&M	OJT of CCPP training plan was identified in CCPP-1.	• The way of formulating "Training Plan" was introduced and proposed to Candidate Trainers. • "Roadmap" of "Training Plan"	100%	"Road Map" of "Training Plan" was proposed to discuss among UE & NTC/NTPP. • "Road Map" of "Training Plan" is to be improved to achieve "Overall Goal" after the termination of
	Accreditation system	Nil	• The way of formulating "Certification for Trainees" was proposed and agreed. • "Roadmap" of "Accreditation System" was formulated and agreed. • 25 staffs of Navoi-2 GT, 20 staffs of Turakurgan, 20 staffs of Takhiatash were trained by NTC in 2018 without	90%	• 40 staffs are to be trained by NTC in 2018. • NTC is to conduct "Questionnaires" & "Performance Test" • NTC is to be legally registered for official accreditation of trainees and trainers.
	Monitoring system of training	Nil	• Monitoring & Evaluation Structure was proposed and agreed.	100%	• Further discussion required among UE & NTC/NTPP to implement regular "Monitoring & Evaluation "on Training of NTC to achieve "Overall Goal" after the termination of the Project in March 2019.

(Source: UE)

Table 4.1.3-2 Updated information in PDM for Output 3 and Output 4

Output 3～4					
Outputs	**Verifiable Indicator**	**Baseline Value**	**Project Result**	**Achieved rate**	**Target Value To be Advised**
3. Training curricula, materials and equipment of CCPP O&M are developed.	Training curricula and textbooks of O&M CCPP	Nil	・Whole textbooks of 12 courses were completed both in English and Russian. ・In October 2018, English version was handed over to	100%	・Textbooks for 12 courses are to be compiled and edited ・Textbooks must be secured not to be disclosed according to the Letter of Non Disclousure agreed between JICA and UE.
	Training equipment of O&M CCPP	Nil	・Whole training equipment, No1,No2, No6, No8 & No9 were delivered and handed	100%	・Training equipment for No1,No2, No6, No8 & No9 are to be delivered and handed over to NTC/NTPP
	Result of monitoring for training	Nil	・Monitoring & Evaluation Structure was proposed and agreed.	90%	・"Monitoring & Evaluation" is to be implemented regularly ・NTC is to conduct "Questionnaires" & "Performance Test" ・NTC is to be legally registered for official accreditation of trainees and trainers ・"Monitoring & Evaluation" is to be implemented every regularly to achieve "Overall Goal" after the termination of the Project in March
4. Trainers of CCPP O&M are trained and secured.	No. of accredited CCPP O&M trainers	Nil	・14 candidate trainers are trained and accredited as Project Trainers in #13 mission in October 2018.	90%	・10 trainers to be trained and accredited ・Further discussion for the source of additional and alteration of trainers. ・NTC is to be legally registered for official

(Source: UE)

4.2 DAC Criteria for Evaluating Development Assistance

4.2.1 Relevance: High

"Welfare Improvement Strategy" is one of the most important national policies in Uzbekistan. The establishment of CCGT contributes to significant improvement in power generation efficiency, so that it is the highest priority measures to develop and improve social economies.

4.2.2 Effectiveness: Fair

For "Outputs 3 and 4" of PDM, it have been implemented to nurture the trainers, as a key activity of TOT since 2016, and at the same time revising textbooks, procurement and delivery of training equipment were carried out. It could inspire the affirmative participation of Uzbekistan side and brought out the high level outcomes. These activities are worthy of evaluation as visible outcomes such as textbooks and training equipment.

On the other hand, "Outputs 1 and 2" were aimed to provide with an invisible framework of policies, systems and planning. Those would be important foundation to enable to develop human resource by self-help efforts of Uzbekenergo after the Project completion,

4.2.3 Efficiency: Fair

Since the training center site has been changed to Navoi, the efficiency of the activities for “Outputs 1 and 2” related to development of O&M policy was descended. As these issues should be discussed with UE HQ in Tashkent, the frequent round-trip between Navoi and Tashkent made project implementation with lower efficiency.

In addition, buildings for training center had not been allocated until July 2018 8 months before the Project completion. It lead to delays to handover of training equipment because the installation rooms have not been decided. Also, it affected on scheduling of practical training with equipment. It lead to concerns in the extension

of the Project.

Despite the unexpected situation as described above with the time constraint before the Project completion, JET achieved the output according to the original scheme. The contribution were made by JET whom improved the efficiency of the Project, and by the great decision by NTPP and UE HQ as they adopted CCGT-2 building to training center.

4.2.4 Impact: Fair

Although "Impact" is still small, it can be estimated "Fair" at present. Even before March 2019, the Project completion was evaluated as increasing the good 'Impact' gradually by the Project. Moreover, in March 2022 when the overall goals will be achieved, the more positive impact will be expected.

After the completion of TOT, 14 trainers were certified under the Project in October 2018. For the purpose to train staffs about learning the basic knowledge, these trainers have started trainings since March 2018; 1 course in mechanical field, 2 courses in electrical field and 3 courses in equipment field. The 65 trainees of these trainings were from three different power stations installed CCPP. Among these 65 trainees, 25 were new employers of the GT unit of Navoi CCPP-2. Some of them were not to be assigned to the GT unit of Navoi-2, i.e. some were assigned to Navoi CCPP-1. NTC trainers expected those new employees to be incorporated into staff rotation after training. Including the NTC trainers, the training will contribute directly or indirectly to the business of CCPP, because they will become the staff of the units in near future.

4.2.5 Sustainability: Fair

It is essential to update and improve the curriculum, textbooks and training materials to keep the sustainability after the Project completion of March 2019. For this purpose, JET has transferred technology of "Monitoring and Evaluation system" (refer to 2.2.8). However, JET recommends keeping the current status of curriculum, textbooks, etc. until March, 2022 which is the achievement deadline of the overall goals.

Although the staff training has started since March 2018, there was no incentive for trainer allowance, so that the trainer's willingness was only to rely on reducing the future burden for himself. Regarding this situation, JET repeatedly told UE management and NTTP management, and appealed to approve allowance and treatment for trainers. In December 2018, JET was informed by the NTC director that allowance for trainers will be approved. Therefore, further outputs can be expected to be improved in future O&M staff training of UE.

4.3 Achievement of the Project Activity

In sections 4.1 and 4.2, it was described the achieved degree of accomplishment of project activities according with PDM and DAC evaluation. Here, they are reported in detail items, on the achievement degree from the viewpoint of expected Outputs.

4.3.1 Output 1: O&M policy of CCPP is developed

"O&M Policy" includes the following target activities;

(1) To confirm Internal Regulations for O&M of CCPP
(2) To support to formulate Policy for O&M of CCPP
(3) To review the Scope of Maintenance Agreement with GT Manufacturer referring to the Japanese examples

The target activities shown above are reviewed as follows;

(1) To confirm Internal Regulations for O&M of CCPP

Regarding “(1) Internal Regulation for O&M of CCPP” stated above, “Company Standard: Regulations of Combined Cycle Gas Turbine Unit (CCPP)”, (here in after referred to as “Company Standard”), has been confirmed as “Internal Regulations” through discussions during several missions. Details of “Company Standard” were mentioned in section 2.1.3 (1).

"Company Standard" is an internal rule that all staff of Navoi CCPP-1 should know, and is targeted to make thorough knowledge of rules with the training examination. If staffs could not pass the examination, it is important enough to lead to losing a job. Also, "Company Standard" is revised every 3 years. Because of these reasons, the "Company Standard" was confirmed to be the basic internal regulations concerning O&M CCGT, by the information obtained from the interview with the stakeholders.

JET discussed continuously to confirm if the improvement of “Company Standard” is required with NTC and UE HQ, but they answered there is no necessary improvement for it.

The project was completed with no clarification on which division of UE are in charge of “Company Standard”. Although the deputy chairman of UE, the Project Manager, proposed that the conclusion of the Non- Disclosure Agreement were required to disclose the details of information of ‘Company Standard’. Document draft of Non- Disclosure Agreement has not been proposed and applied by Uzbekenergo yet.

Internal Regulation existing

Progress: 50%

Step of Work	Work Ratio	Progress
Information Gathering & Analysis	**25%**	**Done: 25%**
Discussion for Improvement	**25%**	**Done: 25%**
Planning for Improvement	25%	
Discussion, Improvement and /or finalization	25%	

(2) Formulation of Policy and Plan for O&M of CCPP

To formulate the 'O&M policy and plan’, JET confirmed the following current status. JET requested the information on shutdown and incident record, and got data from 2013 up to 2015, but no later data was presented. Regarding the "Development of policies and plans for O&M CCPP ", JET proposed "CCPP O&M Policy and Plan (draft)" formulated with reference to Japan case. (Refer to 2.1.5 "Maintenance Policy Planning Proposal and Recommendation"). Also, after consulting with relevant departments of the UE, it was obtained an agreement on the administrative level. As a follow-up discussion, JET proposed discussions with the

management level, but it was not carried out. However, as degree of work progress, JET concluded consultation with department manager level of UE HQ, so it is assumed 100% achievement.

Policy for O&M of CCPP

Progress: 100%

Step of Work	Work Ratio	Progress
Information Gathering/Analysis & Planning	**30%**	**Done: 30%**
Comprehensive Discussion	**50%**	**Done: 50%**
Finalization	**20%**	**Done: 20%**

(3) Scope of Maintenance Service Agreement with GT Manufacturer

There are several challenges including "Long Term Service Agreements (LTSA)" and "Gas Turbine Hot Parts Maintenance" to reduce maintenance costs. However, it is not easy to identify the reasonable solutions without data collection from periodic inspections. The management of Navoi TPP is reluctant to keep spare parts of GT because of the high price, which gives the impression that what is done in Japan is not likely to be in the practice in Uzbekistan. Therefore, JET reviewed and explained the importance and merit to keep spare parts and maintenance agreements to trainer candidates, Navoi TPP and UE HQ. JET expects Navoi TPP to reconsider spare parts and maintenance agreements though persuasion from UE HQ and/or trainer candidates.

Based on the requests by UE HQ, training material including methods to manage as "Gas Turbine Hot Parts Maintenance", contents based on diagnosing the remaining life, periodic inspection and after-sales service, into text book No. 5.

Scope of Maintenance Agreement with GT Manufacturer

Progress: 100%

Step of Work	Work Ratio	Progress
Information Gathering & Analysis	**30%**	**Done: 30%**
Presentation	**30%**	**Done: 30%**
Planning	**20%**	**Done: 20%**
Discussion, Improvement and/or Finalization	**20%**	**Done: 20%**

4.3.2 Output 2: Human Resource Development Plan, Training Plan, Accreditation System of CCPP O&M are Developed

(1) Human Resource Development Plan

The Human Resource Development Plan and its roadmap were proposed to UE HQ and Navoi TPP along with the presentations at the 1st and 2nd JCC. The head of Work with Personnel Department of UE HQ responded the proposal from JET as under:

1) Training method of Staff (Refer to section 2.2.6.1 and section 3.3)

・UE to maintain and utilize with the existing Human Resource Development Plan at this moment.

2) Appropriate instruction by management/ senior staff (Refer to section 2.2.6.1(1))

・UE considers to add the proposed idea on “Staff Training Guideline” at the coming occasion of revision.

3) Regular staff rotation between Operation staff and Maintenance staff (Refer to section 3.3(2))

・UE to study and discuss the regular rotation system.

4) Potential of ability for CCPP Staff (multiple skill; Refer to section 3.3(2))

・Future ability will be potential even if inefficiency is identified in the beginning stages.

5) Database for Specialized skills

・UE will study and discuss to have a Database for recording specialized skills

6) Management meeting for technical training supervisors (Refer section 2.2.2.2 (2))

・UE will take note

Human Resource Development Plan

Progress: 100%

Step of Work	Work Ratio	Progress
Information Gathering & Analysis	**10%**	**Done: 10%**
Discussion for Planning & Roadmap	**20%**	**Done: 20%**
Discussion	**50%**	**Done: 50%**
Improvement and/or Finalization	**20%**	**Done: 20%**

(2) Training Plan

In February 2016, JET, UE HQ and Navoi TPP agreed the training scheme consisting of three fields, i.e. Mechanical, Electrical and Equipment as detailed below;

1) Mechanical Field : No.1, No.2, No.3, No.4, No.5 (Five Training Courses)
2) Electrical Field :No.6, No.7, No.8 (Three Training Courses)
3) Equipment Field : No. 9, No.10, No.11, No.12 (Four Training Courses)

The achievements of training plan are to be detailed as follows;

(a) The securing of trainer candidates

Since the site change of the new training center to Navoi, new trainer candidates were required to be adopted. JET interviewed recommended staff of CCPP-1 and conventional TTP at Navoi, and 16 trainer candidates officially selected in August 2017. Two of them passed the Japanese government's international student examination, i.e. JDS, and quit candidate from the list of trainer candidates. A trainer certification ceremony held at Workshop (October 5, 2018 at Navoi CCPP-1) conducted as part of the 13th mission (September to October, 2018), and 14 trainers were officially accredited.

(b) Technology Transfer from Tashkent to Navoi

JET requested Navoi TPP to approve trainer candidates in Tashkent to visit Navoi to handover technical knowledge learnt by TOT implemented to the trainer candidates in Tashkent.

・Navoi TPP & NTC agreed to accept ex-trainer candidates from Tashkent.

・The Technology Transfer was carried out before beginning of TOT in Japan in February 2017.

・However there was no financial arrangement by Navoi TPP and NTC, which should be discussed in the near future.

(c) Training for O&M staff

NTC firstly started the training staff at Navoi power station, in May 2017. Trial training was started for 37 staffs of Navoi conventional TPP (Mechanical field and Facility field: 17 staff and Electrical field and C&I: 20 staff). Implemented training courses were No. 4, 5, 9, 10 and 11. (Mechanical field and Facility field) With the result of trial training, trainer candidate prepared the draft of Lecture Plan.

In 2018, employment of staff for Navoi CCPP-2 were approved by UE, training for new employees were carried out as follows. (Refer to section 2.2.7 (2)) Two staff from Turakurgan TPP, a new CCPP, participated in the above same training. After that, each 20 staff from Turakurgan TPP and Takhiatash TPP have been participated training since November in 2018.

Numerical targets of this project goal have been proposed several times so far, and in 2017, the goal of "150 staff who are trained and received qualification by the end of March 2019, i.e. the end of the project" was proposed. However, since the basis of calculation was ambiguous, regarding the numerical targets was approved again in the third JCC of July 10, 2018 as follows again.

a) The number of allocated trainers：10 staff（end of March 2019）

As mentioned above, 14 registered trainers were accredited officially under this project in October 2018, and the target goal has already been achieved as of October 2018.

b) The number of certificated staff：40 staff（end of March 2019）

The target number of staff training was set to 40 persons based on the staff training plan of GT unit (commissioning in January 2019) which is planned for the prior operation of Navoi CCGT-2. This training for GT unit staffs in Navoi CCPP-2 was confirmed 25 persons trained in 2018.

Training for 20 employees of Turakurgan TPP, and for 20 employees of Takhiatash TPP were completed in the end of December 2018.

In order to evaluate the achievement of staff training goals, certification of trainee is a prerequisite. Methods set in the project are: (1) questionnaire to trainees, (2) confirmation of Trainee's comprehension degree, (3) evaluation of textbooks & curriculum, (4) trainer's evaluation. Collecting this information, and summarize in monitoring format (Refer to Appendix 19, Monitoring Report of NTC Trainings) Director NTPP (Project Director) report to the deputy chairman of the board of UE (Project Manager).

Trainnig Plan 100%

Step of Work	Work Ratio	Progress
Information Gathering & Analysis	**30%**	**Done: 30%**
Discussion for Planning & Roadmap	**20%**	**Done: 20%**
Planning and Roadmap	**20%**	**Done: 20%**
Discussion	**15%**	**Done: 15%**
Improvement & Completion	**15%**	**Done: 15%**

(3) Accreditation System (trainees, O&M Staffs)

As a result of confirming the current accreditation system of staff through an interview with TTC and others, the Project agreed to record the result of training on the ID card issued by Navoi TPP for certification of training for the time. Regarding the operation of certification system for O&M staffs at NTC in the future, it can be achieved by issuing ID card in the condition upon the official approval of NTC.

Depending on the contenst included in each 12 courses, it is also necessary to assume that a prescribed procedure is required under the application of the accrediation system by "National Certification Authority << Sanoatgeokontehnazorat >>".

Accreditation System (Trainees, O&M Staff)

Progress: 100%

Step of work	Work ratio	Progress
Information gathering & analysis	**30%**	**Done: 30%**
Discussion for planning & roadmap	**20%**	**Done: 20%**
Planning and roadmap	**20%**	**Done: 20%**
Discussion	**15%**	**Done: 15%**
Improvement & completion	**15%**	**Done: 15%**

4.3.3 Output 3: Training Curricula, Materials and Equipment of CCPP O&M are developed

(1) Training Curricula and Textbooks

As reviewed earlier in “4.1 Output 1: O&M policy of CCPP is developed” and “4.2 Output 2: Human resource development plan, training plan, accreditation system of CCPP O&M”, training for curricula, 3 fields and 12 training courses are proposed and agreed on by both UE HQ and Navoi TPP. Especially in the 9th Mission, management of Navoi TPP requested additional training courses, i.e. “Repair and Maintenance”. If estimating the preparation for new subject, of textbook, TOT and translation works, it is difficult to complete within the project period, so JET asked to decline this proposal.

12 textbooks were to be completed through TOT and practical training using training equipment and Mock-Up training ware also conducted. (Refer to section 2.2.7 (1))

In order to avoid repetition of TOT by JET, the former trainer candidates in Tashkent have took over to trainer candidates in Navoi in January 2017. However, as already stated in 4.2 Output 2 (2), the traveling allowance for business trip was not treated. In the future activities, staff at each power station will gather in NTC, so that it is essential for various expenses related training by budgetary measures of UE HQ.

Training Curricula & Materials (Textbooks for Mechanical/Electrical/Facility Field)

Progress: 100%

Training Subject Number / Step of Work	Work Ratio	No.1	No.2	No.3	No.4	No.5	No.6	No.7	No.8	No.9	No.10	No.11	No.12	Progress
Information Gathering & Analysis	30%	○	○	○	○	○	○	○	○	○	○	○	○	Done: 30%
Draft Curricula & Textbooks	30%	○	○	○	○	○	○	○	○	○	○	○	○	Done: 30%
Discussion for Curricula & Textbooks	10%	○	○	○	○	○	○	○	○	○	○	○	○	Done: 10%
To Complete Handover Training Shceme	30%	○	○	○	○	○	○	○	○	○	○	○	○	Done: 30%

(2) Training Equipment

The most serious obstacles of delivering the training equipment were the site change to the new building in CCGT-2 in July 2018, and the delay of the progress. As the result, the construction site of the training center changed twice from the beginning of the project. Considering the scale and quality of the building for training center, it should have been highly delightful. However, for the No.6 - training equipment, Static Frequency Converter (SFC), acceptance inspection and handover was postponed for the reason of undecided installation room.

JET informed that the building of CCGT-1 originally created the layout of the existing building of the conventional power plant so that it will be short of the space if only the new CCGT-2 building. The opinion of NTPP that training facility should be limited only in CCGT-2, but JET asserted to use 2 buildings, i.e. building of CCGT-1 and of CCGT-2, because of the enough space and of equipment installation are prior. JET informed that it is possible to change the place after March 2019 under responsibility of NTC/NTPP, if it is judged that usability is not optimum. Ultimately, JET's assertion has been accepted by Director NTPP consent. (Refer to section 2.3.4 for equipment delivery)

JET supported the acceptance by NTPP/ NTC on every delivery of equipment, and all deliveries were completed.

Procurement of Training Equipment

Progress: 100%

Training Subject Number / Step of Work	Work Ratio	No.1	No.2	No.6	No.8	No.9	Progress
Information Gathering & Analysis	30%	○	○	○	○	○	Done: 30%
Discussion on Procurement List	20%	○	○	○	○	○	Done: 20%
Draft JICA Procurement Form	30%	○	○	○	○	○	Done: 30%
Installation & Test at Site	20%	○	○	○	○	○	Done: 20%

4.3.4 Output 4: Instructors of CCPP O&M are trained and secured

After the main project area was changed to Navoi, the first TOT for Navoi trainer candidates was conducted

in December 2016 (7th mission), and final TOT was completed between September and October in 2019 (13th mission). In January 2019, the supplementary mock-up training using 3D model was conducted, as the last TOT. Every TOT, trainer candidates revised the Russian textbooks based on English edition. In the meantime, JET conducted the supplementary TOT in Japan in order to catch up the lag of project implementation, caused by delay of building, and finally managed to complete all contents within project period.

(1) TOT (Training of Trainers)

Textbooks of 12 subjects were completed through TOT by trainer candidates until 13th mission, in September to October 2018. The practical training No.9 in facility field using 3D model was implemented in January 2019. The ceremony of the 3rd workshop was held, and five sets of English textbooks were handed over to Director of NTPP, i.e. Project Director. JET required to follow the Non-Disclosure Agreement between UE and JICA, since these textbooks contains the confidential affairs from each JET's company. (Refer to 2.2.7 (1) for TOT implementation)

TOT (Training of Trainers)

Progress: 100%

Training Subject Number / Step of Work	Work Ratio	No.1	No.2	No.3	No.4	No.5	No.6	No.7	No.8	No.9	No.10	No.11	No.12	Progress
Selection of Trainer Candidates	30%	○	○	○	○	○	○	○	○	○	○	○	○	Done: 30%
To Conduct Training of Trainers	30%	○	○	○	○	○	○	○	○	○	○	○	○	Done: 30%
Mock / Practice	20%	○	○	○	○	○	○	○	○	○	○	○	○	Done: 20%
To Qualify as Trainers	20%	○	○	○	○	○	○	○	○	○	○	○	○	Done: 20%

(2) Accreditation of Trainer

Information gathering and analysis have been done until the 7th mission in December 2016. In the 8th Mission in May 2017, further discussions were done both in Navoi and Tashkent to complete the "Accreditation System of Trainers".

The accreditation system for trainers were agreed on the following steps.

1) Interview selection of Trainer candidates recommended by UE
2) Participation for TOT in Uzbekistan (including practical training using training equipment)
3) Participation for TOT in Japan
4) Evaluation and judgement on Mock-Up Training

In addition, the trainer certification adopts the accreditation by each course.

Accreditation of Trainers

Progress: 100%

Step of Work	Work Ratio	Progress
Information Gathering & Analysis	**30%**	**Done: 30%**
Discussion for Planning & Roadmap	**20%**	**Done: 20%**
Planning and Roadmap	**20%**	**Done: 20%**
Discussion	**15%**	**Done: 15%**
Improvement & Completion	**15%**	**Done: 15%**

(3) Securing of Human Resources using External Resourcing

Considering the required number of staff in the future, it will be easy to secure the trainers. It is essential to consider the rotation of the NTC trainers in future. In order to secure the resource of trainers, it should be supposed the CCGT staff in NTPP or CCGT staff other than Navoi.

For example, 5 former trainer candidates in Tashkent had participation record in TOT and completed the training program of TOT in Japan. JET proposed to utilize these former trainer candidates for human resources to conduct training on dispatched training by business trips. Regarding the securing the outsourcing of trainers, it should be judged to hire them in accordance with the number of required trained staff regardless of past record. As an outsourcing, UE, NTPP and NTC should be considered to invite professors and teachers such as universities, engineering universities in Navoi as trainer candidates.

Securing of Human Resources using External Resourcing

Progress: 80%

Step of Work	Work Ratio	Progress
Information Gathering & Analysis	**30%**	**Done: 30%**
Discussion for External Resource	**20%**	**Done: 20%**
Planning	30%	**Done: 30%**
Discussion & Completion of Planning	20%	

Chapter 5

5. Suggestions for Activities after the Project

This project has been conducted to establish the training system for overall goal “Capacity of O&M of CCPP is strengthened”. The achievement level of this project was described in Chapter 4. JET proposed the manuals for related establishment of training system and these were agreed with UE. During the project implementation period, UE could not provide adequate and prompt responses for a time because of organizational changes, site change of the new training center and reshuffling of staff.

UE needs to continuously promote the formulation for the proposed manuals as regulatory documents, because at this point they have not yet been completed.

This chapter describes the structure of the UE in Section 5.1, items of expected outputs in Section 5.2, and beyond these also proposes future activities.

5.1 Organization and Management Structure of Training System

UE needs to get the approval of establishment of an NTC, and establish the assured training system. It is seemed that it will be possible to minimize the influence on business promotion from future organizational changes by clarifying the work based on the established documented regulations. For the final official version of the proposed manuals and/or documents, it is necessary to clarify the department in charge and the person in charge and give them the authority necessary for them to implement them.

In order to smoothly management training education by the NTC in future, JET makes the following proposals related to the management system.

5.1.1 Organization of NTC

As described in 3.1 (2), in order to grant the NTC the authority to issue training certifications, approval of an application to the Ministry of Higher and Secondary Specialized Education is required as a training institution. Regarding application and training management, it is necessary to take immediate action on the following items.

(1) Application for accreditation of NTC

NTC should promptly apply for accreditation as a training institute, and the power to issue ID cards, in cooperation with the Department of Work with Personnel of UE HQ and the Tashkent Training Center (TTC).

(2) NTC Staff

TTC is operated with 16 staff. Meanwhile, NTC currently appoints only 4 staff. It should be implemented that UE will promptly add more NTC staff, as follows.

1) Director, 1 person, already appointed: Management of the Training Center
2) Deputy Director, 1 person: Assist Director in all matters, for example, to formulate Training Plan and Training Report etc., and in the employment of trainers.

3) Full time trainer, total 3 persons, each to train in 3 fields: Full-time trainer should have the title of Chief Trainer, or supervising trainer if more suitable. For each specialized field, each full-time trainer prepares the training plan draft, lecture plan drafts etc., and is in charge of implementing the training with part-time trainers or by himself.

4) Staff for training plan and report preparation: 2 or more persons, of which 1 is already appointed: Response to general affairs and personnel documents. Responsible for issuing documents such as manuals, training plans, lecture plans, Individual Training Program, Training reports, etc.: The Project have agreed to the issuing of the "Manual for Training Plan", "Manual for Appointment and Role of Trainers of NTC", "Manual for Authorization of Trainers under the Project" and the Lecture Plan of 12 courses, which have already been drafted.

The urgent enactment and issuing of these documents is requested.

5) Assistant administrative staff for training: 3 or more persons (at least 1 for each specialized field): Office work of training preparation, management of ID cards, collection of questionnaires for training monitoring, and preparation of draft training report.

6) Staff in charge of facilities and equipment etc.: 2 persons, who are already appointed: Management of training facilities, consumables, Management of training equipment

7) Temporary employment for training as necessary: In line with the training plan, employment by the training director, deputy director, or full-time trainer every time training is offered. Preparation of lecture plan, implementation of training and administering of training questionnaire, and drafting training report, according to instruction by a full-time trainer.

5.1.2 Corresponding Organization of UE HQ

(1) Department of Work with Personnel of UE HQ

In order to facilitate training and management of NTC, it is recommended to add more staff for the Department of Work with Personnel of the UE HQ. Required tasks that need to be addressed are shown as below.

1) Mid-term Training Plan: Although UE has not formulated the mid-term training plan at present, it recommends strengthening the structure of "Mid-Term Training Plan Formulation". It is reasonable to cooperate with the power plant operation department of UE HQ, under the guidance of the foreign economic investment department.

2) Manual for Human Resource Development Plan: It have already agreed to the content of the manual on human resource development plan, refer Appendix 4 and 5.The urgent enactment and issuing of these 2 manuals is requested.

3) Annual Training Plan: Currently, although there are corresponding staff who prepare the annual training plan of TTC, the work volume will double due to the training plan of NTC. And, for the introduction of On-Site training for senior staff and training for trainers, responding to these new operations and communication with NTC and the Power Plant Operation Department is needed. The corresponding organizational units should be reinforced by hiring more staff.

4) Monitoring and Evaluation System on Training: In order to operate the "Monitoring and Evaluation System on Training" proposed in this project, the Department of Work with Personnel of UE HQ have to

summarize and submit the report to the Deputy Chairman of the Board. The corresponding personnel should be reinforced by adding more staff.

(2) "Power Plant Operation Department" of UE HQ

In order to facilitate training and management of NTC, it is recommended to hire more staff for the "Power Plant Operation Department" of the UE HQ. Required tasks that need to be addressed are shown as below.

1) Mid-term Training Plan: UE has not formulated the med-term training plan at present. For formulating the "Mid-Term Training Plan", the forecast of installation and renovation plan of power supply facilities and operation plans are needed. A corresponding organizational unit that cooperates with the "Department of Work with Personnel", is required in the "Power Plant Operation Department".
2) Manual related to Operation and Maintenance: The contents of the manual concerning O&M of CCGT were agreed. (Refer to Appendix No 6, 7, 8 and 9). The urgent enactment and issuing of these manuals is requested.
3) Correspondence to On-site training: To implement On-Site training described in above section (1) 3), prior information about the periodic inspection plan of CCGT is needed. It is recommended that cooperation with the "Department of Work with Personnel" and the NTC should be reinforced.

(3) "Foreign Economic Relations and Investment Department" of UE HQ

The Foreign Economic Relations and Investment Department is not in a position to directly correspond to the related work of training education, but as made clear in Section 3.1., they are in the position to supervise this project. In other words, Foreign Economic Relations and Investment Department should instruct and manage the cooperation, to "Department of Work with Personnel", to "Power Plant Operation Department", and to the NTC. They are also expected to pay attention to the work progress of each division, and need to instruct/ direct these in order to promote training smoothly, for the future success of the Project.

5.2 Developing O&M Policy of CCPP

It is important that O&M staff can appropriate judge and correspond during emergencies, in order to secure the safety of the staff and facilities of CCGT and conduct the best operations on CCGT. Regarding the O&M management policy of CCGT, JET proposed the 4 manuals which are mentioned in Sections 2.1.4 to 2.1.5. The Power Plant Operation Department of UE HQ are requested to formalize the agreed manuals as official UE documents in cooperation with NTPP.

Documentation can lead to clarification of the tasks between UE HQ and each CCPP, and it contributes to manage smooth maintenance under the UE groups. It is proposed to take note for the development of policy of the following suggestions listed in Table 5.2-1

Table 5.2-1 Suggestions on the Development of the O&M Management Policy

No	Specific policies	Activities
1	We will emphasize basics and have them improve knowledge and skills.	・We will cover lack in experience by training. (We will seek to acquire knowledge and skills which could not be gained only by implementing routine work.)
2	We will fully enforce efforts to have them tackle jobs with confidence and pride.	・We will conduct evaluation of the education (training) and its follow-up.
3	We will enhance teamwork and communication to exert their comprehensive strength.	・We will ensure responses in case of an emergency with teamwork.
4	We will create an environment where we always look back on their work results and conduct self-training	・The immediate manager will seek to create workplace which allows for personal development and at the same time encourage his subordinates to acquire qualifications inside and outside the company. ・The immediate manager will evoke "can-do spirit" of his subordinates to achieve goals and results and in cooperation with his colleagues and other workplace create an environment that would enable them to perform jobs efficiently.

(Source: JET)

5.3 Human Resource Development Plan, Training Plan and Accreditation System for O&M

5.3.1 Human Resource Development Plan for O&M

(1) Human Resource Development Plan

As for the Human Resource Development Plan, two proposed manuals, as mentioned in section 2.2.6.1, were agreed. The Department of Work with Personnel of UE HQ is requested to formalize the UE official documentation in cooperation with the Power Plant Operation Department. It is also important to implement the Plan・Do・Check・Act (PDCA) cycle in Table 5.3-1.

Table 5.3.1-1 PDCA on Human Resource Development and Training Plan

	Human Resource Development Plan	Training Plan
P(Plan)	To develop Human Resource Development Plan of O&M personnel. * In "Human resource development plan", describe "goal and final target level". Goal : Stage 3 in Table in Appendix 4 Operation staff = 6-7 years Maintenance Staff = 6-8 Years Final Target Level : Stage 4 in Table in Appendix 4	To develop the training plan of O&M personnel.* In the training plan, describe about "goal". Gaoal (in Table in Appendix 4) Operation Staff ・Stage1 (Operation & Maintenance) 1.5 year ・Stage2 2years・Stage3 1-2years・Stage4 1year Maintenance Staff ・Stage1 (Operation & Maintenance) 1.5 year
D(Do)	To develop the best training plan for each individual each.	To implement the training of each fiscal year.
C(Check)	Every year , to review the system to find out ability.	In training carried out, find out each individual ability by oral examination or written test.
A(Action)	In case of non-acheive to the target level, to establish a follow-up training system.	In the case of non-achieve to the target level, to implement the follow-up trainig.

(Source: JET)

(2) Human Resource Development with simulator

Especially regarding the training for operation staff, utilizing the installed simulator procured by JICA and training in unit tracking / stopping operation and accident response will prove effective for improving operation ability. NTC will notify concerning the training results (level confirmation) about "strengths / weaknesses" of the trainees, and notification makes it possible to make use of

"strengths" and complement "weaknesses", in the actual work. For this, it is important for supervisors to promote the nurturing the subordinates focusing on (1) emphasis on basics, (2) attitude towards work, and (3) emphasizing teamwork and communication.

The following Table 5.3-2 shows the suggestions and recommendations on the activity plan for human resource development in the future of operation and maintenance of CCPP.

Table 5.3.1-2 Suggestions and Discussions on Activity Plan for Human Resource Development

No.	Contents of Suggestion/ Recommendation	Backgrounds & Reasons for Recommendations	Discussion Results
1	For engineering simulator, develop training materials, authorize trainer candidates and develop training plans. ① UE side and JET will develop training materials based on the specifications of malfunction training. ② UE side and JET will develop training materials based on the manufacturer's manuals. ③ Trainer candidates, Operator：2 person and Programmer:2 person, will be determined to participate training in Japan. ④ Development of Training plan for engineering simulator	It is important to develop training materials for engineering simulator associated with the installation of a simulator, authorize trainers, develop training plans and efficiently implement them.	It is desireble. Reasons： High effectiveness/ sustainability
2	Training of the unit utilizing a engineering simulator (new installation). ① Improve professional skills of operator with the training of trouble shooting. After installing the simulator, to implement training of "Trouble shooting" by the instructor. ② Improve professional skills of C&I staff and programmer with the training using maintenance tool.	①It is recommended that training with a simulator, a combined type of a typical unit. It is most effective in improving skills of operators to provid to cope with an unit emergency, in "normal starts and stops of the unit" and "troubleshooting of the unit". ②Controler name of Gas Turbine is "Netmation". GT is carried out in "Netmation Logic ", and is operated through "Netmation operation graphic". *	It is desireble. Reasons： High effectiveness/ sustainability

* In the case that GT have some trouble and GT operation need to be changed, Netmation Logic or graphic need to be chaned immediately.

(Source: JET)

(3) Human Resource Development for long term

JET made the following requests and suggestions as a means to enhance and reinforce UE's Human Resource Development for future.

Table 5.3.1-3 Requests and Suggestions on Human Resource Development

No	Contents of Requests & Suggestions (R&S)	Backgrounds & Reasons for R & S
1	Implementation of Off-JT on quality & safety control in Japan ・Number of participants: 4 to 5 persons (Manager class in charge of boilers, turbines, electricity or instrumentation) ・Implementation site: Gas-firing CCPP ・Period: 2 months×2 times	In order to enhance skills on quality & safety control of maintenance staff, it is suggested that they learn the reality of quality & safety control of the periodic inspection work conducted through the Japanese power companies' Off-JT and such Off-JT be laterally spread to UE's Thermal power plants.
2	Technical staff are recommended to attend the English OFF-JT and improve their English skill in consideration of increasing the number of CCPP unit in the future.	Engineering technical personnel and operation personnel have enough English reading skill. However maintenance personnel can't read and speak English
3	It is suggested that engineering manager class and maintenance manager class staff participate in JICA-hosted trainings and maker-hosted technical trainings to improve their skills (knowledge & capabilities).	Equipment trouble frequently occurred at the initial stage of the plant operation, but currently there are few cases of emergency response to such trouble in GT, GT control equipment and ST. In addition it is impossible for maintenance personnel to gain experience which is required for them to acquire professional skills, because there are few cases of periodic inspections of GT.
4	Japan and Uzbekistan have been improved Human resource development method for many years. JICA Study Team doesn't force the Japanese method, but recommend the Japanese electric company's "Human Resource Development Plan of CCPP O&M staff" which is described target level clearly.	Human resource development for O&M staff at Navoi has been carried out through OJT based on the following training curricula which they have carried on for many years. For example, ①After newcomers first receive medical check-up and have an interview, they are to be assigned such as Operation Division or Maintenance Division. ②O&M staff assigned to each division shall receive internship training (watching their seniors to perform their jobs) for three months at maximum. Those who pass certification test by oral tests can proceed to duplication training (receive training on troubleshooting of equipment with the attendance of their seniors). ③After finishing the 12-day duplication training, newcomers pass certification test and they can get a job as regular personnel.

(Source: JET)

5.3.2 Training Plan for O&M of CCPP

(1) Integration of contents with existing training centers, i.e. conventional thermal power generation training

Training materials prepared in this project are specialized in CCGT and do not deal with the contents which are implemented in TTC. In order to establish the training system covering the whole of power generation, it is necessary for the Department of Work with Personnel of UE HQ to coordinate the training contents and period for the training plan with TTC and NTC.

Regarding the formulation of the training plan, JET have proposed and agreed on the Manual for Training Plan Draft, Appendix 15, based on the current annual training plan procedure of UE. (Refer to Figure 2.2.3-1) However, the agreed-upon manual does not describe the detailed tasks to be conducted by Department of Work with Personnel. When the training plan is being formulated, a conference for information sharing and opinion exchange should be convened, and it is also necessary to consider the inclusion of the Power Plant Operation Department. At the same time as clarifying these procedures, the Department of Work with Personnel must review and revise the Manual for Training Plan Draft to make it an official document.

It is necessary to finalize it as soon as possible as a training plan for 2019, and to create one for 2020 and after as well.

(2) The relationship of OJT and other conditions (Individual Training Program)

To improve the capacity of O&M management, OJT at the actual site is essential. Training by power plant at site, and OJT on CCGT is now only conducted at Navoi CCPP, so OJT for staff of newly constructed CCPP is carried out in Navoi. The outline of training implementation is in the “Individual Training Program”. Although the details of training contents depend on the facilities used at each plant, it is assumed to improve the capability of O&M management by generalizing OJT and training by power plant at site, in Navoi.

The “Individual Training Program” in Navoi is an outline of training by power plant at site, and it will be rolled out as a standard training program to all CCPP in UE. JET requested revisions to the “Individual Training Program”, which are described in this project. (Refer to Appendix 25 [Request concerning the Individual Training Program], Appendix 13 [Request to confirm the progress of the Project]) Prompt action is required for NTC and the Human Resource Department of NTPP to revise the “Individual Training Program”.

(3) Lecture Plan

As already mentioned in 3.4. (2), the Lecture Plan is necessary to make the Training Plan. Trainers have already completed a Draft of Lecture Plan. NTC need to promote publishing the Draft of Lecture Plan as an official document. Due to the formulation of the Lecture Plan, it is possible to standardize how lectures will proceed, and not to have variation in blurring of content every time the trainers and circumstances differ.

5.3.3 Accreditation System for O&M of CCPP

(1) Certification for O&M staff

The trainees before official approval of NTC are the O&M staff from Navoi CCPP-2, Turakurgan CCPP and Takhiatash CCPP as described in Section (2) of 2.2.7, and training will be preferentially implemented for them.

Since it cannot issue an ID card to record the completion of the training, NTC had agreed that NTC record the training and make a training report, i.e. a journal, as a temporary arrangement and transcribe it afterwards when an ID card can be issued. NTC needs to cooperate with the Department of Work with Personnel of UE HQ and obtain accreditation from the Ministry of Higher and Secondary Specialized Education of Uzbekistan soon, in order to ensure the certification of completion of the trainees in the future.

As another consideration, there is an existing confirmation of training completion by "Sanoat geokontehnazorat". In the conventional thermal power generation training of TTC, "Sanoat geokontehnazorat", the national accreditation organization, witnesses the completion exam and records the result by confirmation with signature on an ID card. 7 subjects related to this project should be witnessed by "Sanoat geokontehnazorat". NTC needs to introduce the "Sanoat geokontehnazorat" training completion certificate procedure with the cooperation of the Department of Work with Personnel of UE HQ and TTC.

(2) Accreditation for trainers

Regarding the accreditation for trainers by this project, as mentioned in Section 2.4.5, it was conducted in accordance with Appendix17, Manual for Authorization of Trainer under the Project. A total of 14 trainers were secured.

The accreditation system conducted by NTC after the completion of the project is already agreed on in Appendix 18, Manual for Appointment and Role of Trainer of NTC. NTC should promote finalization of this manual in cooperation with the Department of Work with Personnel of UE HQ, without waiting for official approval as described in Section 5.1.1 (1). When finalizing the manual, it is desirable to refer to and include the Road Map for Trainers, i.e. Figure 2.2.6-8.

5.4 Curricula, Training Material and Training Equipment

5.4.1 Training Materials

As a first step of improving training to promote by NTC, training will be made easier to understand for trainees by formulating and operating the training monitoring and evaluation system mentioned in 2.2.8. It is also important to take advantage of the proposed questionnaire format and review the composition of the format if necessary. (Refer to Appendix 19, Monitoring Report of NTC Training Format)

(1) Periodic update of training materials

NTC should bring in a framework of revising training materials, in order to promptly reflect the facility specifications of CCGT to be newly constructed, consistency with O&M work based on specific facilities, and content concerning future technological innovation. And, regarding how new

technology is reflected in the training materials, NTC need to obtain the information from UE HQ and each CCGT and ensure that it is reflected in revisions of training material.

Meanwhile, in the No. 12 course "GT O&M Lecture", the project examined the mechanism that the training implementation itself leads to revision of the training material, and incorporated a method not dependent on the training monitoring/evaluation system into the Lecture Plan. The contents of the No. 12 course includes GT maintenance, parts repair and GT start-up-and-stop, and training is conducted in connection with the actual trouble or accident example. The current training materials explain the examples of troubles prepared by JET, but in the Lecture Plan, it is required that trainees themselves explain and introduce the accidents or failures that they have experienced. The trainers need to pay attention to the sustainable and autonomous revision of training materials and training implementation with this information introduced by the trainees.

(2) Collections of final certified exam questions of each subject

The 12 training courses conducted by NTC defines a Q&A to be used during training in the Lecture Plan. As for the method of using Q&A, it is intended that trainers use this while considering the trainees' level by application in the training and adopting for writing or oral test. (Refer to Appendix 16, Manual for Lecture-Lesson Plan) The trainers should consider the results of training and points from monitoring and evaluation system, and apply these to the lecture plan such as by adopting existing Q&A or making new Q&A.

5.4.2 Training Equipment

(1) Introducing framework for update and repair

As for management of training equipment which have been procured by JICA, NTC staff need to maintain and update this equipment responsibly. NTC staff needs to investigate substitutable procurement paths in domestic markets so that consumables such as penetrant for PT can be continuously and periodically refilled.

5.4.3 Curriculum

(1) Preparing curriculum for senior staff including across departments

In this project, training curriculum were defined with the aim that each staff member can acquire knowledge in his own specialty. There is no problem for new employee level staff, however, senior staff will require the knowledge that goes beyond his department.

Therefore, it is required for NTC to prepare the curriculum for senior staff in the future. Preparing the Lecture Plan for On-Site Training, described in section 5.5, is related to this.

(2) Revising the curriculum

Regardless of the trainers in charge, the training curriculum needs to be established so that the same training outcomes can be obtained from the same training course. And, it is necessary to revise the training curriculum based on the result of the questionnaire for trainees in order to upgrade the effect of training for next training.

5.5 Developing and Securing of Trainers

(1) The number of trainers to be developed for the future

14 trainers, accredited under this project, will be the main personnel in the starting period of the training center, but it is required to increase the number of trainers in future. JET estimated the result, described in 2.4.5 (3), and points out that at least 4 more trainers shall have been added by 2020, but this figure does not include the periodic transfer of trainers. NTC need to immediately prepare and implement a development plan for trainers including the number of replacements for trainers.

(2) Clarification of employment conditions of trainers

As mentioned in 2.4.5, it is necessary to clarify the trainer's treatment for the following reasons; necessity of full-time trainer, the work of part-time trainers and treatment of dispatching training.

NTC need to cooperate with the Human Resource Department of NTPP and the Department of Work with Personnel of the UE HQ, and have a "Job Description" for Chief Trainer, Deputy Trainer and Assistant Trainer defined in manuals. After the confirmation of the level of the job in the hierarchy and relation to the Tariff & Qualification Handbook (OTKC), it is also necessary to clarify employment conditions and treatment.

In addition, the Department of Work with Personnel of UE HQ needs to consider the development of a periodic replacement and promotion system described in 3.9(3), and make attractive conditions to secure the best trainers.

(3) Developing Trainers/ On-Site Training

As mentioned in 3.9 (5), trainer candidates are required to have experience in periodic inspections, and it is also required in the Manual for Appointment and Role of Trainer of NTC (Refer to Appendix 18). When NTC / UE develop trainers themselves, if trainer candidates do not have experience in periodic inspections of CCGT, they need to conduct On-Site training using periodic inspection in UE.

The Chief Trainer should prepare the contents of the "Lecture Plan Draft" for each course of "On-Site Training", and clarified the "Q & A on-site" and "On-site Explanation Points", and need to complete the "Lecture Plan for On-site Training". In addition, the completed "Lecture Plan for On-site Training" will be possible to utilize for senior staff training as well.

Before appointment of new trainers, Director NTC will confirm and approve the evaluation results of a mock-up training by each subject conducted by the Chief Trainer and Deputy Trainer.

In addition, since the expiration date of trainer certification is within 3 years, NTC needs to prepare a training plan for re-education of trainers.

(4) Considering the utilization of outsourced trainers

To consider the outsourcing of trainers, professors and academics of the university and institute of technology in Tashkent and Navoi are eligible candidates. In the Manual for Appointment and Role of Trainer of NTC, the condition to become NTC trainer is defined as, 1) recommendation of the UE HQ, 2)

completion of course attendance, 3) experience of the major overhaul inspection of CCGT. But there are few external persons who can satisfy these conditions for outsourcing, especially in above 3). Training contents contributed by invited professors and academics are supposed to be special technical elements and the fundamental theory of gas turbines as described in 2.4. NTC needs to consider the implementation of training regarding the new technology and theory in the 12 training courses introduced, by using invited trainers.

On the other hand, 5 former trainer candidates in Tashkent who are not outsourced trainers almost satisfy the conditions for appointment as trainer. If necessary, they can be eligible candidates to be appointed after confirmation by mock-up training. NTC should consider whether they can be utilized as trainers to conduct dispatch training in the future.

5.6 Conclusion

This project was implemented by the JICA expert team (JET), i.e. Asia Engineering Consultant Co., Ltd., Nippon Koei Engineering Consultants, The Chugoku Electric Power Co., Inc., and Power Engineering and Training Services, Incorporated Engineering Center, during the period from October 2016 to March 2019.

For Establishment of CCGT Training Center, JET confirmed its current status and issues regarding the human resource development plan, training plan, and accreditation system for CCGT O&M in UE. JET completed proposals for the “Human Resource Development Plan”, “Staff Allocation Plan”, “Systematical Training Plan”, “ Accreditation System”, and completed implementation of the “Development of curriculum and training materials”, and “Development installation plan for necessary training equipment”. JET also advised on the renovation for training facilities. Furthermore, JET proposed and tried introducing a monitoring and evaluation system as a mechanism for appropriate management of the CCGT training center.

In the future, continuous implementation of these suggestions will certainly contribute to securing O&M staff of CCGT with the necessary technical level, and pave the way for the improvement of the reliability of power supply in Uzbekistan and elimination of shortages that do not keep up with the demand for electricity.

Before submitting the report, JET asked Uzbekistan side to review and comment on the Draft final. The following comments were received from the project director, General Director of NTPP, Mr. Kahramon Ganiev.

(1) There is no objection and comments on the content of the report.
(2) Navoi's O&M staff who are appointed and accredited as NTC trainers already had considerable operating experience, and as a result of receiving a new technology transfer from JET through this project implemented by the cooperation of JICA, the project director confirmed of the trainers of NTC to have great confidence in operating technology.
(3) Therefore, this project is highly evaluated as a project of JICA, and I would like to express my gratitude to all of JICA and JET.

(4) On the other hand, in the case of periodic inspections, when we look at the reality where it is judged mainly by Technical Advisor dispatched from manufacturer, we feel strongly that the technical capacity for repairing equipment is a weak point. We strongly hope that we will continue to have opportunities and【 training on maintenance and management of equipment 】will be carried out. We would like to have training of the capacity building of human resources focusing on【 maintenance and management of equipment 】by all means.

As mentioned above, in addition to the contents of the technical cooperation implemented this time, it has been strongly requested to carry out "Strengthening training on maintenance and repair of equipment" as a new project. In the future, by considering further cooperation with the Uzbekistan side, we definitely believe that it is possible to make the outcome of technical cooperation more effective.

As mentioned above, in addition to the contents of the technical cooperation implemented this time, it has been strongly requested to carry out "Strengthening training on maintenance and repair of equipment" as a new project. In the future, by considering further cooperation with the Uzbekistan side, we recognize that it is possible to make the outcome of technical cooperation more effective.

Lastly, all of us on the JICA Expert Team would like to express our sincere gratitude to JICA and the Japanese Embassy in the Republic of Uzbekistan. The JICA Expert Team would also like to express our sincere gratitude to the UE Headquarters and the Navoi and other related power stations for their cooperation and support in carrying out this project.

Chapter 6

6. Procurement and Simulator Training

6.1 Project Background

The first combined cycle power plant (CCPP-1) in Uzbekistan was constructed and installed at Navoi Thermal Power Plant (hereinafter referred to as "NTPP") and this was funded by the government of the Republic of Uzbekistan. The additional combined cycle power plant (CCPP-2) in Navoi which are under construction namely; the Talimarjan Thermal Power Plant and Turakulgan Thermal Power Plant with funding from the Japanese ODA Yen loan. Uzbekistan will be requiring additional power plants for its future electricity demand and it is projected that approximately 20 CCPPs will be constructed and installed. This is to note that the projected 20 units of CCPP's is not an official data but was based from interviews with potential proponents. The projected CCGT Construction Plan is considered as recommendation for information purposes only and details is shown in Table 6.1-1.

Table 6.1-1 CCGT Construction Plan (As of June 2019)

20190630

CCGT Construction Plan

as of 2019 June

Power Plants	Constructed & Commissioned	Under Construction	Planned & Planning	
Navoi	Navoi-1 (478MW/F: MHPS) 2012/9			
		Navoi-2 (450MW/F: MHPS) 2019/1(Single Cycle)		
			Navoi-3&4 (650MW/J×2: MHPS)	
Tashkent CHPP (Nearby Airport)	T-1 (27MW Hitachi NEDO) 2013/1			
			T-2&3 (27MW×2 JICA Yen Loan)	
Talimarjan	T-1&2 (450MW×2 F: MHPS) 2016/8,12			
			T-3&4 (450MW/ForJ×2: MHPS?) ADB(7)/EBRD(3)	
Tashkent CCPP(Suburb)	T-1 (370MW GE China Fund EXIMBANK) 2016/9			
Turakurgan		T-1&2 (450M/F×2 : MHPS) 2019/12,2020/3		
			T-3&4 (450M/F×2 : MHPS)	
Tahiatash	T-1&2 (250MW×2: GE) 2016/8,12 ???			
			T-3&4 (250MW×2: GE?) Fund is not confirmed.	
Fergana CHPP		F-1&2 (25MW×2: KHI NEDO)		
Syrdaria			S-1,2,3,4 (650MW/J: MHPS?)	
Turkish IPP in Surkhandarya			IPP-1 (450MW/F: MHPS?)	
Turkish IPP in Bukhara			IPP-1 (MW: ?)	
Total - Uzbek Large GT	6 units	3 units	12 units	21 units
Total - Uzbek Small GT	1 units	2 units	2 units	5 units
Total - IPP	-	-	2 units	2 units
				TOTAL

(Source: JET)

The CCPP-1 in NTPP started its commercial operation in 2013. Given the six (6) years stint of the commercial operation of the CCPP-1, the professional experiences of the staff assigned in the O & M are not that adequate. Improvement of professional capacity and skills of the staff to efficiently carry the routine work at O & M at CCPP-1, is one of the most urgent issue in Uzbekistan.[3]

In order to address the prevailing concern, the government of the Republic of Uzbekistan has requested for a technical cooperation project entitled "The Project for the Establishment of the Combined Cycle Gas Turbine (CCGT) Operation and Maintenance Training Center (hereinafter referred to as the "Project")

[3] As part of the power sector reform, Uzbequenergo has been implemented a corporate spin-off to set up Ministry of Energy to deal with government administration and other Joint Stock Companies by each generation technology such as thermal power, hydropower, nuclear power, Renewable energy, and etc. (see 6.2 Project History).

with the Japanese government under ODA Loan Project. The Project started in September 2015 is considered a part of the "Energy Infrastructure Improvement Program." In June 2019, the construction of the training facility of NTC was completed.

On the other hand, the equipment procurement of "GT Cut Model" and "Simulator" is an additional activity under "The Project for the Establishment of the Combined Cycle Gas Turbine (CCGT) Operation and Maintenance Training Center (hereinafter referred to as the "Main Task"), commenced in November 2016.

In order to realize the "Overall Goal[4]" of the Project to capacitate a full-pledged simulator trainers, JICA approved in December 2018, the conduct of a "Simulator Training." as an additional activity under the Main Task. The procurement and installation of a CCPP Simulator is also equally important as this will be needed in training the trainers for them to have an actual experience on the operation of a CCPP.

The overall Project was completed in May 2019 including the completion of the NTC facility where the procured GT Cut Model and Simulator are readily to be installed.

6.1.1 Procurement of GT Cut Model and Simulator

6.1.1.1 Procurement of GT Cut Model

The procurement of the GT Cut Model under the Main Task will play an effective tool for the conduct of training to improve the skills of O&M staff at the CCPP.

The technical specifications of the procured GT Cut Model as requested by the Uzbekistan government is the type that is similar to the GT installed in CCPP-1 of NTPP which is the M701F4 model, manufactured and installed by MHPS. Furthermore, the requested specifications for the rotor is an electric rotating model, and the combustor shall be with electrical decoration so that the participants to the Simulator Training will have an actual operation experience and able to familiarize the equipment of the existing CCPP-1. This ensure that the overall result of the training program is effective as it will enhance the knowledge and skills of the trainers.

6.1.1.2 Procurement of Simulator

A simulator to be used as hands-on tool is absolutely effective in the implementation of training program in the NTC in order to develop and enhance the technical knowledge of O & M staff at the CCPP. The realization in the procurement of the Simulator has been influenced by UE which is the project C/P at that time[5] has suggested for the installation of Simulator to be used for training the O&M staff of CCPP and the Unit was planned to be constructed in the near future. In November 2016, the first field work, an activity under the Main Task was conducted to confirm the needs of a simulator unit for the training program in the NTPP/NTC. JET, on the other hand, has mobilized the procurement of the Simulator with the approval by the Uzbekistan government as to the mode of supply and the technical specifications of the Simulator. JET procured the Simulator through an open bidding.

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[4] Target values to be achieved by March 2022; (1) To train 530 CCPP staff (2) To secure 20 trainers to train O&M staff of CCPP

[5] JSC Thermal Power Plants (JSC TPP) took over the place of UE (JSC Uzbekenergo) in February 2019.

6.1.2 Pilot Training of Simulator

Originally, the overall activity under the Main Task was scheduled to be terminated after the installation and handover of the equipment despite the Simulator training is not yet conducted. This is with the premise that the Uzbekistan government was the one responsible in the implementation of the simulator training program after receiving the Seminar User Guidelines for Simulator that was prepared by MHPS. The Simulator Training to be conducted by Uzbekistan will cover only the simple handling and operation of a Simulator. However, the following topics not included in the seminar by MHPS are considered important and necessary for discussion to the participants prior to the conduct of a practical training using a Simulator:

(1) Detailed discussion on the guidelines for each cases of malfunction
(2) Causes of accident and setting
(3) Concepts of training and level of accident and its background

A continued discussion has taken place among JET, the General Director of NTPP and the Director of NTC on the best way to utilize the installed Simulator to achieve the desired outcome for an effective results of the training program for participants of the Training of Trainers of NTC. JICA has provided the best solution on the prevailing issue as to the use of the Simulator to conduct additional simulator training within the implementation period of the Project contract which was approved in December 2018.

6.2 Process of Project

The power sector reform in Uzbekistan started in 2018. The Ministry of Energy that was newly established in February 2019 took over the administrative function for the electricity business from UE. The Uzbekistan government has decided to spin off the power generation business of UE and established a JSC for each power generation company by generating electricity. All of the CPPP companies including NTPP are now under the umbrella of JSC Thermal Power Plants (hereinafter referred to as "JSC TPP"). Under the power sector reform, the individual power company is regulated to pursue its power business independently to generate profit. However, some power generation company such as NTPP, Talimarjan TPP, and Turakurgan TPP, were funded from ODA loans are required to repay the loan from the respective power plants generation income or financing. NTC is currently one of the departments under NTPP. The government has approved[6] NTC as a government educational institution in June 2019 and as a result, NTC will be required to register as one of the JSC companies under the umbrella of JSC TPP.

Uzbekistan has considered the Simulator for CCPP operation as the most important device for practical and effective training equipment granted by the technical cooperation of JICA. Said equipment was turned over in May 2019 after the conduct of the on-site inspection and trial operation. The Simulator in

[6] Approval is issued under the name of NTPP

Navoi is the first and the only one in Central Asia, and it is expected that it will contribute to attain an effective result in the training program in the near future as well as to develop the skills and improve the technical know-how of the staff to properly operate the CCPP under the JSC TPP. In addition, it is also expected that the outcome of the Simulator training allows the staff to be productive and able to contribute to the profitability of the generation business of NTPP/NTC.

The GT Cut Model and Simulator being part to the overall activity under the Main Task were turned over to NTC in May 2018 and in May 2019, respectively. Both equipment will be used for the hands-on application in the training program, to improve the capacity of the human resources at the O&M of the CCPP. The planned activities under the Main Task started in November 2016, and the technical cooperation project was completed on schedule.

One of the most important achievements of the Technical Cooperation Project is the establishment of NTC to train the O & M staff of the CCPP. Moreover, the deliverables in the Project were successfully completed such as the curricula for the training of O&M staff of the CCPP, textbooks for classroom lectures and training equipment for practical training to promote deeper understanding of the topics being discussed and these materials has provided a good references for the training program and create a conducive environment to learn.

The most important aspect and accomplishment in the Project is the capacity development for the human resources specifically the training for the O&M staff and the trainers. In October 2018, a total of fourteen (14) trainers were jointly selected, trained and were issued a certification as NTC trainers by JET and NTPP/NTC.

In November 2016, the first field work by the Uzbekistan delegates to Japan, an activity under the "Main Task" the technical specification of GT Cut Model and Simulator were discussed as the main agenda. The Uzbekistan delegates conformed with JICA /JET to finalize the technical specification at the full discretion of JICA/JET prior to the return of the delegates to Uzbekistan. Moreover, the scope of simulator training has been approved for the training of O&M staff of CCPP, NTPP/NTC with the following conditions:

(1) Location of CCPP training center and official name of the training center

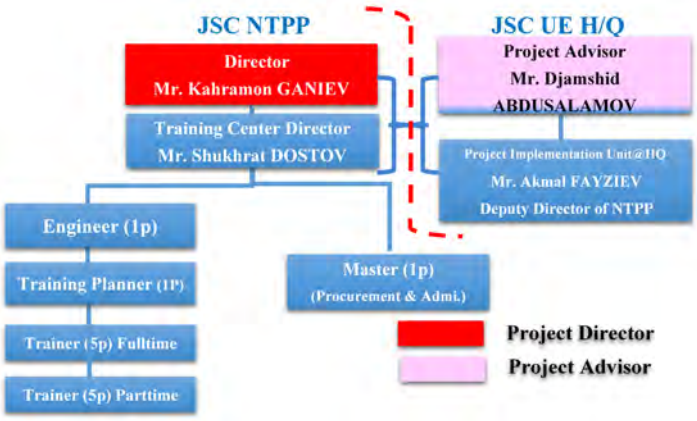
The CCPP training simulator shall be housed inside a building for the protection of the equipment. A building has been identified and will be renovated to house the simulator room and training classrooms for CCPP. The official name of the training center is not yet announced.

(2) Draft Structure for Implementation of Navoi Training Center for CCPP

Figure 6.2-1 provides the implementation structure as an outcome from the discussion in November 2016. The officials in the training center are Mr. Kahramon GANIEV of General Direct of NPP to be Project Director and Mr. Djamshid ABDUSALAMOV of Deputy Chairman of UE to be Project Sdvisor.

In order to enhance the activities of the training business of NTC, the Organizational Structure of Navoi Training Center has been updated to make it responsive to the current situation. JET proposed the organizational structure to NTPP/NTC in the seventh field work as described in Figure 9.3-1 of "9.3

Assistance to the New Training Center in Establishing the Operation System and Organizational Structure" in Chapter 9.



(Source：JET)

Figure 6.2-1 Organizational Structure of Navoi Training Center

The training using Simulator is focused to train "Operating staff" and "I&C engineers and Programmer staff" to improve the knowledge and skills of O&M staff for the CCPP. Both JET and NTPP/NTC will provide the following framework of the training program:

(1) Normal start / stop of plant operation
(2) Countermeasures against abnormal plant conditions (utilizing the malfunction function)
(3) Automatic sequence and interlock both in normal and abnormal conditions
(4) Usage of software
Example; How to use OPS (Operator Station), ACS: Accessory Station, EMS (Engineering & Maintenance Station) and MPS (Multiple Process Station)
(5) Maintenance tools; Control logic and Plant graphic design

As earlier mentioned, regarding the request of Uzbekistan government that GT Cut Model and Simulator shall be similar to the existing configuration of CCPP-1 installed at NTPP. In December 2016, following the completion of the first field work , JET was scouting for manufacturer including MHPS that could possibly design and manufacture the existing GT Cut Model and Simulator. However, no one was interested to fabricate and bid the GT Model and Simulator. MHPS is the original manufacturer of the CCPP installed at NTPP.

To address the concern, JET submitted "Form 6" of JICA shown as below to request approval from JICA for a special purchase order to MHPS without a competitive bidding of the procurement. Form 6 was approved by JICA in July 2017.

Form 6

Annex V: Statement of Reason to Designate the Brand

Country : Uzbekistan

Project name : "The Project for Establishment of the Combined Cycle Gas Turbine (CCGT) Operation and Maintenance Training Center (Procurement)

No.	Equipment name	Manufacturer name	Brand designation requirements	Specific reason for applicable requirements ※
1	GT Cut Model	Mitsubishi Power Systems, Ltd.	A, B, E	As per Attachment 1
2	Off-site Simulator	Mitsubishi Power Systems, Ltd.	A, B, E	As per Attachment 2
Requirement for Brand designation & Instructions	a. Procurement of equipment that has patents or industrial property rights, etc., and there is no equivalent substitute. b. If the purpose cannot be achieved unless it is consistent with equipment that has already been procured or has been decided to be procured c. When there are significant advantages in terms of after-sales service, etc. (If it exceeds 25 million yen, you can confirm in detail the after-sales service system of the equipment specified by the brand (the management status, technical level, number of engineers, equipment contracts, etc. of the person who performs the after-service) (It is necessary to submit materials indicating that the after-sales service system of other companies' products is inadequate and that there are no plans for maintenance immediately after equipment procurement.) d. When the primary user of the equipment at the equipment introduction site is proficient in handling the equipment and there is a risk that it will be difficult to switch to another model and the business purpose may not be achieved. (If it exceeds 25 million yen, it is necessary to submit an official request form regarding the designation of the stock from the institution of the recipient.) e. In order to achieve the project purpose, it is essential to ensure the compatibility and consistency of data between the destination of equipment delivery and Japanese research institutes / collaborators. And consistency can be ensured. f. If the brand includes a specification that is de facto standard in the country where the equipment is used. (If it exceeds 25 million yen, it is necessary to submit a document that shows that the specific specification occupies a significant percentage of the market in the country where the equipment is used.) g. Other than equipment of a specific brand, it is extremely difficult to achieve the objective, and the effect and efficiency of achieving the objective are significantly reduced.			(Remarks) ※ Attach a separate sheet if the above column is not enough for description of the review.

6.2.1 Procurement of GT Cut Model and Simulator

In order to implement the effective procurement of GT Cut Model and Simulator, a special purchase order was submitted to MHPS. The following information was attached to the "Statement of Reason to Designate the Brand".

Attachment 1

Specific Reason for the Requirement

GT Cut Model

A. In case to procure equipment with patents or industrial property rights, etc., and in case no equivalent substitute exist.

GT Cut Model, which UE requested to install is the GT Cut Model of M701F4 manufactured by MHPS * 1, which boasts the largest number of installation in Uzbekistan, and can only be manufactured by MHPS.

* 1 MHPS was registered on February 1, 2014, when Mitsubishi Heavy Industries, Ltd. and Hitachi, Ltd. merged their business of manufacturing thermal power generation systems.

B. In case if the purpose cannot be achieved unless it is consistent with equipment that has already been procured or has been officially procured.

The GT Cut Model is manufactured based on drawing data for actual technical design of MHPS gas turbine, M701F4 type, and this drawing data is only owned by MHPS which is the only manufacturer of M701F4 type. Therefore, manufacturing and supply of the GT Cut Model with on M701F4 model can possibly procured from MHPS.

E. In order to achieve the project purpose, it is essential to ensure the compatibility and consistency of data between the delivery destination of equipment and Japanese research institutes / collaborators, and in case of the compatibility and consistency of data is possible only by specific brand.

GT Cut Model is manufactured based on the technical specification of the facilities installed in Navoi CCPP-1, Gas Turbine M701F4, manufactured by MHPS. Therefore, the Cut Model manufactured by MHPS corresponds to the installed GT, which enables NTPP/NTC to implement the reasonable training showing the exact model of the GT installed in Navoi CCPP-1.

Attachment 2

Specific Reason for the Requirement

Off-site Simulator

In November and December 2016, JET has proposed the procurement of Simulator in Uzbekistan. Based on the result of the interviews with the official and staff of NTC and JSC UE, responsible for the training of O & M staff, JET confirmed the needs of the simulator, and s proceeded to select simulator trainers. JET continued discussions and agreed on the installation site of Simulator and other training equipment and the organizational structure to conduct maintenance of the training equipment.

Aiming to attain on the conduct of training to O&M staff of CCPP, NTPP/NTC requested and proposed the trainings with simulator as follows;

(1) The first priority is participants to learn how to handle the control system (*) installed in Navoi CCPP-1 which started operation in 2012.

(2) NTPP/NTC considered to appoint shift managers of Navoi CCPP-1 as simulator trainers. For simulator training, it is most efficient to use control system (*) equivalent to the real one installed in Navoi CCPP-1, which trainers, i.e. operators in CCR use and operate in daily work at Navoi CCPP-1.

(3) The control system (*) enables operators of the CCPP to obtain detailed information on malfunctions and other abnormalities through the data communication with gas turbines and other facilities installed in Navoi CCPP-1. Simulator training is the best solution to train maintenance staff. This is because the devices, e.g. the graphic screens and the program with the control system, are incorporated in the simulator. In order that maintenance staff accumulate the knowledge and skills of CCPP, the training using simulator, which incorporates the devices equivalent to the one installed in Navoi CCPP-1, is most efficient.

(4) Part of the Project is to participate some practical trainings in Japan. Trainees shall experience a logic editing, and operation of a gas turbine using monitoring PC. As a result of experiencing the high effectiveness through such trainings, NTPP/NTC strongly requested to implement similar training module and environment to provide with the practical trainings using PC with a logic editing, monitoring function.

JET reviewed the proposals and requests from UE and NTPP/NTC and evaluated the ideas of C/P to be reasonable and appropriate.

Note) Control system (*): NETMATION made by MHPS

A. In case to procure equipment with patents or industrial property rights, etc., and in case of no equivalent substitute exist.

The delivery destination of equipment is NTPP, where CCPP with GT M701F4 is installed. GT is the main

facility of CCPP together with ST to supply power to generator. It is possible to execute intellectual property rights owned by Mitsubishi Hitachi Power Systems *1 for operational control and control system (*) in the operation of CCPP. As operational control and control system (*) incorporated in Simulator are manufactured only by MHPS, there is no other equivalent alternative manufacturer

*1 Mitsubishi Hitachi Power Systems Ltd. was registered on February 1, 2014, when Mitsubishi Heavy Industries, Ltd. and Hitachi, Ltd. merged their thermal power generation systems business. As MHPS is the only manufacturer of GT M701F4 type, various parameters and control programs (logics) related to the operation of CCPP are available. It is possible to simulate how the influence

B. In case the purpose cannot be achieved unless it is consistent with equipment that has already been procured or has been procured

is to affect GT operation from unexpected accident. Therefore, trainees of simulator training can be trained properly according to the formulated accident through the simulator manufactured by MHPS in line with actual equipment.

E. In order to achieve the project purpose, it is essential to ensure the compatibility and consistency of data between the delivery destination of equipment, i.e. UE in Uzbekistan, and Japanese research institutes / collaborators, and in case of the compatibility and consistency of data is possible only by specific brand.

The purpose of the power business of UE, as the delivery destination of equipment, can only be achieved by realizing stable daily power generation of CCPP. In November 2016 as discussion s with NTPP/NTC, has showed their interest to improve the training using the simulator to realize stable operation of CCPP. There was strong request and proposal to implement the simulator training to train trainees and to master on the use, operation and maintenance of the existing MHPS control system, NETMATION.

In the simulator system, maintenance tools, such as additional programs for solving gas turbine problems newly built are requested to train instrument and control engineer and programmers. Regarding maintenance tools, MHPS has the various technologies. As a manufacturer of gas turbine M701F4 type, MHPS continuously collects a large amount of data from various MHPS gas turbines including the M701F4 type operating in various areas of the world, and MHPS analyzes the information to build an excellent database and to develop more efficient technology. UE requested MHPS to supply simulator with maintenance tools, i.e. NETMATION, can effectively expand countermeasures for future troubles including maintenance tools.

Given the above-mentioned situation, the suggestion of JET to UE, its request will not be realized without MHPS.

6.2.2 Pilot Training of Simulator

Simulator training, which was newly planned as an additional work under the Main Task, was re-consigned to "Kanden Powertech," a specialized private organization for the operation of thermal power

generation in Kansai Electric Power Company Group. Considering the delivery of Simulator was delayed in May 2019, the implementation deadline of the Main Task was extended in order to complete the "Pilot Training" of Simulator before June 2019. The actual training period was 10 days because of the availability of the two experts from Japan. Although simulator training is generally aimed to train operators, the "Pilot Training" was formulated to train instructors who are responsible for operator training.

6.3 Purpose of Project

The purpose of the Main Task was to implement the procurement of GT Cut Model and Simulator including "Pilot Training" of Simulator to support the Uzbekistan government to realize the "Overall Goal" and to achieve the four "Results" through the necessary "Activities" of the Project.

The "Overall Goal" of the Project is to strengthened the "Capacity of Operation and Maintenance of Combined Cycle Power Plant (CCPP) and this will be realized through the achievement of the "Project Purpose" which is to formulate and establish a "Training System of operation and maintenance for CCPP.." The following four (4) "Outputs" are specific outcomes in order to achieve the "Project Purpose";

Output 1: Operation and Maintenance Policy of CCPP is developed.
Output 2: Human resource development plan, training plan, and accreditation system of CCPP O&M are developed.
Output 3: Training curricula, materials and equipment of CCPP O&M are developed.
Output 4: Trainers of CCPP O&M are trained and secured.

Procurement of "GT Cut Model" and "Simulator" complements well with the "Training curricula, materials and equipment" in "Outcome 3" above, and "Pilot Training" of additional work is developed by "Trainers are trained and secured" in "Outcome 4" above. In the Project, (1) "Training curricula is developed" (2) "Training materials, such as Textbooks of 12 courses are developed" (3) Trainers are trained and secured through the "Training of Trainers". All of those are considered as the software support provided by the achievement of the Project, and the Main Task aimed to provide with "GT Cut Model" and "Simulator" including "Pilot Training" were formulated to enhance the effectiveness of the Project results as the hardware support.

6.3.1 Procurement of GT Cut Model and Simulator

Based on the R/D (Record of Discussion) agreed between Japan and Uzbekistan on January 27, 2015, the Main Task was formulated to support the Project in achieving the "Overall Goal". Specifically, the Main Task is to provide with advice and guidance to Uzbekistan government for the delivery and installation of "GT Cut Model" and "Simulator" procured by JICA, and also to support JICA for the procurement of the equipment. The Main Task has been implemented as a follow-up support for the Project, resulting to the procurement and delivery in May 2018 of the GT Cut Model, and the delivery and turned over of the Simulator in May 2019.

As earlier mentioned, the Main Task was to implement the procurement of GT Cut Model and Simulator

including “Pilot Training” of Simulator to support the Uzbekistan government in realizing the “Overall Goal”, which is to strengthen the “Capacity of Operation and Maintenance of Combined Cycle Power Plant (CCPP)”. The establishment of “Training system of operation and maintenance for CCPP” is the Project Purpose, which is formulated to enhance the “Overall Goal” to be timely achieved.

The target participants to the training program are planned such as: (1) To train 530 CCPP staff, (2) To secure 20 trainers to train O&M staff of CCPP, which were approved by the JCC in March 2019. The Target participants of “530 CCPP staff” and “20 trainers” are to be achieved by March 2022. Three (3) years after, a monitoring system will be establish to oversee the achievements of the Uzbekistan governments if it able to accomplish the “Overall Goal” properly and on time, The “Monitoring and Evaluation” system introduced by JET is to ensure the targets are achieved completed as well effect technology transfer through discussions with relevant stakeholders in the “Project” regarding the procedures and methods of “Monitoring and Evaluation”. Moreover, the conduct of the Training of Trainers together with Training equipment and Textbooks, the completion of the building construction and the governmental approval as educational institution, and the establishment of NTC the overall project activities were successfully implemented. The only issues that remains to be seen is the readiness of the Uzbekistan government to commercially operate NTC as Training Business.

6.3.2 Pilot Training of Simulator

JET has selected “107 Malfunctions Accident Cases” out of a total of “186 Malfunctions”. “18 In June 2019 eighteen (18) Malfunctions” were reviewed in details as subject in the “Pilot Training” under the Main Task. It is envisioned to achieve technical transfer of “89 Malfunctions” and this will have to be continuously implemented.

The purpose of the “Pilot Training” was to promote Simulator trainers of NTC for them to acquire the training skills as simulator trainers so that they can effectively train the CCPP operators. At the same time, the trainers' skills and the business ability of NTC management and staff were also evaluated.

Following the conduct of the “Pilot Training” for “18 Malfunctions Accident Cases”, the two Japanese instructors and JET will conduct evaluation to the TC instructors' to determine if their skills are appropriate is appropriate. However the instructors’ experience in operating CCPP is very short[7]. Major inspection of CCPP was carried out only once in CCPP-1 of NTPP in September 2018. It is reasonable to conclude that it is extremely difficult for NTPP/NTC to develop on their own a comprehensive training plan including textbooks and manuals of the remaining “89 Malfunctions”. In other words, JET would like to say clearly that if there is no further technical transfer of Malfunctions by the Japanese experts, an appropriate simulator training business will not be realized.

The technical transfer of “89 Malfunctions” should be immediately implemented with the Japanese experts, who drafted and formulated the “Tasks and Proposals for Business Operation (Implementation System of Works, Operation System) details is in Chapter 11 “.This should be implemented as soon as possible as a part of the Main Task.

[7] The first CCPP in Uzbekistan, i.e. CCP-1 of NTPP commenced its commercial operation only in January 2013.

6.4 Structure of Project Implementation

The implementation structure of the Main Task is as follows;

(Source: JET)

Figure 6.4-1 Implementation Structure of the Main Task (Management Team)

6.5 Work Flow Chart

Table 6.5-1 Business flowchart reflects the business results as of the end of July 2019.

6.6 Dispatch of Experts

Table 6.6-1 Engagement Plans / Results of Business Personnel reflects the results from the first field work in November 2016 to the seventh field work, June to July 2019, of the final field work.

6.7 List of Trainees

6.7.1 Procurement of Simulator

In November 2018, “Factory Test” of Simulator was conducted at the MHPS Takasago Factory. After carrying out a “Pre-Shipment Inspection” in March 2019 before shipment, simulator-related equipment was delivered to NTPP on April 6, 2019.

The field test of Simulator was conducted for one month in the sixth field work scheduled from April to May 2019. Table 6.7-1 shows list of Attendees from of NTPP/NTC staff for the “Simulator Site Acceptance Test”

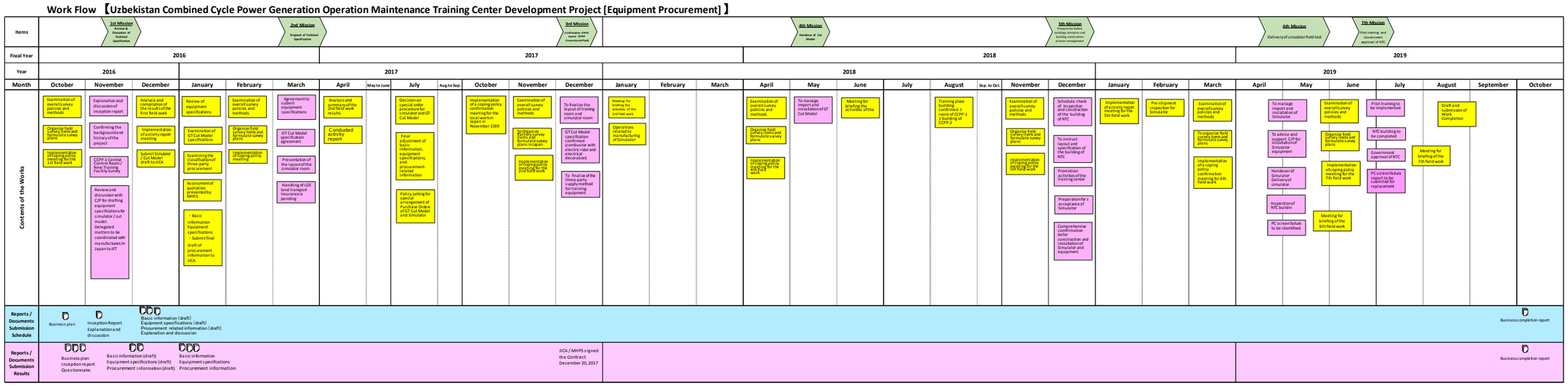
6.7.2 Pilot Training of Simulator

The “Pilot Training” for Simulator training was conducted in the 7th field work in June 2019. Table 6.7-2 shows the list of Attendees t for the “Simulator Pilot Training” from NTPP/NTC staff.

As reviewed in 6.3.2 Simulator Pilot Training, the “Pilot Training” is focused on the “Training of Trainers” for Simulator. At the same time, (1) “Simulator Instructor Ability” and (2) “NTC Management and Staff Training Business Operation Ability” were also evaluated.

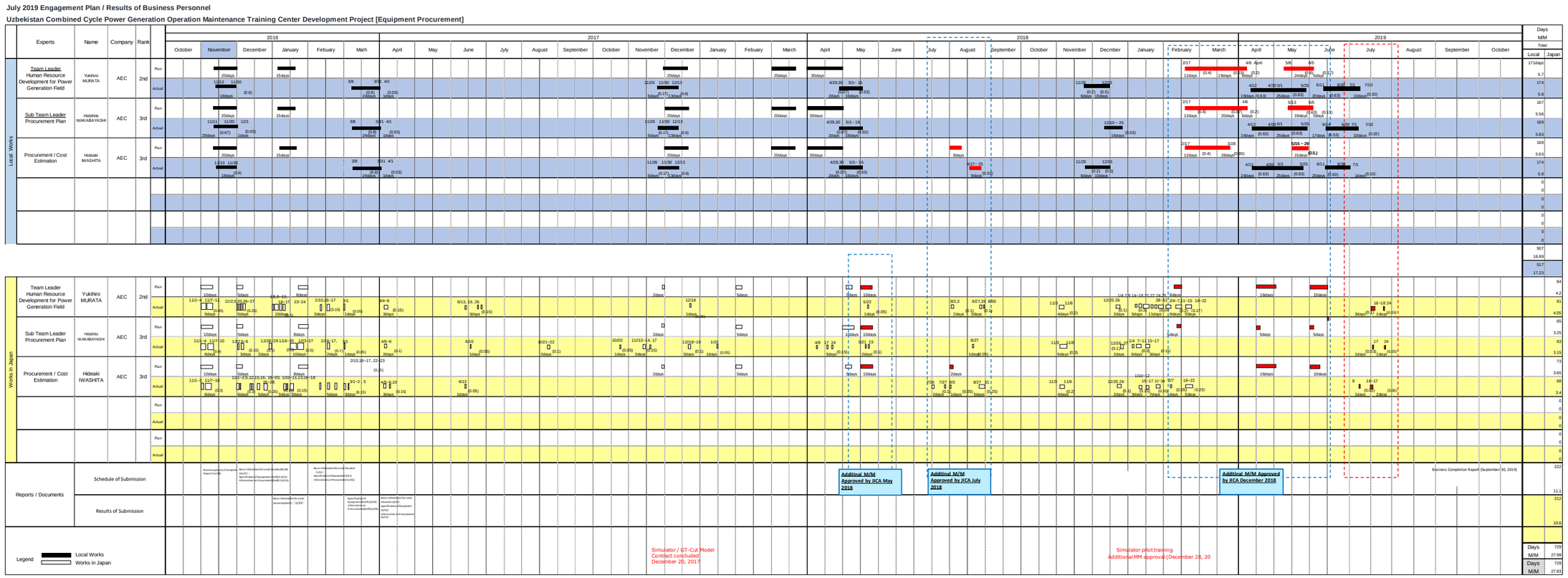
Table 6.5-1 Work Flow Chart

Work Flow 【Uzbekistan Combined Cycle Power Generation Operation Maintenance Training Center Development Project [Equipment Procurement] 】



(Source : JET)

Table 6.6-1 Engagement Plan / Results of Business Personnel



(Source : JET)

Table 6.7-1 Attendance List for “Simulator Site Acceptance Test”

		Mr. Jamshid PIRMANOV Navoi CCPP-2 Leading engineer on TME	Mr. Shukhrat BAYLIEV Navoi CCPP-2 Engineer on TME	Mr. Lutfillo KHUDOYKULOV Navoi CCPP-2 Seinior master on operation	Mr.Ulmas KADIROV Navoi CCPP-2 Engineer Programmer	Mr. Khudoyor KHALILOV Navoi CCPP-1 Engineer Programmer	Mr. Latif KHASANOV Navoi CCPP-1 Leading Engineer-Programmer	Remarks
2019/4/15	Inspection of the training department's indoor department. Confirmation of simulator transportation package (10 pieces)							Confirmed that there were no abnormalities in the appearance inspection of the transport package (10 pieces).
2019/4/16	Confirmation of purchased goods from JICA Uzbekistan Office							Confirmed that there were no abnormalities in each purchased item.
2019/4/17	**Unpacking Inspection** - Package disassembly - Loading into the simulator room and installation							Confirmed the serial number of each device and nothing was wrong.
2019/4/18	**Installation** - Desk installation position determination - LAN and power cable laying							
2019/4/19	**Installation** - Cable connection work							
2019/4/20								
2019/4/21								
2019/4/22	**Installation** - Power on each device and start							Confirmed that the failure occurrence on the monitor (one unit) of the simulator and replaced it with spare parts.
2019/4/23	**Hardware test** **System test** - System boot test	Attended	Attended	Attended	Attended	Attended		The power was temporarily interrupted, but it was confirmed that the system started after power recovery.
2019/4/24	**System test** - PC performance check - Interface check - System restart, system shutdown test			Attended	Attended	Attended		Navoi Deputy Director and former training center director visited the simulator inspection.
2019/4/25	**Instructor function test** - Managing user function - Alarm confirmation / reset function	Attended	Attended	Attended	Attended	Attended		Visitors (4 people) came to see the inspection.
2019/4/26	**Instructor function test** - Trand monitoring function - Current value monitoring function - Malfunction function - Remote function	Attended	Attended	Attended	Attended	Attended		
2019/4/27								
2019/4/28								
2019/4/29	**Instructor function test** - Scheduling function - Instructor operation log function - OPS operation log function - Alarm log function - Hard copy function - Log printing function Self-study (due to gas compressor trouble)	Attended	Attended			Attended		Instructor candidate performs voluntary test for trouble occurrence of CCPP-2 gas compressor.
2019/4/30	Self-study (due to gas compressor trouble)					Attended		Instructor candidate performs voluntary test for trouble occurrence of CCPP-2 gas compressor.
2019/5/1	※ MHPS-TA has updated some software of the simulator (as originally planned).							
2019/5/2	**Simulation model test - Plant start-up / shut-down** - Start-up (0 → 2 on 1) - Individual shut-down (2 on 1 → 1 on 1)	Attended	Attended		Attended	Attended	Attended	Officials from the Uzbekistan government came to visit the simulator room and training center.
2019/5/3	**Simulation model test - Plant start-up / shut-down** - Additional start-up (1 on 1 → 2 on 1) - Shut-down (2 on 1 → 0)	Attended	Attended	Attended	Attended	Attended		
2019/5/4								
2019/5/5								
2019/5/6	**Simulation model test - Malfunction test** - GT portion	Attended	Attended	Attended	Attended	Attended		
2019/5/7	**Simulation model test - Malfunction test** - ST portion	Attended	Attended		Attended	Attended		
2019/5/8	**Simulation model test - Malfunction test** - HRSG portion	Attended	Attended	Attended	Attended	Attended		MHPS-TA explained the difference between NAVOI ccpp 1 and the model of the simulator in the flow outline.
2019/5/9	War memorial day（National holiday in Uzbekistan）							
2019/5/10	**Simulation model test - Malfunction test** - HRSG portion, Electrical	Attended			Attended	Attended		
2019/5/11								
2019/5/12								
2019/5/13	**Simulation model test - Malfunction test** - BOP portion	Attended	Attended		Attended	Attended		
2019/5/14	**Training - Simulator use (OPS)**	Attended	Attended	Attended	Attended	Attended		
2019/5/15	**Training - Simulator use (OPS, EMS)**	Attended	Attended		Attended	Attended	Attended	The CCPP-1GT was shut down due to a gas compressor problem (then recovered).
2019/5/16	**Training - Simulator use (OPS, EMS)** **Comprehension test conducted（all 5 trainees passed）**	Attended	Attended		Attended	Attended	Attended	
2019/5/17	**Completion Report / Organize / Clean up**							

（ Source : JET）

Table 6.7-2 Attendance List for “Simulator Pilot Training”

		Mr. Jamshid PIRMANOV Navoi CCPP-2 Leading engineer on TME	Mr. Shukhrat BAYLIEV Navoi CCPP-2 Engineer on TME	Mr. Lutfillo KHUDOYKULOV Navoi CCPP-2 Seinior master on operation	Mr.Ulmas KADIROV Navoi CCPP-2 Engineer Programmer	Mr. Khudoyor KHALILOV Navoi CCPP-1 Engineer Programmer	Mr. Uktam KUVANOV Navoi CCPP-2 Engineer I&C	Mr. Fakhriddin BAZAROV Navoi CCPP-1 Shift Manager	Operator participant	Remarks
2019/6/14	**Simulator equipment specification check**	Attended	Attended		Attended	Attended	Attended			The equipment specifications of this simulator were explained to the trainers.
2019/6/15										
2019/6/16										
2019/6/17	**Training operation explanation, Training for mindset** **B-003 CONDENSATE PUMP(A) FAULT**	Attended	Attended		Attended	Attended	Attended			Prior to the pilot training, we explained the operation of the training and lectures on the attitude of the instructor.
2019/6/18	**G-013 GT1 DISC CAVITY TEMP HIGH** **S-015 ST LUBE OIL COOLER(A) PERFORMANCE DEGRADATION**	Attended	Attended	Attended	Attended	Attended	Attended		5	
2019/6/19	**G-063 GT1 BLEED MP VALVE ABNORMAL(CLOSE)** **G-021 GT1 TCA TUBE LEAK** **B-018 CIRCURATING WATER PUMP(A) FAULT**	Attended	Attended	Attended	Attended	Attended	Attended		8	
2019/6/20	**E-006 STG AVR TROUBLE** **G-007 GT1 FUEL GAS HDR PRESS LOW**	Attended	Attended	Attended	Attended	Attended	Attended		12	The trainees made "Marfunction contents list" (8 cases).
2019/6/21	**G-037 GT1 FUEL GAS TEMP LOW (C/C)** **H-031 HRSG1 IP DRUM LCV STUCK CLOSE**	Attended	Attended		Attended	Attended	Attended		6	University student visit (1 person) The trainees made "Marfunction contents list" (2 cases).
2019/6/22										
2019/6/23										
2019/6/24	**S-003 VACUUM PRESS LOW** **H-007 HRSG1 HPEVA TUBE LEAK**	Attended	Attended			Attended	Attended	Attended	8	TA lectured on the water quality management to the trainees.
2019/6/25	**B-009 GLAND STEAM PRESSURE CONTROL VALVE STUCK CLOSE** **G-019 GT1 FGH TUBE LEAK** **S-008 HPMSV(LH)STUCK CLOSE**	Attended	Attended	Attended		Attended	Attended		4	TA & trainees discussed the homework (the cause of the condenser vacuum drop).
2019/6/26	**G-041 GT1 ROTER COOLING AIR TEMP HIGH(S/C)** **G-027 GT1 LUBE OIL TEMP HIGH** **G-017 GT1 AIR INLET FILTER CHOKE**	Attended	Attended	Attended		Attended	Attended		6	
2019/6/27	**Additional lecture (trainee creation), whole reflection**		Attended	Attended		Attended	Attended		2	The trainees made "Marfunction contents list" (8 cases).

（ Source : JET）

Chapter 7

7. Activities for Procurement of GT Cut Model and Simulator

7.1 Implementation of Procurement of GT Cut Model

7.1.1 Needs Survey for Specification of GT Cut Model

(1) UE requested JET to procure and supply a GT Cut Model, based on the M701F4 GT designed and installed in Uzbekistan by MHPS. This is because MHPS is the only manufacturer able to design and manufacture a GT Cut Model based on the installed CCGT in Navoi CCPP-1. UE is expected to promote the effective training using the GT Cut Model, along with the basic structure of M701F4 type of MHPS.

(2) UE proposed a GT Cut Model equipped with an electric rotor instead of a fixed one, and a combustor equipped with electrical illumination decoration. The details of the specifications of the F type GT Cut Model agreed between UE and JET are shown in the table below.

Table7.1-1 Specifications of F type GT Cut Model

MHPS made M701F4 Gas Turbine Model for Navoi Training center		
1	Scale	1/15 Model
2	Model Total length The entire outline dimensions	1,147mm About W1,250mm ※ D700mm, H600mm
3	On a semi-casing 90 degrees cut	
4	Motorized rotor	
5	The stationary blade is produced in a range that looks.	
6	Combustor with decorative illumination	
7	Combustor is up and down and a half each 2 radical production in the range of visible.	
8	Materials: Resin / ABS	
9	Name with a plate of the air intake chamber, compressor, combustor, turbine, exhaust chamber. (Nameplate displayed in English and Russian)	

(Source: JET)

● Exhibition stand: Floor stand (with pipe leg), finishing melamine decorative, acrylic cover (without frame), with a title nameplate (display in English and Russian)

MHPS Gas Turbine (M701F4) Cut Model	
	

7.1.2 Examples for Utilization of GT Cut Model

JET introduced a practical use of the GT Cut Model to UE showing the example in a Japanese power company.

7.1.2.1 Newly assigned staff of CCPP in the thermal power unit of the electric power company are supposed to acquire knowledge on power generation from the thermal power technological textbooks of “Basic Edition of Power Generation” and “Edition of Power Generation.”

In order to understand the principles of Gas Turbines and their structures (equipment including Compressors, Combustors, Turbines, etc.), use of the GT Cut-Model in a classroom lecture and practical training course are effective for O&M staff training.

7.1.2.2 For general CCPP of visitors who will see the cut model of the GT, it is PR of a power plant operated by a high efficiency gas turbine.

Type：F Type GT Cut Model
Scale：(1/15Type)

7.1.3 Pre-shipment and Witness Test of Factory Inspection for GT Cut Model

7.1.3.1 Witness Test of Factory Inspection for GT Cut Model：

It shows the Factory Witness Inspection and Test Results for GT Cut Model due to JET below:

(1) Date and Time：Apr.9,2018 13:30～15:15

(2) Venue: Mitsubishi Hitachi Power Systems, LTD. Takasago Factory (Japan)

(3) Participants：【JET】；Y. Murata, H. Wakabayashi, H. Iwashita

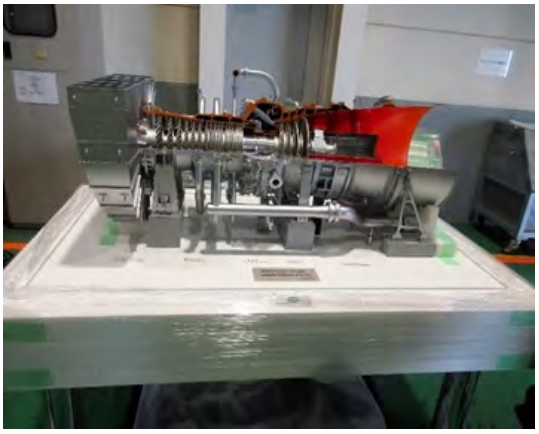
Inspection responsibility section：MHPS Quality Management Division

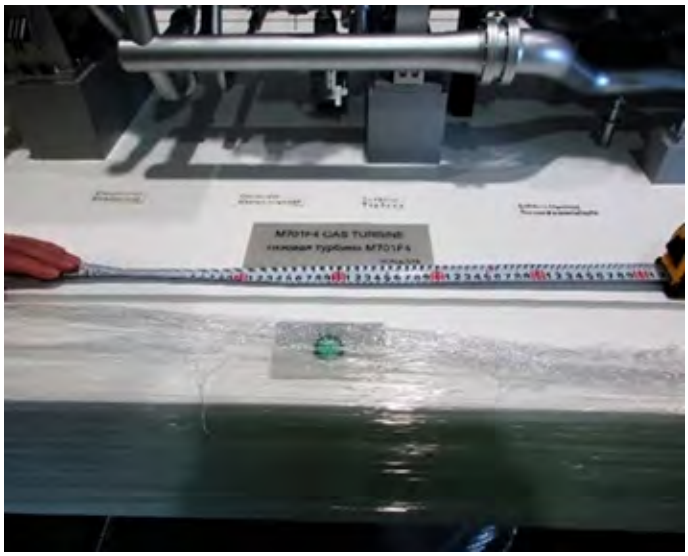
(4) Inspection and Test Items：

1) Appearance Inspection (Visual Inspection)
2) Dimensional Inspection
3) Operation Test

(5) Factory Witness Inspection and Test Results: As shown in the table below, it was confirmed that there is no abnormality.

Table 7.1-2 Factory Witness Inspection and Test Results for GT Cut Model

Test Items	**Test Procedure**	**Acceptance Criteria**	**Results**	
			JET	**MHPS**
Appearance Inspection (Visual Inspection)	・Check overall appearance	・Confirm there is no apparent damage. ・Confirm there are nameplates for air inlet equipment, compressor, combustor, turbine, and exhaust gas equipment.	GOOD	GOOD
				

<table>
<tr><td rowspan="2">Dimensional Inspection</td><td>・Outline dimensions of main parts conforming to the approved document.</td><td>To be confirmed as per approved document.
1. DWG. No. AD-23590
Witness Inspection and Test Procedure at Shop GT Model</td><td rowspan="2">GOOD</td><td rowspan="2">GOOD</td></tr>
<tr><td colspan="2">  </td></tr>
<tr><td rowspan="2">Operation Test</td><td>・Press the switch on exhibit stand, and confirm the rotor rotation and combustor lamps turn on.</td><td>・Confirm rotor rotation.
・ Confirm combustor lamps turn on.</td><td rowspan="2">GOOD</td><td rowspan="2">GOOD</td></tr>
<tr><td colspan="2">  </td></tr>
</table>

(Source: JET)

7.1.3.1 Pre-shipment Inspection for GT Cut Model

The implementation results of the Pre-shipment Inspection for GT Cut Model by JET is shown below.

(1) Date and Time：13:30～16:00 Apr.17,2018

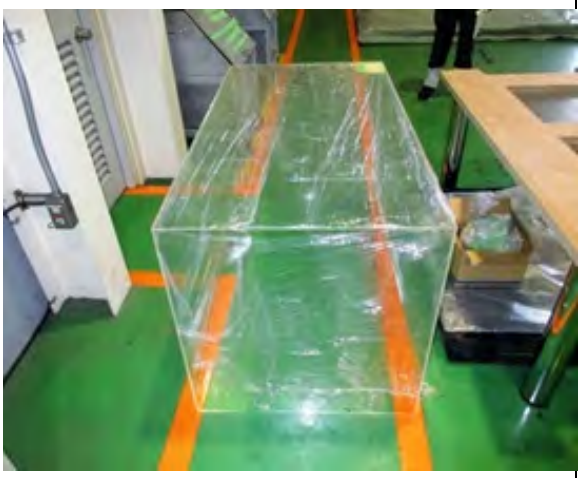
(2) Venue: Nissho Logistics Co., Ltd. Warehouse (Urayasu City, Chiba Prefecture)

(3) Participants：【JET】Y. Murata, H. Wakabayashi

Inspection responsibility section：MHPS Quality Management Division

(4) Inspection items of GT Cut Model : Shown in the table below.

Table 7.1-3 Inspection Items of GT Cut Model

No.	Items	Brand	Quantity
1	Gas turbine model	M701F4　Gas turbine model 	1
2	【Accessories】 Showcase	Melamine makeup acrylic cover 	1

3	【 Accessories】 Exhibition stand	Floor type 	1

(Source: JET)

(5) Inspection and Test Items：

1) Appearance Inspection (Visual Inspection)
2) Dimensional Inspection
3) Operation Test

(6) Results of Pre-shipment Inspection：

JET and MHPS confirmed no abnormality, as shown in the table below.

Table 7.1-4 Results of Pre-shipment Inspection for GT Cut Model

Test Items	**Test Procedure**	**Acceptance Criteria**	**Results**	
			JET	**MHPS**
Appearance inspection (Visual Inspection)	・Check overall appearance	・Confirm there is no injury or damage appearing. ・Confirm there are nameplates for air inlet equipment, compressor, combustor, turbine, and exhaust gas equipment.	GOOD	GOOD
Dimensional Inspection	・Outline dimensions of main parts conforming to the approved document.	To be confirmed as per approved document. 2. DWG. No. AD-23590 Witness Inspection and	GOOD	GOOD

		Test Procedure at Shop GT Model		
Operation Test	・Press the switch on exhibit stand, and confirm the rotor rotation and combustor lamps turn on.	・Confirm rotor rotation. ・ Confirm combustor lamps turn on.	GOOD	GOOD

(Source: JET)

7.1.4 Site Test for Hand-over of GT Cut Mode

(1) Participants: JET Mr. Murata, Mr. Wakabayashi, Mr. Iwashita and staff and trainers of Navoi Training Center

(2) The table below shows the implementation results of the site acceptance test of GT Cut Model.

Table 7.1-5 Results of Site Hand-over Test for GT Cut Model

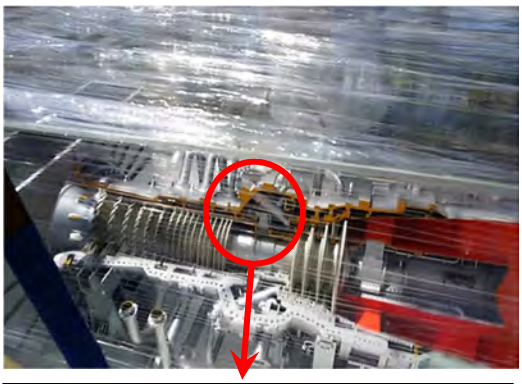
【 Date :2018/5/5 Packing material in the transport car】

Appearance inspection: no abnormality

【 Date :2018/5/5 Unloading the packing material from transport car】

Appearance inspection: no abnormality

【 Date :2018/5/5 Operation confirmation test performed on the rotor and the combustor: No abnormality 】



The electrical decoration of the combustion chamber was visually inspected and operation checked. Confirmed no abnormalities.

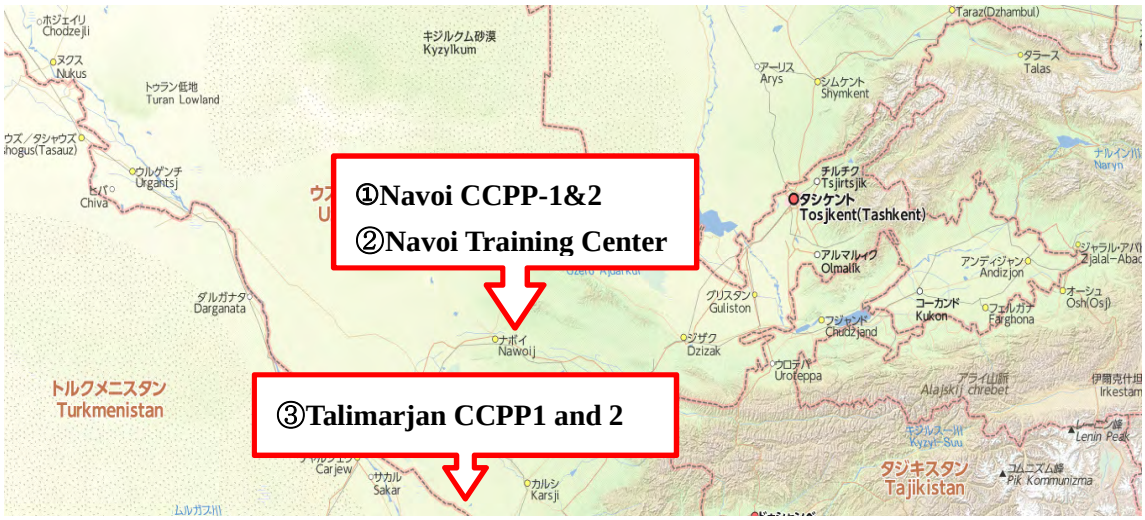
After unpacked inspection, GT Cut-Model was repacked and carried in the storage of NTPP.

(Source: JET)

7.2 Implementation of Procurement of Simulator

7.2.1 Site Survey for Monitoring Works in CCR and Equipment for Operation

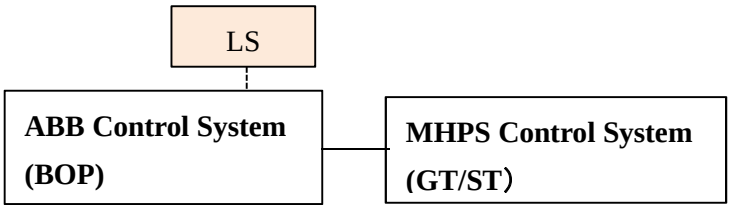
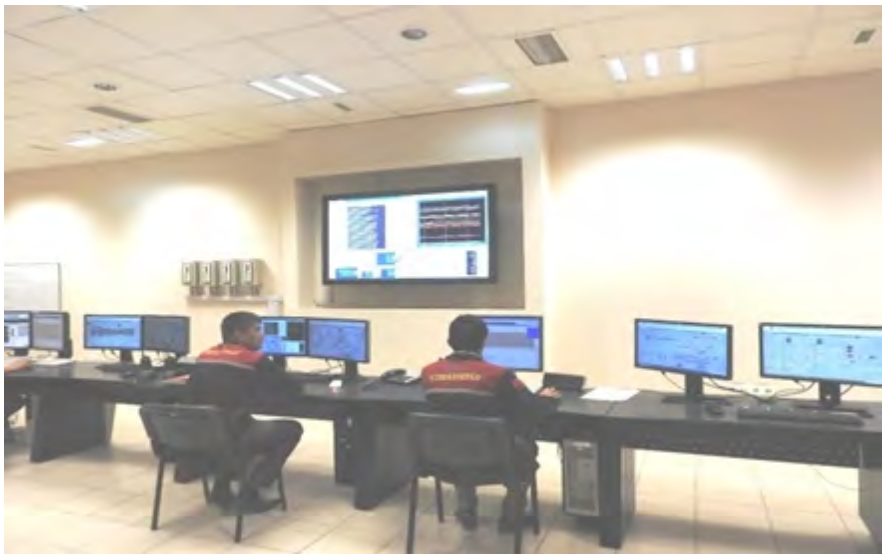
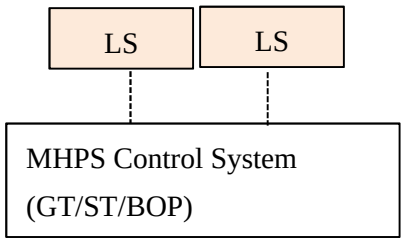
(1) The locations of the visit destinations in Uzbekistan are shown below.



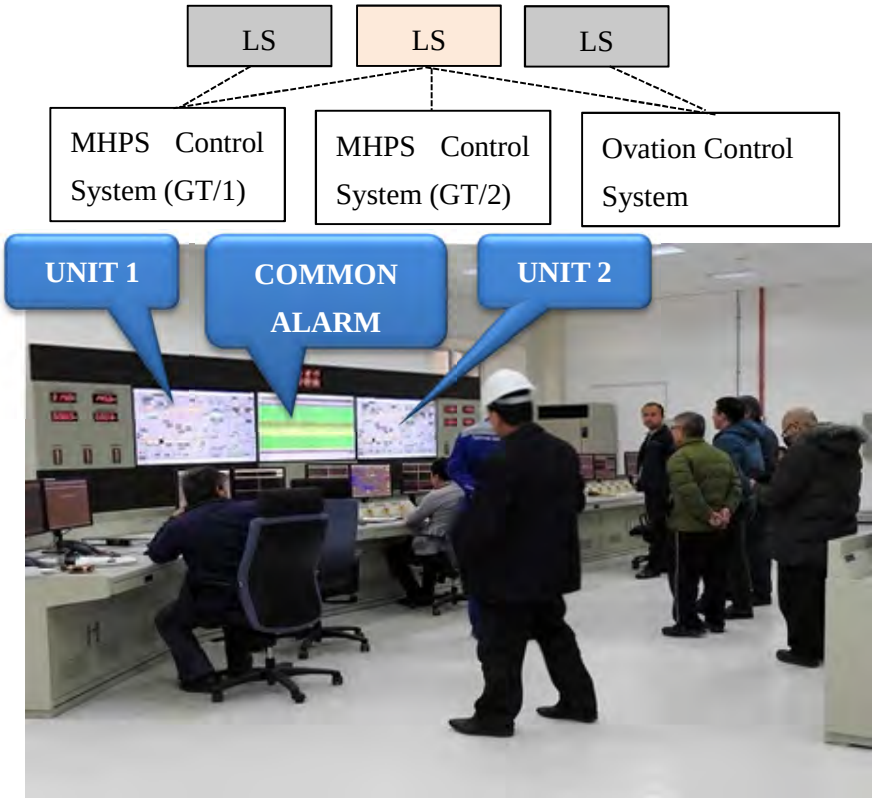
(2) The following table shows the survey results for monitoring and control equipment in CCR.

Table 7.2-1 Monitoring and Control of Equipment in CCR

	Navoi CCPP-1	Navoi CCPP-2	Talmarjan CCPP-1 & 2
Main Equipment Specifications	GT (MHPS made)：315MW (15　) ×1 ST　T　(MHPS made)：164.15MW (GT100%) ×1	GT (MHPS made)：325MW (15　) ×1 ST (MHPS made)：162MW (GT100%) ×1	GT (MHPS made)：320MW (15　) ×2 ST：(Fuji Electric made)：156MW (GT100%) ×2
GT Operation Condition	・Acceleration Speed：Appr. 135 rpm / min. ・Max. range of Min. load：6.6% of min. load GT (20MW/min.)	・Acceleration Speed：Appr. 135 rpm / min. ・Max. range of Min. load：6.6% of min. load GT (20MW/min.)	・Acceleration Speed：Appr. 135 rpm / min. ・Max. range of Min. load：6.6% of min. load GT (20MW/min.)
Cooling System	Water Cooling System	Air Cooling　System	Water Cooling System

Large Screen (LS) Monitoring System	Navoi CCPP-1:   Navoi CCPP-2:  

Talimarjan CCPP-1 and 2 :



(Source: JET)

7.2.2 Needs Survey for Simulator System to be installed

(1) For simulator training, NTC/NTPP advised how to teach the skills and knowledge of the operation and maintenance of CCPP as follows:

1) Training in the handling of the GT control system installed in Navoi CCPP-1.
2) Shift Managers of Navoi CCPP-1 who are familiar with the control system of MHPS will

be selected as the candidates for simulator trainers for O&M staff training.

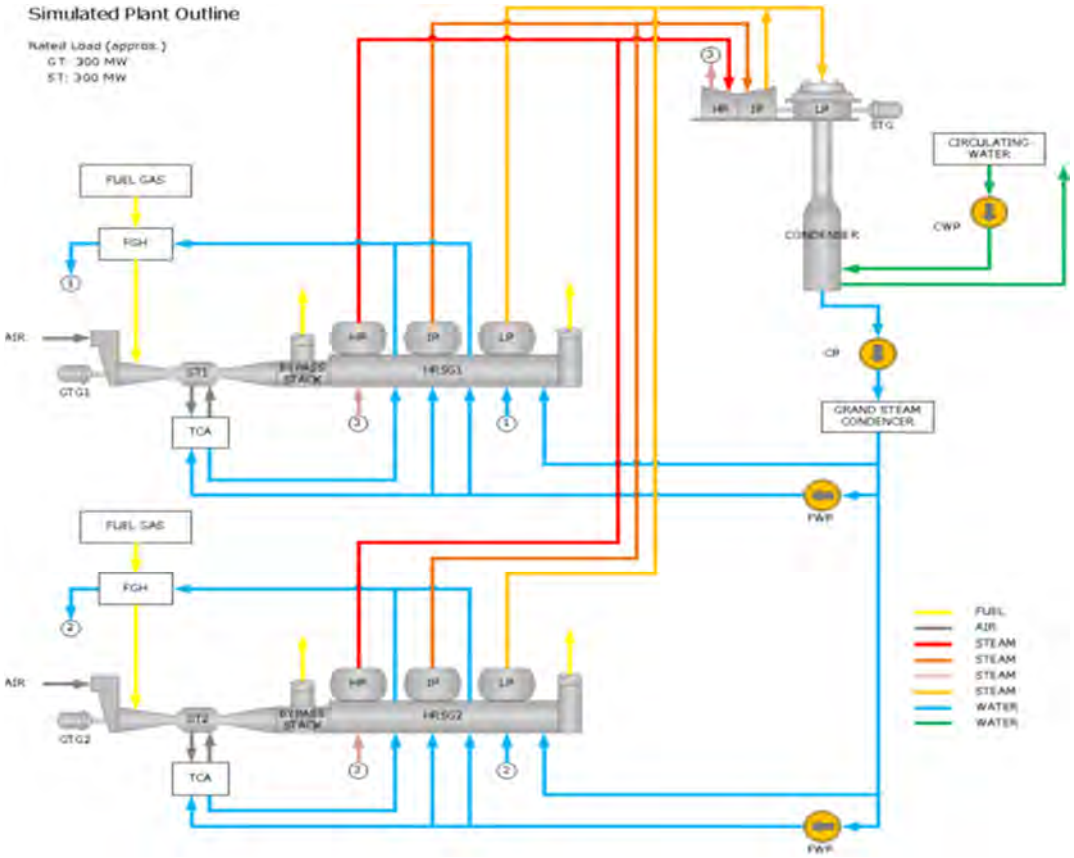
3) Programmers and I&C staff will learn the program of the graphics screen and control logic of the control system, i.e. "Netmation", made by MHPS.
4) In simulator training, it is most effective to use the system equivalent to the GT control system, i.e. “Netmation”, operated by trainers in daily work at CCPP-1.
5) The control system enables the gathering of information on an abnormality, such as failure through the data communication with an installed gas turbine or other device.

7.2.3 Scope of Supply for Simulator

(1) The simulator of this project is designed to reflect the equipment configuration of the MHPS Standard, i.e. “Gas Turbine, F type 2 on 1”.

※ The Schematic diagram of “Gas Turbine, F type, 2 on 1” is shown below.

2 on 1: GT (Rated output: 300MW) × 2 units, ST (Rated output: 300MW) × 1 unit



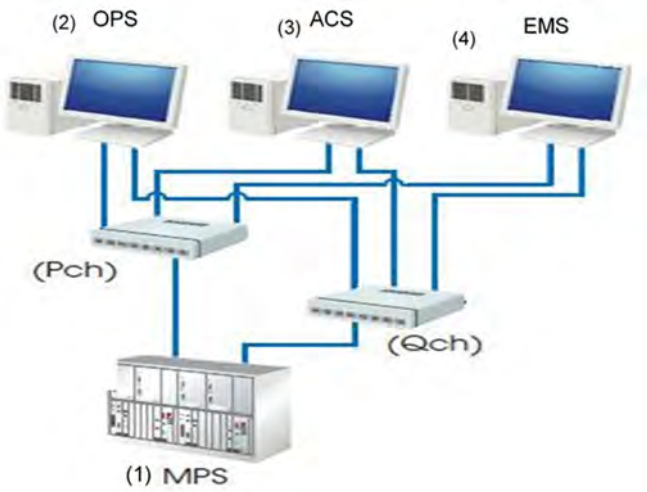
(Source: JET)

Figure 7.2-1 Schematic diagram of gas turbine F type 2-on-1 facility

(2) Scope of simulation

1) Software functions of major simulator systems：

(a) Overview of the major equipment of four software functions are shown as follows:



No.	Item	Function
(1)	MPS: Multiple Process Station	MPS is a controller CPU which manages the input and output to the Site, and controls the logic execution. In the OTS, it is simulated as the Virtual Controller.
(2)	OPS: Operator Station	OPS is the CRT operation device in CCR Graphic (system diagram) display Control loop plate (control panel) Alarm display Trend display Monitoring of logic operation status
(3)	ACS: Accessary Station	ACS is used for storage and management of various long-term data of facilities. ACS units are equipped with the following data management functions to support operation: Reports Data logging List display, etc.
(4)	EMS: Engineering and Maintenance Station	EMS is used for the maintenance of various services DIASYS Netmation offers. Configuration of control systems Creating and updating control logic for MPS Creating graphics for display on OPS

		Configuration of OPS functions Drawing management

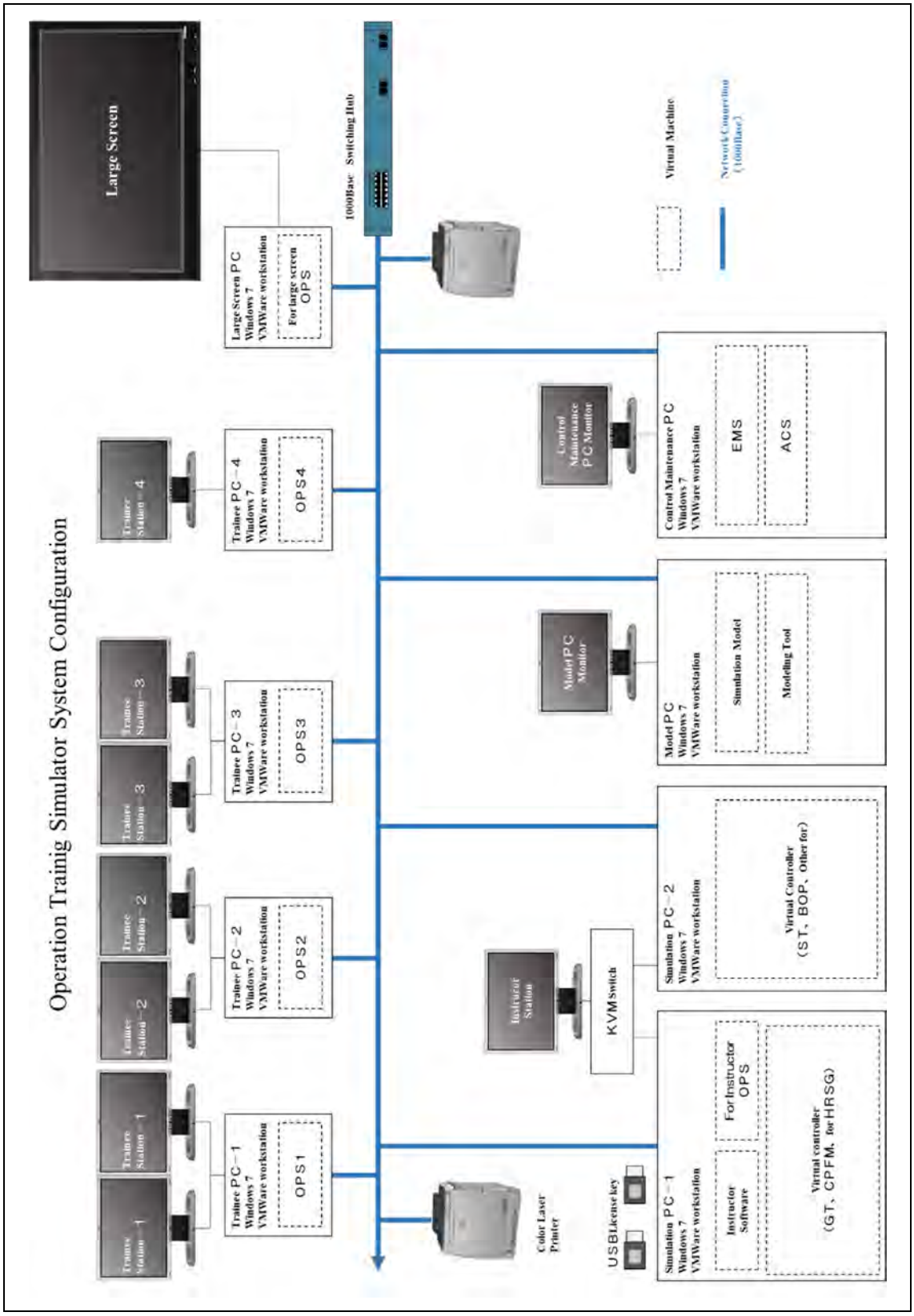
2) System configuration of OTS (Operation Training Simulator) :

(a) The main purpose of the OTS is to learn how to use Netmation software: OPS (Operator Station), EMS (Engineering and Maintenance Station), ACS (Accessory Station).

(b) The main components of OTS are: Instruction Station, DCS (Distributed Control System) simulation and a plant simulation model. These functions are provided in a Virtual Machine.

(1) Instruction Station Instructor conducts the training session by using Instructor functions. For example, Instructor can change the plant condition (initial condition) to fit the training purpose or insert malfunctions to perform the training under abnormal plant conditions.
(2) DCS Simulation Standard DCS software (OPS, EMS, and ACS) are simulated in OTS. Standard control logic is used in the OTS and calculated in virtual controllers on Simulation PC.
(3) Simulation Model High-Fidelity simulation model can be applied to OTS.

(c) The design of the OTS system is based on the "Configuration diagram of OTS system" as shown below;



(3) Summary of Simulation Model

The following table shows the summary of the simulation model, which is selected as the objects of simulation:

Table 7.2-2 Scope of Simulation

No.	Main System selected for Simulation
1	**Gas turbine System** - Gas turbine model calculates the turbine power, rotor torque, turbine speed, exhaust gas profile from fuel gas temp. / press. / flow, IGV position, combustion pressure, etc.
2	**Generator System** - The model, which calculates the generator power fixed by the energy balance of the turbine including inertia, is used.
3	**HRSG System** - High-pressure steam, intermediate pressure steam, and low-pressure steam generated by HRSG, are calculated from the heat from gas-turbine exhaust gas, and water from feed water system.
4	**Steam Turbine System** - The rotor torque and turbine speed are calculated from conditions of high-pressure steam, intermediate pressure steam, and low-pressure steam generated by HRSG.
5	**Power Grid and Electrical System** - Power to auxiliaries is consistently provided from electrical system health. - Power is calculated under single phase, according to the junction of the house service breaker, using system side as infinite bus. - Current calculation covers the main system between the generator and infinite bus. M/C bus is simulated ideal performance.
6	**Fuel system** - Flow, temperature, and pressure for fuel gas to combustor are calculated. - Fuel gas characteristics and composition are constant.
7	**Fuel Gas Heater (FGH) / Turbine Cooling Air (TCA) Cooler** - Heat exchange in FGH and TCA is simulated as counter flow heat exchanger.
8	**Feed water System / Condensate water System / Main Steam System** - Closed cycle of feed water and steam is simulated. Pressure, temperature, and flow are calculated on each representative point. Calculated mass and heat is conserved in this closed cycle.
9	**Circulating Water System / Condenser** - Water temperature, pressure and flow in circulating water systems are simulated. Heat exchange between water and ST exhaust steam at condenser is calculated and it

	conserves the mass and heat of the closed cycle.
10	**Instrument Air System** - Instrument air pressure is simulated as constant, on the assumption that instrument air is always normal.
11	**Lube Oil / Control Oil / Generator Oil System** - Flow, temperature, and pressure for oil are calculated in consideration of the open / close status for each valve, start / stop status for each equipment, heat exchanging performance, and so on. - Valve of shaft vibration varies with turbine speed, bearing temperature, etc.
12	**Closed Cooling Water System** - Flow, temperature, and pressure for cooling water are calculated in consideration of the open / close status for each valve, start / stop status for each equipment, heat exchanging performance and so on.
13	**Boundary Conditions** - The parameters which are necessary for simulation and also out of scope are fixed value. - These parameters are called as "Boundary Conditions." For example, water temperature, ambient temperature, infinite bus voltage / frequency and source of fuel supply.
14	**Local Operation** - Local Operation is excluded from simulation scope. - If Local Operations cannot be done from CCR, Remote Function will avail the local operations to be used for training.

(Source: JET)

(4) Items of Operation Training

The following table shows the items of Operation Training, which is included within the Simulation Scope.

Table 7.2-3 Items of Operation Training

No.	Items of Operation Training
1	Normal start-up
2	Spin Operation
3	Turning Operation
4	Auto Synchronization Note: Manual operation is out of scope.
5	Load Change Operation

5-1	Control mode – Governor (Speed Control)
5-2	Control mode – Load Limit (Load Control)
5-3	Auto Load Regulator On or Off
6	Normal Shut -down
7	Special Operation
7-1	Load Run Back / Auto Stop
8	Emergency Shut –down
8-1	GT Trip
8-2	ST Trip

(Source: JET)

(5) Out of Scope for Simulation

The following equipment, system, plant phenomena and operations are excluded from simulation.

Table 7.2-4 Out of Scope for Simulation

No.	Items
1	Gas compressor system
2	High voltage transmission system
3	Firefighting system
4	Desalination system
5	Water treatment system
6	Chemical injection system
7	Aged deterioration of the Plant
8	Combustion Pressure Fluctuation
9	Water hammer and drain production
10	Water quality changes such as pH, dissolved oxygen and so on.
11	Operation before APS start
12	Local operation
13	Water intake screen
14	Auxiliary Boiler

(Source: JET)

(6) Supply Scope of Hardware and Software

The following table shows the supply scope of hardware, software and etc., discussed and agreed between JET and NTPP/NTC, which are to be installed for the operator training station.

7.2.4 Equipment Supplied by MHPS

The equipment supplied by MHPS (hardware and software required for OTS) are shown in the following table:

Table 7.2-5 Equipment supplied by MHPS

※OTS: Operation Training Simulator,
ACS: Accessory Station,
EMS: Engineering and Maintenance Station,
OPS: Operation Station (Monitoring and Operation PC)

No.	Items	Q'ty	Remarks
1	Simulation PC/ Monitor/ Mouse (Instructor Station)	PC×1, Monitor×1	<Installed Software> (1) Instructor Software (2) Virtual Controllers (3) OPS Software for Instructor Size: 23-inch, English display
2	Trainee PC/Monitor/ Mouse (Trainee Station)	PC×4, Monitor×7	<Installed Software> (4) OPS Software Size: 23inch, English display
3	Model PC/ Monitor/ Mouse	PC×1, Monitor×1	<Installed Software> (5) Simulation Model Software (6) Modeling Tool Software Size: 23-inch, English display
4	Control Maintenance PC/ Monitor/ Mouse	PC×1, Monitor×1	<Installed Software> (7) ACS Software (8) EMS Software Size: 23inch, English display
5	Large Screen PC	PC×1,	<Installed Software> (9) OTS Software Size: 23-inch, English display
6	Large Screen	1	70-inch large screen OTS graphic Installed in "Large Screen PC" can be displayed. Size: 23-inch, English display
7	USB License Key	2	(10) OTS cannot work without USB License Key (11) Connected to Simulation PC

8	Laser Printer	2	(12) Color laser printer
9	Network HUB	1	(13) 1000 Base, Layer 2 (14) Stored in PC
10	KVM (Keyboard, Video, Mouse) Switch	2	Switch the monitor for Simulation PC1 and Simulation PC2
11	UPS (Uninterruptible Power Supply)	2	In case the main power supply to UPS shuts off for a few minutes, OTS System will be automatically shut down safely
12	Trainee Desk/ Instructor Desk	7	Simple desk ・1,400mm×800mm—3 ・1,600mm×800mm—3 ・600mm×800mm —1
13	Cable related to Simulator	1 set	
14	Spare Parts	PC×1, Monitor×1	
15	Others		
(1)	Accessories and Consumables	1 set	・Printer paper (5,000 sheets/ box) 20 boxes ・Color printer: six toner each color ・Mouse pad ・And other, 2 years of those recommended by the manufacturer

(Source: JET)

7.2.5 Equipment Procured by JICA Uzbekistan Office

The following table shows equipment procured by JICA Uzbekistan Office.

Table 7.2-6 Equipment procured by JICA Uzbekistan Office

No.	**Item**	**Qty**	**Photo**
1	Wooden Table	**1**	

2	Ergonometric Chair with wheels	**9**	
3	Whiteboard markers - Black 3 pieces - Blue 3 pieces - Red 3 pieces - Eraser 1 piece	**1 set**	
4	Telephone for emergency ※ 2 pieces directly linked without number buttons ※ 2 pieces with number buttons	**4 pieces**	
5	Transceiver	**1 set**	
6	Laptop HP Probook 450 G5	**1**	

7	Projector Epson	**1**	

(Source: JET)

7.2.6 Witness Test for Factory Inspection and Pre-shipment Inspection of Simulator Equipment

7.2.6.1 Witness test of Factory inspection of Simulator Equipment

The inspection was assisted by MHPS providing the test results based on the document submitted by MHPS, "DRW. No. D4-J2054 FACTORY WITNESS TEST PROCEDURE FOR TRAINING SIMULATOR". The details are shown below:

(1) Date: November 5-8, 2018

(2) Venue: MHPS Takasago factory

(3) Participants：

1) Navoi CCPP-1： Mr. Alishel MUSAYEV (Leading Engineer),
Mr. Latif KHASANOV (Leading Engineer Programmer)
2) JICA Tokyo Office：Mr. Tadokoro (State full name)
3) JET: Mr. Murata, Mr. Wakabayashi, Mr. Iwashita (State full name)
4) Supervisory Section: Control System Engineering Department / Takasago Control Solution

(4) Inspection Items

1) Hardware Test
2) System Start-up/Shut-down Test
3) Instructor Function Test
4) Simulation Model Test
   (a) Plant start-up / shut-down test
   (b) Malfunction Test

(5) Inspection / Test Results

As shown in the table below, it was confirmed that all the items pointed out in JET's Witness Test of Factory Inspection were corrected in the re-Witness Test of Factory Inspection. The reference is made to the report submitted by MHPS for Witness Test of Factory Inspection; "DWG. No. ARD2181118 FACTORY WITNESS TEST REPORT FOR TRAINING SIMULATOR".

Table 7.2-7 Factory Witness Test Results of Simulator Equipment

Test Item	Acceptance Criterion	Outline of issues pointed out/ Confirmation result
- **Hardware Test:**		
1. APPEARANCE CHECK 【 Simulator Equipment Set: Appearance inspection preparation】	There is no abnormality in all equipment supplied by MHPS. (Visual inspection) 	Passed
2. INTERFACE CHECK **【 Interface Test, Computer Performance Test】**	Hardware and system configurations are the same as the configurations described in the drawings “BASIC PLAN FOR TRAINING SIMULATOR” 	Passed
- **System Startup/ Shut-down Test**	Operation result is the same as “Confirmation” description in the check sheet	
- **Instructor Function Test**	Operation result is the same as “Confirmation” description in the check sheet	Remote function Test: To examine the

【 Instructor Function Test】		simulation model works properly according to the test procedure specifications. → JET conducted a five-point verification test at the retest on December 25 and confirmed that it was corrected.
- **Simulation Model Test**		
(1) Plant start-up / shut-down test **【 Plant Start / Stop Test】** **【 Plant Start-up】**	There is no irrelevant alarm and sequence delay during Plant start-up / shut-down.  	・Correction of the indication for condenser pressure and steam condition at plant startup: → JET confirmed the correction of the indication both for condenser pressure and steam condition at plant startup.

【 Plant Start-up Ready 】		
(2) Malfunction Test (30 Items) **【 Malfunction Test】**	When a malfunction is initiated, the result is the same as the malfunction specification defined in D4-J2050 MALFUNCTION SPECIFICATION FOR TRAINING SIMULATOR (cause, malfunction degree, event and so on). 	・ 11 items of Failure: Malfunction must be operated according to the test procedure specifications. → During the retesting session on December 25, JET conducted a verification test based on the responses to the 11 items pointed out and no problems were particularly identified.

(Source: JET)

＜Drawings and related test items submitted by MHPS＞

Drawing-No.	Drawing- Name	Factory Acceptance Test						
		(1)			(2)	(3)	(4)	
		(i)	(ii)	(iii)			(i)	(ii)
D3-J0037	Layout Drawing for Training Simulator	✓						
D4-J2046	Hardware Specification	✓	✓	✓				

	for Training Simulator							
D3-J0038	Schematic Drawing for Training Simulator	✓	✓	✓				
D4-J2047	Instructor Function Specification for Training Simulator				✓	✓		
D4-J2051	Plant Model Specification for Training Simulator						✓	✓
D4-J2050	Malfunction Specification for Training Simulator							✓

- Hardware Test：(a) Appearance Check, (b) PC Performance Check, (C) Interface Check
- SystemStart-up/ Shut-down Test
- Instructor Function Test
- Simulation Model Test：(a) Plant Start-up/ Shut-down Test, (b) Malfunction Test

7.2.6.2 Pre-shipment inspection of simulator equipment

(1) Date：March 7, 2019

(2) Venue: Ryowa Electric Instrumentation Co., Ltd. Takasago Factory

(3) Participants：

【JET】Y. Murata, H. Iwashita

Inspection responsibility section: Control system engineering department

Control Solution, Takasago

(4) Inspection Results；

As a result of the inspection of equipment specifications, quantity, serial number, visual inspection and etc., the two companies, JET and MHPS agreed that all goods are passed.

7.2.7 Unpacking the Transportation Packages and Attending Inspection of Simulator

7.2.7.1 Unpacking simulator training equipment (MHPS supply equipment)

(1) Date ：April 17, 2019

(2) Venue ： NavoiCCPP-2 warehouse

(3) Participants ：【JET】Mr. Murata, Mr. Wakabayashi, Mr. Iwashita

MHPS ：TA (2 Persons)

NTC：Mr. Aybek ADINOV (Specialist) and 6 others

(4) Results of unpacking

Results of unpacking of the packages: No damages were identified by visual inspection after unpacking of the transport packages (10 pieces) of Simulator.

Unpacking inspection	
	
	
	

7.2.7.2 Inspection of goods

All the items have passed the inspection criteria after visual inspection of specifications, quantity and serial numbers of the training equipment, etc. in the presence of the three parties (JET, Navoi Training Center, and MHPS).

Table 7.2-8 Inspection results of equipment supplied by MHPS

※OTS: Operation Training Simulator, ACS: Accessory Station

EMS：Engineering and Maintenance Station, OPS： Operation Station

No.	Specifications	Qty	Serial No. Check and Visual Inspection	Results
(1)	Instructor Station Unit： (a) Instructor PC： HP (Hewlett Packard) Elite Desk 800 G3 SF (b) Monitor： EIZO Flex Scan EV2451-BK ③ Keyboard (English) ④ Mouse ⑤ Cable ＜Installed Software＞ (15) Instructor Software (16) Virtual Controllers (17) OPS Software for Instructor Size：23inch, English display	2 1 1 1 1	JPH825JD JPH825J0B 96201058 BEXHP0BVBAP3SI FCMHH0AHDAL79T	Pass
(2)	Operator Station Unit： (a) Trainee PC： HP (Hewlett Packard ） Elite Desk 800 G3 SF ② Monitor： EIZO Flex Scan EV2451-BK ③ Keyboard (English)	4 7 4	JPH825J08 JPH825J05 JPH825J07 JPH825J06 96195058 96130058 96020058 96204058 96192058 96199058 96194058 BEXHP0BVBAP35J BEXHP0BVBAP35K	Pass

	④ Mouse ⑤ Cable ＜Installed Software＞ - OPS Software Size：23inch, English display	4 7	BEXHP0BVBAP35A BEXHP0BVBAP3SG FCMHH0AHDAL7AC FCMHH0AHDAL7AH FCMHH0AHDAL79U FCMHH0AHDAL7AP	
(3)	Simulation Mode Unit： 1. Simulation PC： HP (Hewlett Packard) Elite Desk 800 G3 SF ② Monitor: EIZO Flex Scan EV2451-BK ③ Keyboard (English) ④ Mouse ⑤ Cable ＜Installed Software＞ (18) Simulation Model Software (19) Modeling Tool Software Size：23-inch, English display	 1 1 1 1 1	 JPH825J02F 96189058 BEXHP0BVBAP35B FCMHH0AHDAL787	 Pass
(4)	Control Maintenance Unit： ① Control PC： HP (Hewlett Packard ） Elite Desk 800 G3 SF ② Monitor: EIZO Flex Scan EV2451-BK ③ Key board (English) ④ Mouse ⑤ Cable ＜Installed Software＞ (20) ACS Software (21) EMS Software Size：23-inch, English display	 1 1 1 1 1	 JPH825J02B 96197058 BEXHP0BVBAP3SF FCMHH0AHDAL780	 Pass

(5)	① Large Screen PC： HP (Hewlett Packard ） Elite Desk 800 G3 SF ② Cable ＜Installed Software＞ (22) OTS Software Size：23-inch, English display	1 1	JPH825J029	 Pass
(6)	① Large Screen： NEC LCD-P703 ② Cable - 70-inch large screen OTS graphic installed in “Large Screen PC” can be displayed. Size：23-inch, English display	1 1	84100626NJ	 Pass
(7)	USB License Key： WIBU SYSTEMS (23) OTS cannot work without USB License Key - Connected to Simulation PC	1	2-2999179	 Pass
(8)	① Laser Printer： HP（Hewlett Packard）Laser Jet Enterprise M750dn ② Cable - Color laser printer： ※One is for Instructor, the other is for trainee	2 2	CNFKL5YFRX CNFKL6MC9D	 Pass
(9)	① Network HUB：BLACKBOX LGB616A ② 1000Base-Cable ※1000Base, Layer 2 / Stored in PC	1 1	25181600232	 Pass
(10)	KVM (Keyboard, Video, Mouse) Switch： ATEN CS1912 ※Switch the monitor for Simulation PC1 and Simulation PC2	2	A1I3-106-0037 A1I3-106-0039	 Pass
(11)	Trainee Desk (1～3) ：Simple desk	3		Pass

	MHPS（W1400 × D800 × H700 mm^3）			
(12)	Trainee Desk 4 ：Simple desk MHPS（W1600 × D800 × H700 mm^3）	1		Pass
(13)	Instructor Desk ：Simple desk MHPS（W1600 × D800 × H700 mm^3）	1		Pass
(14)	Control Maintenance Desk ：Simple desk MHPS（W1600 × D800 × H700 mm^3）	1		Pass
(15)	UPS RACK ： MHPS（W600W × 850D × 700H mm^3）	1		Pass
(16)	UPS（Uninterruptible Power Supply）： OMRON BU2002RWL - In case the main power supply to UPS shuts off for few minutes, OTS System will automatically be shut down safely	2	A0817120000205G A0818010000105G	Pass
(17)	Other necessary accessories (consumables) ① LAN Cable ② AC Cable ③ Printer Paper 2,500 sheets ④ Printer Toner： 1set is 4 color (YMCK) ⑤ Speaker (4) BNM-SPL7UBK ⑥ Trip and Reset Button (Incorporated in Trainee Desk2) ⑦I/O board ⑧DI Interface Module (Incorporated in IO Simulation PC) ⑨DI Interface Cable (Incorporated in Trainee Desk2) ⑩IO Terminal Block (Incorporated in Trainee Desk2) ⑪IDEO Extender VE901T VE901R	 12 23 10 6 1 1 1 1 1 1 1 1 1	 OG180300392 OG180300211 OG180300321 OG180300397 A1H6-373-0031	Pass

	⑫Wall Mount kit PDW T XL ⑬Security Wire SLE-6S-1 ⑭USB Port Lock　(Only Port Lock) SL-46BLOP ⑮USB Port Lock　(Include Port Lock remove Key) SL-46-BL ⑯ Power Supply Cable ※about 60m	1 1 1 9 19 1 6	A1H6-373-0031	
(18)	Spare Parts： 7　　PC (Instructor) HP（Hewlett Packard）Elite Desk 800 G3 SF ①　Monitor (Instructor) EIZO Flex Scan EV2451-BK ②　USB License Key： WIBU SYSTEMS	 1 1 1	 JPH825J02C 96131058 3-4157528	Pass
(19)	Consumables required for trial operation： ①　Printer Paper　2,500 sheets ②　Printer Toner : 1set is 4 color(YMCK)	 2 2		Pass

(Source: JET)

7.2.8 Witness for Carrying in and Installation of Simulator Equipment

7.2.8.1 Carrying training equipment into the simulator room

(1) Date：April 17, 2019

(2) Participants：【JET】Y. Murata, H. Wakabayashi, H. Iwashita

MHPS；2 persons of TA

Persons involved of NTC

(3) Equipment to be carried in

Carrying-out the supply equipment of MHPS which has been temporarily stored in a warehouse in the NavoiCCPP-2

Carrying-out the supply equipment of JICA which has been temporarily stored in the Navoi TPP warehouse

Carry equipment into the simulator room (2F) and temporarily place it in place

7.2.8.2 Witness of simulator equipment installation work

(1) JET witnessed the installation work of the simulator equipment in the table below.

The defective equipment is as follows:

1) Call test was not possible because there was no power supply to the emergency telephone supplied by JICA.

2) One monitor was defective (Video does not appear); Serial No. 96199058

→ Replacement with spare monitor: Serial No. 96131058

In addition, the defective monitor will be replaced with a new one, and will be stored at the Navoi Training Center in the middle of July as spare equipment.

(2) The work inspection items that JET witnessed in the installation work of the simulator equipment are as follows:

1) Appearance check of all equipment

2) Large screen mounting:

-Video amplification device (Video extender) installation and Large screen: LAN cable laying

3) Installation of USB port connector protective cover and cap for each PC

4) UPS Rack: Cable connection

5) LAN and UPS power supply cable laying, grounding wire installation (each desk panel)

6) Determining the position of the desk panel: Operator room, Instructor room

7) Installation of simulator equipment: Telephone installation and wiring work, whiteboard installation, chair Installation

8) Power on and start up each device

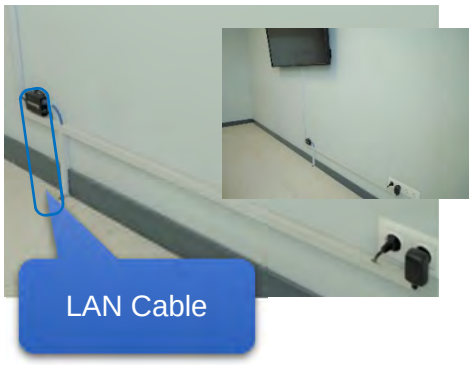
＜Reference Drawings ＞

Drawing- No.	**Drawing- Name**
D3-J0038	**Schematic Drawing for Training Simulator**

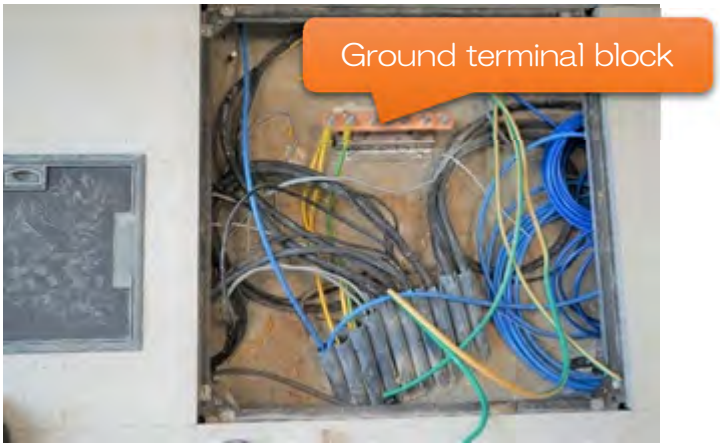
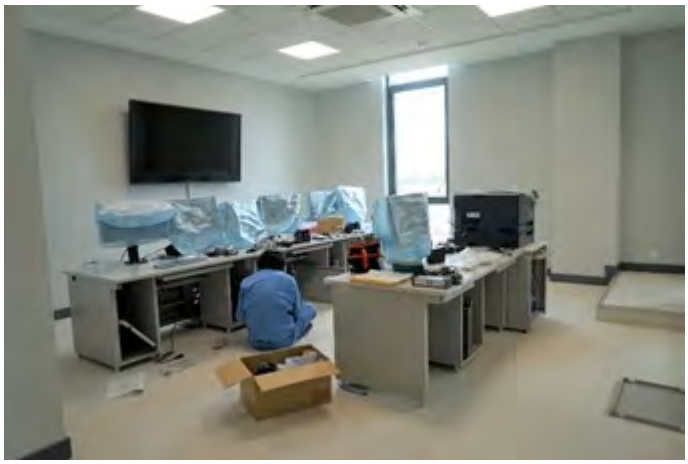
(3) The table below shows the results of the witness inspection of the installation of training equipment.

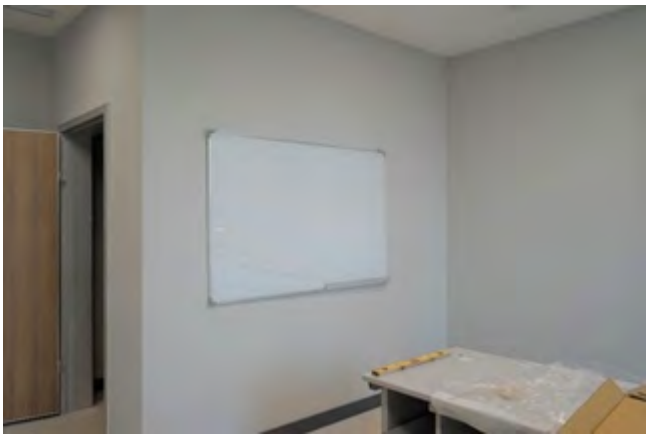
Table 7.2-9 Witness inspection results of installation work of training equipment

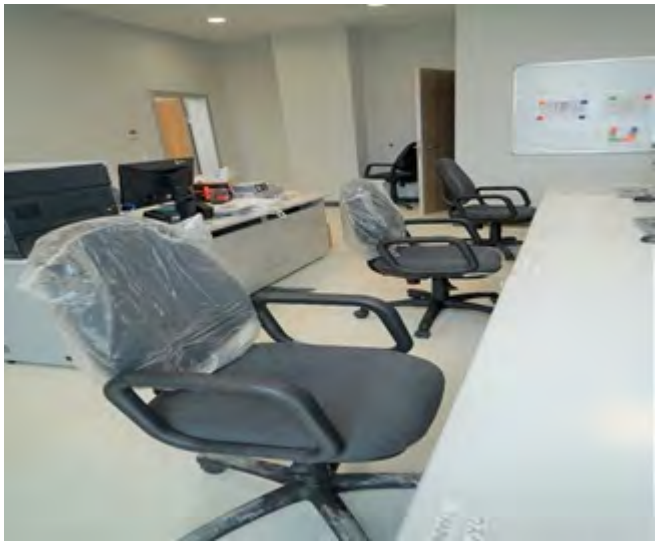
No.	**Witness inspection items**	**Remarks**
1	Appearance check of all equipment	Pass
2	＜Large screen mounting＞	Pass

	 ＜Video amplification device (Video extender) installation, LAN cable laying＞  	
3	< Installation of USB port connector protective cover and cap for each PC>	Pass

		
4	＜UPS Rack: Cable connection＞ 	Pass
5	＜Laying LAN and UPS power supply Cable＞  ＜Grounding wire installation (each desk board)＞	Pass

		
6	Determining the position of the desk panel ： ＜Operator room＞  ＜Instructor room＞ 	Pass Pass
7	Installation of simulator equipment:	

	＜Telephone installation and wiring work＞ The call test was not possible because there was no power supply to the emergency telephone supplied by JICA.  ＜White board installation＞  ＜Chair installation＞	The NTC side will carry out the construction later. Pass Pass

		Pass
8	＜Power on and start-up each device＞ ※ One monitor is defective; No image on the screen; Serial No. 96199058  : Used as a spare monitor Serial No. 96131058 	Training is conducted by replacing spare Monitor Pass
9	Performance check	(※)

10	Interface check	(※)
11	System restart / shutdown	(※)
※	Hardware testing and system restart / shutdown were performed during the installation period.	

(Source: JET)

7.2.9 Site Test for Handover of Simulator

7.2.9.1 Site witness test associated with the simulator training equipment hand-over

(1) As a result of conducting delivery tests on Simulator training equipment, JET determined that all the test items in the following table were acceptable because they were beyond the accepting criteria of equipment. In the meantime, on-site tests were conducted based on "D4-J2125 Site Test1 Procedure for Training Simulator" in the presence of JET, Navoi Training Center, and MHPS.

Table 7.2-10 Results of Site witness test for handover of simulator

OTS：Operation Training Simulator

Test Item	Acceptance Criteria	Results
1. Hardware Test (1) Appearance Check (Visual Inspection)	-There was no abnormality in all equipment supplied by MHPS 	Pass
(2) Interface Check -PC Performance Check	-Hardware and system configurations are the same as configurations described in the drawing "Basic Plant for Training Simulator"	Pass
2. System Start-up / Shut-down Test (1) System Start-up (2) System Restart-up/ Shut-down	-OTS system can start-up and shut-down according to the procedure.	Pass

		
3. Instructor Function Test： (1) Managing Users Function (2) Snapshot Function (3) Reset Function (4) Run/ Freeze Function (5) Simulation Speed Change Function (6) Volume Setting Function (7) Alarm Act. / Reset Function (8) Trend Monitoring Function (9) Current Value Monitoring Function (10) Malfunction Function (11) Remote Function (12) Scheduling Function (13) Instructor Operation Log Function (14) OPS Operation Log Function (15) Alarm Log Function (16) Hard Copy Function (17) Log Printing Function (18) Instructor Display Function (19) OPS Display Function (20) Backup/ Restoration	-OTS function is as specified. -Operation method for instructor station is as specifications.  	Pass Pass

Function		
4. Simulation Model Test: (1) Plant Start-up / Shut-down Test ① Start-up: (0➞ 2on1), Cold start Individual Shut-down: (2on1➞ 1on1) ② Additional Start-Up : (1on1➞ 2on1) Shut-down : (2on1➞0)	-There is no irrelevant alarm and sequence delay during Plant start-up /shut-down. 	Pass
(2) Malfunction Test ① GT Portion: 33 Cases ② ST Portion：15 Cases ③ HRSG Portion: 28 Cases ④ Electrical Portion: 11 Cases ⑤ BOP Portion: 20 Cases Total：107 Cases	-Pre-programmed Malfunction function is the same as the specifications. 	Pass

(Source: JET)

＜MHPS submitted drawings and related test items＞

Drawing-No.	Drawing- Name	Site Acceptance Test						
		(1)			(2)	(3)	(4)	
		(i)	(ii)	(iii)			(i)	(ii)
D3-J0037	Layout Drawing for Training Simulator	✓						
D4-J2046	Hardware Specification for Training Simulator	✓	✓	✓				
D3-J0038	Schematic Drawing for Training Simulator	✓	✓	✓				
D4-J2045	Basic Plan for Training	✓	✓	✓	✓	✓	✓	✓

	Simulator							
D4-J2047	Instructor Function Specification for Training Simulator				✓	✓		
D4-J2049	Insulation Procedure for training Simulation	✓	✓	✓				
D4-J2051	Plant Model Specification for Training Simulator						✓	✓
D4-J2050	Malfunction Specification for Training Simulator							✓

(1) Hardware Test：(1) Appearance Check, (2) PC Performance Check, (3) Interface Check
(2) SystemStart-up/ Shut-down Test
(3) Instructor Function Test
(4) Sumilation Model Test：(1) Plant Start-up/ Shut-down Test, (2) Malfunction Test

7.2.9.1.2 Simulation operation training by TA of MHPS：

(1) Conducted training on the following simulation operation items.

<Reference Drawings>

Drawing- No.	Drawing- Name
D4-J2057	**Operating Manual for Training Simulator**

1) Operation of Simulation – Netmation OPS Use Training.

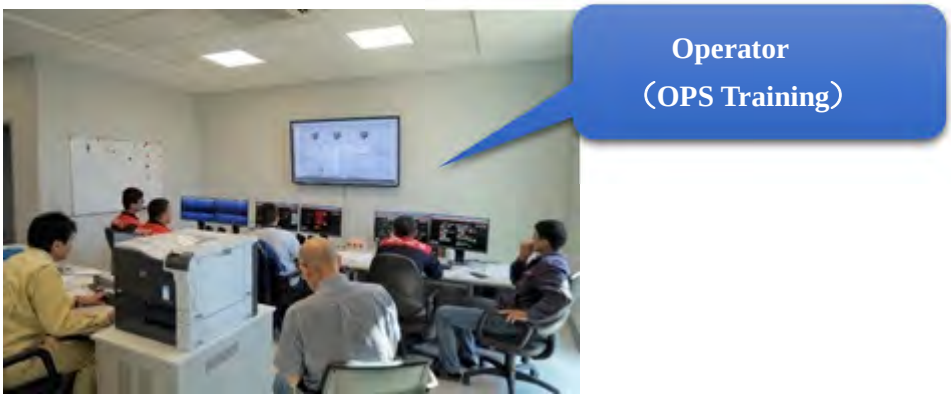
—Based on the “Simulator Plant Operation Procedure”, training was conducted on the following items.

〇APS Start-up

〇Load Operation by APR

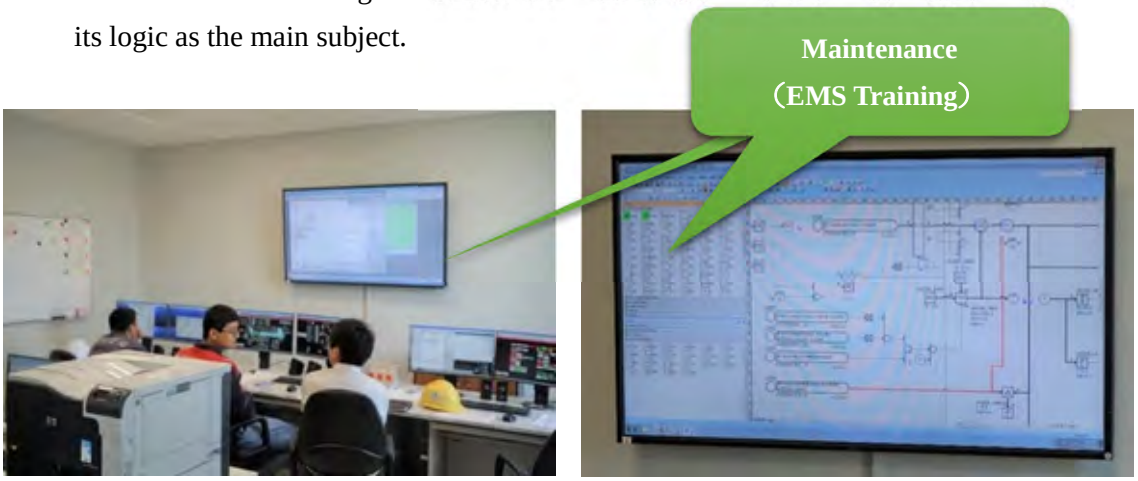
〇APS Stop

〇Switch Radiator Mode from Feed Water Mode



2) Operation of Simulation – Netmation EMS Use Training

— TA conducted training to Instructors on how to use EMS with modification methods of its logic as the main subject.



< Comprehension tests >

(1) Method to confirm Trainees' comprehension: We confirmed the Trainees' comprehension with 69 questions on the operation of Simulators by TA. In the meantime, the Trainees complemented their deficiency in comprehension with questions and answers, etc.

(2) Test method: As method to use Simulators, we conducted comprehension confirmation tests by paper, focusing on the hardware structure and Instructor function.

*We conducted the tests from Table 7.2-12 "Test items and contents of the comprehension confirmation tests."

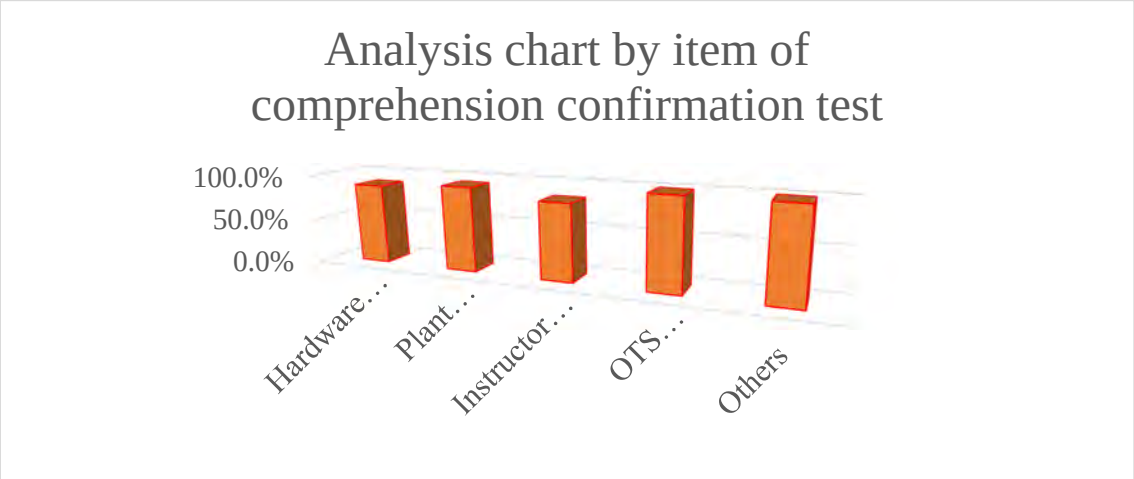
(3) Test-takers: 5 Instructors from Navoi Training Center who witnessed the on-site acceptance tests.

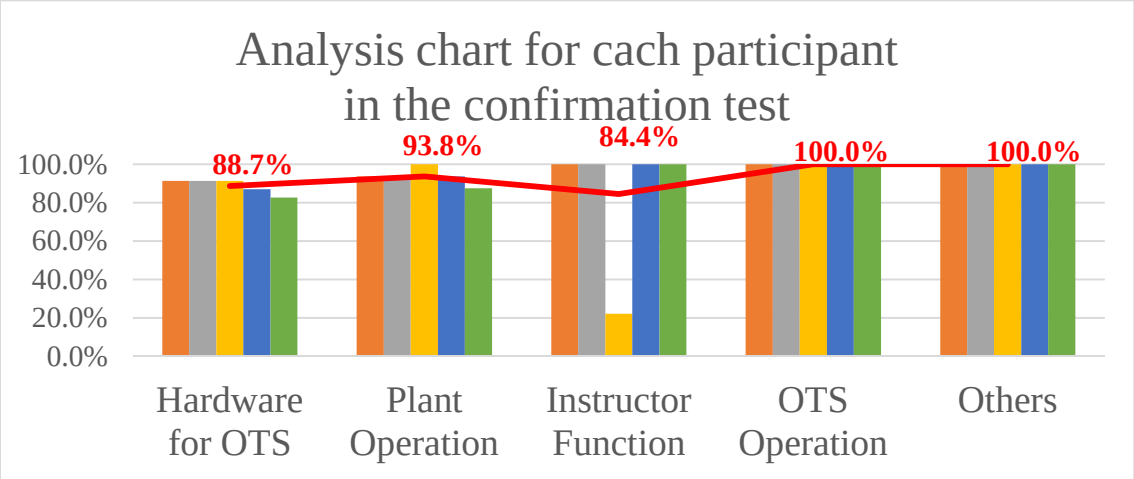
The table below shows the results of individual comprehension tests.

Table 7.2-11 Results of individual comprehension tests

Comprehension test score	Participant A	Participant B	Participant C	Participant D	Participant E	Average
(1) Hardware for OTS (23Qs)	21/23	21/23	21/23	20/23	19/23	20.4/23
(2) Plant Operation (16Qs)	15/16	15/16	16/16	15/16	14/16	15/16
(3) Instructor Function (9 Qs)	9/9	9/9	2/9	9/9	9/9	7.6/9
(4) OTS Operation (7Qs)	7/7	7/7	7/7	7/7	7/7	7.0/7
(5) Others (14Qs)	14/14	14/14	14/14	14/14	14/14	14.0/14

Total score (Total 69Qs)	66/69	66/69	60/69	65/69	63/69	64.0/69
%	95.6%	95.6%	87.0%	94.2%	91.3%	92.8%
Average score	@64/69 92.8%					





(Source: JET)

JET evaluated the technical transfer of operation of the Simulator has been completed, with general comments as follows:

(1) The average of the test score exceeds 80 points, which means Trainees understand Simulator operations.

(2) Only one Trainee got a lower mark in the Instructor Function Test, because he was called and had to return to the CCPP site during the on-site acceptance tests due to an emergency stop of a CCPP unit. JET judged that the other Trainees correctly understand the Simulator operations.

(3) The Trainees asked the TA to explain the unclear points on the examination questions in English. The Trainees understood the explanation of the TA to the questions.

Table 7.2-12 Questionnaire items of Comprehension test

No.	Items	Contents
1	**Hardware for OTS**	
(1)	INSTRUCTOR PC	1) INSTRUCTOR PC is installed in INSTRUCTOR DESK. 1) Installed software is Work Space Manager (for Instructor) and Instructor Software.
(2)	SIMULATION PC	1) SIMULATION PC is installed in CONTROL MAINTENANCE DESK 2) Installed software is Virtual Controllers (MPS) and Bridge Software and Simulation Model
(3)	CONTROL MAINTENANCE PC	1) CONTROL MAINTENANCE PC is installed in CONTROL MAINTENANCE DESK. 1) Installed software is ACS Software and EMS Software.
(4)	IO SIMULATION PC	1) IO SIMULATION PC is installed in TRAINEE DESK2 and is connected to Switch BOX (TRIP PB).
(5)	TRAINEE PC1～4 (OPS1～4)	1) Installed software is Work Space Manager.
(6)	LARGE SCREEN PC (LSOPS)	1) IO SIMULATION PC is installed in TRAINEE DESK4 and is connected to Switch BOX (TRIP PB). 2) Installed software is Work Space Manager.
(7)	NETWORK HUB	1) NETWORK HUB is mounted in UPS RACK.
(8)	KVM SWITCH	1) One KVM SWITCH is to switch the monitor for TRAINEE PC2 and IO SIMULATION PC. 2) Another is to switch the monitor for TRAINEE PC4 and LARGE SCREEN PC.
(9)	USB LICENSE KEY	1) USB LICENSE KEY is connected to SIMULATOR PC 2) OTS cannot work without USB LICENSE KEY.
(10)	UPS	1) UPS is mounted in UPS RACK. 1) Computers stop automatically and safety when sudden black out.
2.	**Operation for KVM Switch** **There are two methods to switch between computers using KVM Switch**	
(1)	Manual Switching	Press a front panel port selection push button once to bring KVM, and USB focus to the computer attached to the

		corresponding port.
(2)	Hotkey Switching	Port switch from the keyboard begin by tapping the Scroll Lock key twice. Then tap the number of the computer attached to the corresponding port and enter key.
3	**UPS Operation**	
(1)	1) The devices connected to UPS: PCs, Monitors and Network HUB 2) The devices not connected to UPS: Large Screen and Printers	
(2)	When one UPS detects an inlet power failure,	
	1) Correct Statement:	After 1 minute all PCs Shut down and after 5 minutes the UPS is powered off.
	2) Incorrect Statement:	After 1 minute the PCs connecting the power outlet to the UPS shut down and after 5 minutes the UPS is powered off.
4	**OTS Operation**	
(1)	Start-up Operation	1) Turn the UPS Device ON, and then the Simulation PC ON, Turn ON the monitors and printers manually. 2) ALL PCs will start automatically, DO not operate anything until OTS starts completely. 3) After OTS start-up completion, list for selecting the Initial Condition (IC file) is displayed on Instructor Station.
(2)	OTS Restart	1) Click [Maintenance] in Instructor Station, then click [System Restart].
(3)	OTS Shutdown	1) Click [Maintenance] in Instructor Station, then click [System Shutdown].
5	**Printer Configuration**	
	The default printer the following PCs from PRINTER (Instructor) or PRINTER (Operator) A) TRAINEE PC — PRINTER (Operator) B) Large Screen PC — PRINTER (Operator) C) Instructor PC — PRINTER (Instructor)	
6	**Instruction Function** **<Summary of Simulation Function>**	

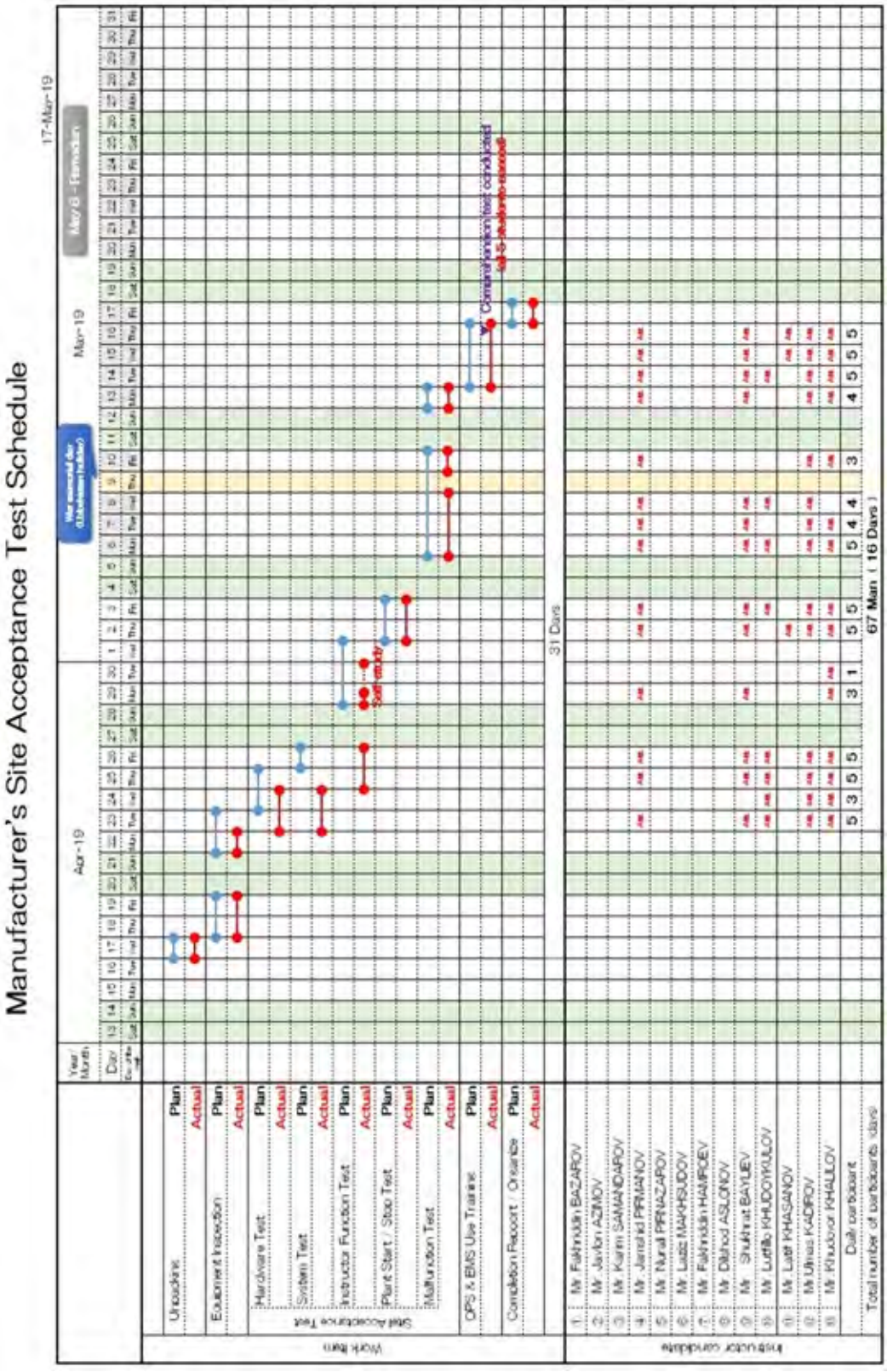
No.	Item	Function	Remarks
(1)	Maintenance Function	1) OTS system start-up/shut -down 2) System monitoring	-

(2)	Simulator Control Function	1) Reset Function Function to set or change the Initial Condition (IC)	Various plant condition or operation condition can be set from IC file list, snapshot file list or backtrack file list at any time during OTS running. The maximum number of registrable IC file is 200.
		2) Snapshot Function Function to save the current simulation status temporarily.	The maximum number of registrable snapshot file is 100.
		3) Run/ Freeze Function Run; Start the simulation. Freeze; Pauses the simulation	-
		4) Backtrack Function The past simulator status is automatically saved as a backtrack file every two minute.	360 backtrack files can be stored at a maximum.
		5) Simulation Speed Change Function Simulation speed can be changed (×2, real time, ×1/2, ×1/4)	Even though simulation speed is changed, time clock count is not changed.
(3)	Malfunction Function	1) Setting the abnormal conditions in the simulation model.	-
(4)	Remote Function	1) The external parameters of simulation can be changed. And some equipment which cannot operate from CCR can be operated.	-
(5)	Monitoring Function	Parameter Monitoring Trend Monitoring	The trend and parameters are displayed on the Instructor Station in real time.
7	**Password for OTS**		
(1)	Work Space Manager (OPS software): User Name: root , User Password: netmation		
(2)	Instructor software User Level:		

	User Name: Administor, User Password: admin User Name: Instructor, User Password: inst User Name: Trainee, User Password : (none)
8	**Backtrack Function**
(1)	Backtrack function is the function to take the snapshot automatically every 2 minutes in real time speed during simulation Run condition. Backtrack file can be loaded (reset) from Initial Condition Reset Function. When simulation speed is double speed (×2), saving interval is changed to 1 minutes. On the contrary, when simulation speed is half speed (×1/2), saving interval is changed to 4 minutes.
9	**Registration for Initial Condition**
(1)	Click [Initial Condition Maintenance] in Instructor to display the "Initial Condition Maintenance" window.
(2)	[Snap Shot List] tab in "Initial Condition Maintenance" window.
(3)	Select a snapshot.
(4)	Select IC number.
(5)	Click [->] to register the Initial Condition to the Initial Condition List.
(6)	Enter a file name and a password, then click [OK].
10	**Backup Function** **The data that simulator is able to backup using Backup function from the following.**
(1)	Initial Condition files
(2)	Trend monitoring configuration files on the monitoring function
(3)	Configuration files on the scheduling function
(4)	Current value monitoring configuration files on the monitoring function

(Source: JET)

Table 7.2-13 Manufacturer's Site Acceptance Test Schedule and Attendants



(Source : JET)

Chapter 8

8. Activities for Pilot Training of Simulator

8.1 Development of Textbooks & Manuals for Pilot Training of Simulator

8.1.1 Textbooks and Manuals and Roadmap of Simulator Training System

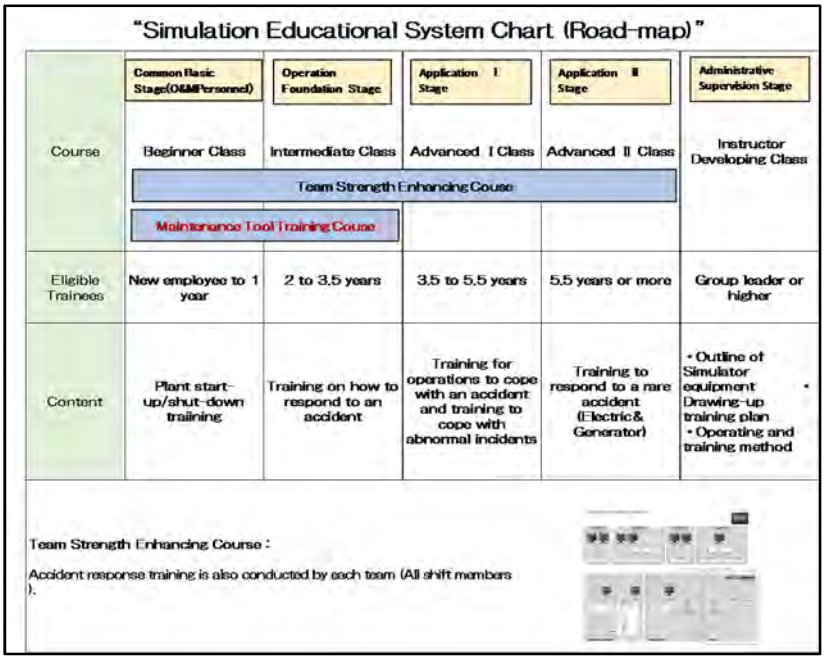
JET has recommended that NTC use the “Implementation Manual for Simulator Training” which contains practical guidelines being applied in the simulator training of power companies in Japan, in order to monitor the targets to be achieved in the human resource development plan.

(1) Basic Concept

Training of O&M staff will be promoted by utilizing a Simulator, based on the skill of trainers and “the approach in training” designed by TA in Japan.

(2) Specific Methods of Training O&M staff

The specific methods of Training O&M staff are shown in the following Simulation Training System Roadmap, with the career levels of staff divided into five (5) stages. Training of the O&M staff should be completed within the basic stages while training for the maintenance tool, such as Netmation, will be completed within three and half (3.5) years after employment.



(Source: JET)

Figure 8.1-1 Simulator Training System (Roadmap)

(3) Management of staff by skill levels

Skill level of staff are shown in the table below:

Technical level	Skill level
Basic Stage (Beginners)	O&M staff has undertaken unit start-up and shutdown training, and have the skills to conduct system operations, inspections, confirmations, and other related activities under the supervision of the Trainer.
Operational Basic Stage (Intermediate)	Trainees have the skills and trained to cope up with accidents in the CCPP facilities (e.g. accidents leading to unit trips or output limits) under the supervision of the Trainer.
Application Stage I (Advanced: Category1)	Trainees have advanced skills to cope up with the occurrence of rare accidents, and capable of preventing accidents under the supervision of the Trainer.
Application Stage II (Advanced: Category II)	As a specialist in operations, Trainees have advanced skills to cope up with unusual accidents, and able to sustain and enhance the prevention of such accidents, under the supervision of the Trainer.
Managing and Supervising Stage	Trainees are holding the position of Shift Managers are familiar with the functions, characteristics and operational methods of the Simulators, and have an effective skills from planning to practical implementation of Team Strength Enhancement Course under the supervision of the Trainer.

(4) Contents of Training

1) Beginners Course

Objective	To enable the trainees to learn and familiarize the unit start-ups and shutdowns, alarm system, sequences, operations, inspections, confirmations, and on other related activities.			
Qualification	Eligible trainees are comprised of patrol staff and those who generally comprehend the procedures for unit start-ups and shutdowns.			
Period	2 days	Number of Participants	2 -3 Persons	
Subjects	Main Topic			Number of hours

Unit Start-Up/ Shut Down	① Training for operation of Plant start-up and shut down. ② Learning the countermeasures for abnormal conditions. ③ Learning the automated sequences and interlock in normal and abnormal conditions. ④ Confirmation of trainees' target skill level.	10
Others	Orientation, Evaluation Questionnaires, and Informal Discussions (Questions and Answers)	1.5

2) Intermediate Course

Objective	To enable trainees to acquire skills through repetitive actual incident scenario setting and appropriately provide response to respective type of accidents (such as but not limited to accidents leading to unit trips and output limits) as basic know-how of power generating operation.		
Qualification	Eligible trainees are those who have completed the OJT and have knowledge in the operation of the existing types of power plant as operator.		
Period	3 days	Number of Participants	2-4 Persons
Subject	Main Topic		Number of hours
Training on how to respond to an accident	(1) Training on how to respond to accidents leading to unit trips and output limits (2) Situation assessment of the accident using abnormal indicators, investigating the cause, studying the progress of an accident, and training on response maneuvers in case of an accident. ③ Confirmation of trainees' target skill level.		22
Others	Orientation, Evaluation Questionnaires, and informal discussions (Questions and Answers)		1.5

3) Advanced Course Category I

Objective	① To help the trainees to retain and enhance their skills as specialists in power generation, and to properly provide response to any normal and/or unusual accidents, as well as maintain and advance the capabilities of accident prevention. ② To help the trainees cope up with operational abnormalities as well as to acquire a high-level skill as Operators.

	③ To confirm the target skill level of the trainees.		
Qualification	Eligible Trainees are those with recommendation from the Unit Manager		
Period	3 days	Number of Participants	2- 4 Persons
Subject	Main Topic		Number of hours
Training for operations to cope up with an accident and training to cope up with abnormal indications.	① Training for high-level measures to be taken against unusual accidents. ② Training for situations assessment, investigation of causes, measures against the development of an accident, using abnormal indicators, etcetera. Advance training for a responsive operation in case of such accidents. ③ Confirmation of target skill level of the trainees.		21
Others	Orientation, Evaluation Questionnaires, and Informal Discussions (Questions and Answers)		1.5

4) Advanced Course Category II

Objective	To help trainees retain and enhance their skills as specialists in power generation and able to properly response to any advanced accident, as well as maintaining and enhancing their capabilities on accident prevention.		
Qualification	The Trainees have completed a one-year Advanced Category I Course and with recommendation from the Unit Manager as eligible participants.		
Duration	2 days	Number of Participants	2-4 Persons
Subject	Main Topic		Number of hours
Training to respond to an unusual accident	① Training to deal with any advanced accident such as: ・Malfunctions related to the Electricity and Generator ② Confirmation of completed level through training.		10
Others	Orientation, Evaluation Questionnaires, and Informal Discussions (questions and Answers)		1.5

5) Instructor Training Course (Simulator Training)

Objective	To provide training to supervisors/leaders who are familiar with the functions, characteristics, and operating methods of the Simulators, and can effectively draw up training plans leading to the

	implementation in the conduct of the Team Strength Enhancing Course. Training will be in teams of working shifts in a power plant.		
Qualification	Eligible trainees are those with recommendation from the Unit Manager and Chief Engineer to participate in the Course.		
Duration	2 days	Number of Participants	2-3 Persons
Subject	Main Topic		Number of hours
Outline of Simulator equipment	Acquisition of make-up, function, characteristics and operating methods of Simulator equipment.		2
Drawing-up of training plans	Acquisition of methods to draw up training plans for Team Strength Enhancing Course.		3
Operating and training methods	OJT of operation and mock exam in the trainer room (taking the training course for training in Team Strength Enhancing Course).		12
Others	Orientation, Evaluation Questionnaires, and Informal Discussions (Questions and Answers)		1.5

6) Team Strength Enhancement Course (Shift Members)

Objective	To enable Shift members in charge of real equipment conduct unit start-ups and shut-downs operation training, as well as response to accidents, to maintain and enhance technical level of the whole team.		
Qualification	All shift members (Each Shift Unit)		
Duration	1 day	Number of Participants	Shift Team Members
Subjects	Main Topic		Number of hours
Operation training to respond to accidents	③ Preliminary team task training by shift members in charge of real equipment, and training items for Team Strength Enhancing Course. ④ Confirmation of leadership ability of Shift Manager and team strength, through training in response to accidents (a team may take the course once a year).		6
Others	Orientation, Evaluation Questionnaires, and Informal Discussions (Questions and Answers)		1.5

7) Training Course for Maintenance Tool（Program Engineer）

Objective	To improve knowledge and skills of programmer staff
Qualification	Eligible Trainees are those with recommendation from the Unit

	Manager.		
Duration	5days	Number of Participants	2-4 Persons
Subjects	Main Topic		Number of hours
Maintenance tool training	① Training for engineering of control logic and plant graphics. ② Confirmation of completed level through training.		38
Others	Orientation, Evaluation Questionnaires, and Informal Discussion (Questions and Answers)		2

The training items for the simulator training course are shown in the following tables.

Operation Simulator Training Items

[Legend] ○: Training item ●: Finished condition check item ◎: Grasp item ■: Experience item

Classification	Training item	Training item details E/T.G/H.S/OOO indicates the number of MF		Common Basic (O&M) Bisinner level	Operation Foundation Stage Intermediate level	Application I Stage Advanced I level	Application II Stage Advanced II level	Administrative Supervision Stage Instructor developing	Team Strength Enhancing Improve Team Ability
Start / Shutdown	Normal Start-Up/Shutdown	Repeated training in APS monitoring mode		○					
	Spin &Turning Operation			○					
	Load Operation (Control Mode,Auto Load Regulator on/off)			○					
	Auto Sincronization			○					
	Special Operation(Load Run Back/ Auto Stop)			○					
	Emergency Shutdown (Plant Trip)			○					
Accident response	GT IGNITOR HEADER LEAK	G001	GT1 IGNITOR HEADER PRESS LOW			●	○	●	
		G002	GT2 IGNITOR HEADER PRESS LOW						
	GT FLAME LOSS	G003	GT1 FLAME OUT TRIP			◎	●	●	
		G004	GT2 FLAME OUT TRIP						
	GT No.1 BEARING CONTACT WITH MOTOR	G005	GT1 BEARING VIBRATION HIGH			◎	●	●	○
		G006	GT2 BEARING VIBRATION HIGH						
	GT FUEL GAS HDR SUPPLY LINE LEAK	G007	GT1 FUEL GAS HDR PRESS LOW			◎	●	●	○
		G008	GT2 FUEL GAS HDR PRESS LOW						
	GT IGV ACTUATOR OIL LEAK	G009	GT1 IGV ACTUATOR ABNORMAL			●	○	●	
		G010	GT2 IGV ACTUATOR ABNORMAL						
	GT LUBE OIL FILTER CHOKE	G011	GT1 LUBE OIL FILTER DP HIGH			○	○	○	
		G012	GT2 LUBE OIL FILTER DP HIGH						

[Legend] ○: Training item ●: Finished condition check item ◎: Grasp item ■: Experience item

Classification	Training item	Training item details (E(T,G,H,S)OOO indicates the number of MF)		Common Basic (O&M) Beginner level	Operation Foundation Stage Intermediate level	Application I Stage Advanced I level	Application II Stage Advanced II level	Administrative Supervision Stage Instructor developing	Team Strength Enhancing Improve Team Ability
Accident response	GT 2C COOLING AIR SUPPLY LINE LEAL	G013	GT1 DISC CAVITY TEMP HIGH			●	○	●	
		G014	GT2 DISC CAVITY TEMP HIGH						
	No.12 GT COMBUSTOR NOZZLE FALT	G015	GT1 BLADE PATH TEMP. VARIATION HIGH			◎	◎	●	
		G016	GT2 BLADE PATH TEMP. VARIATION HIGH						
	GT AIR INLET FILTER FALT	G017	GT1 AIR INLET FILTER CHOKE			●	○		
		G018	GT2 AIR INLET FILTER CHOKE						
	GT FGH TUBE LEAK (OUTLET SIDE)	G019	GT1 FGH TUBE LEAK			◎	◎	●	
		G020	GT2 FGH TUBE LEAK						
	GT TCA TUBE LEAK (OUTLET SIDE)	G021	GT1 TCA TUBE LEAK			◎	◎	●	
		G022	GT2 TCA TUBE LEAK						
	GT MAIN LUBE OIL PUMP (A) ELECTRIC FAULT	G023	GT1 MOP(A) FAULT			◎	○		○
		G024	GT2 MOP(A) FAULT						
	GT MAIN LUBE OIL PUMP (B) ELECTRIC FAULT	G025	GT1 MOP(B) FAULT			◎	○		○
		G026	GT2 MOP(B) FAULT						
	GT LUBE OIL TEMP CONTROL VALVE OPEN STUCK	G027	GT1 LUBE OIL TEMP LOW			◎	○		○
		G028	GT2 LUBE OIL TEMP LOW						
	GT LUBE OIL MIST VAPOER EXTRACTOR (A) ELECTRICAL FAULT	G029	GT1 LUBE OIL MIST VAPOER EXTRACTOR (A) FAULT			◎	○		○
		G030	GT2 LUBE OIL MIST VAPOER EXTRACTOR (A) FAULT						
	GT LUBE OIL MIST VAPOER EXTRACTOR (B) ELECTRICAL FAULT	G031	GT1 LUBE OIL MIST VAPOER EXTRACTOR (B) FAULT			◎	○		○
		G032	GT2 LUBE OIL MIST VAPOER EXTRACTOR (B) FAULT						

[Legend] ○: Training item ●: Finished condition check item ◎: Grasp item ■: Experience item

Classification	Training item	Training item details (E/T.G/H.S/OOO indicates the number of MF)		Common Basic (O&M) Beginner level	Operation Foundation Stage Intermediate level	Application I Stage Advanced I level	Application II Stage Advanced II level	Administrative Supervision Stage Instructor develpoing	Team Streneth Enhancing Improve Team Ability
Accident response	GT CONTROL OIL PUMP) (A) FAULT	G033	GT1 COP(A) FAULT			◎	○		○
		G034	GT2 COP(A) FAULT						
	GT CONTROL OIL PUMP (B) FAULT	G035	GT1 COP(B) FAULT			◎	○		○
		G036	GT2 COP(B) FAULT						
	GT FUEL GAS TEMP CONTROL VALVE (C/C) CLOSE STUCK	G037	GT1 FUEL GAS TEMP LOW (C/C)			◎	○		○
		G038	GT2 FUEL GAS TEMP LOW (C/C)						
	GT FUEL GAS TEMP CONTROL VALVE (S/C) CLOSE STUCK	G039	GT1 FUEL GAS TEMP LOW (S/C)			◎	○		○
		G040	GT2 FUEL GAS TEMP LOW (S/C)						
	GT ROTER COOLING AIR COOLER FAN A FALT	G041	GT1 ROTER COOLING AIR TEMP HIGH (S/C)			◎	○		○
		G042	GT2 ROTER COOLING AIR TEMP HIGH (S/C)						
	GT TCA COOLER COOLING WATER FLOW CONTROL VALVE STUCK CLOSE	G043	GT1 TCA COOLER COOLING WATER TROUBLE (C/C)			◎	○		○
		G044	GT2 TCA COOLER COOLING WATER TROUBLE (C/C)						
	GT TURBINE CASING METAL CASING HIGH	G045	1GT #2 DCT temp hish			◎	○		
		G046	2GT #2 DCT temp hish						
	GT 2C COOLING AIR FCV STUCK CLOSE	G047	1GT #2 DCT temp hish			◎	○		
		G048	2GT #2 DCT temp hish						
	GT FUEL GAS SUPPLY LINE LEAK	G049	GT1 Gas Leakage Density hish			◎	○		
		G050	GT2 Gas Leakage Density hish						
	GT PACKAGE VENTILATION FAN (A) ELECRICAL FAULT	G051	GT1 GT PACKAGE VENTILATION FAN FAULT			◎	○		
		G052	GT2 GT PACKAGE VENTILATION FAN FAULT						

[Legend] ○: Training item ●: Finished condition check item ◎: Grasp item ■: Experience item

Classification	Training item	Training item details (E/T.G/H.S/OOO indicates the number of MF)		Common Basic (O&M) Beginner level	Operation Foundation Stage Intermediate level	Application I Stage Advanced I level	Application II Stage Advanced II level	Administrative Supervision Stage Instructor developing	Team Strength Enhancing Improve Team Ability
Accident response	GT PACKAGE VENTILATION FAN (B) ELECRICAL FAULT	G053	GT1 GT PACKAGE VENTILATION FAN FAULT			◎	○		
		G054	GT2 GT PACKAGE VENTILATION FAN FAULT						
	GT PACKAGE VENTILATION FAN (C) FAULT	G055	GT1 GT PACKAGE VENTILATION FAN FAULT			◎	○		
		G056	GT2 GT PACKAGE VENTILATION FAN FAULT						
	GTCOMPRESSOR LOW PRESS BLEED VALVE CLOSE stuck	G057	GT1 BLEED LP VALVE ABNORMAL (OPEN)			●	○	●	
		G058	GT2 BLEED LP VALVE ABNORMAL (OPEN)						
	SOLENOID VALVE FOR GT1 COMPRESSOR LOW PRESSURE BLEED VALVE LEAK	G059	GT1 BLEED LP VALVE ABNORMAL (CLOSE)			●	○	●	
		G060	GT2 BLEED LP VALVE ABNORMAL (CLOSE)						
	GT COMPRESSOR MIDDLE PRESSBLEED VALVE CLOSE STUCK	G061	GT1 BLEED MP VALVE ABNORMAL (OPEN)			●	○	●	
		G062	GT2 BLEED MP VALVE ABNORMAL (OPEN)						
	SOLENOID VALVE FOR GT COMPRESSOR MIDDLE PRESSURE BLEED VALVE LEAK	G063	GT1 BLEED MP VALVE ABNORMAL (CLOSE)			●	○	●	
		G064	GT2 BLEED MP VALVE ABNORMAL (CLOSE)						
	SOLENOID VALVE FOR GT COMPRESSOR HIGH PRESSURE BLEED VALVE LEAK	G065	GT1 BLEED HP VALVE ABNORMAL (CLOSE)			●	○	●	
		G066	GT2 BLEED HP VALVE ABNORMAL (CLOSE)						
	HRSG HP ECONOMIZER LEAK (OUTLET SIDE)	H001	HRSG1 HP ECO TUBE LEAK		●		◎	●	○
		H002	HRSG HP ECO TUBE LEAK						
	HRSG IP ECONOMIZER TUBE LEAK (OUTLET SIDE)	H003	HRSG1 IP ECO TUBE LEAK		●		◎	●	○
		H004	HRSG2 IP ECO TUBE LEAK						
	HRSG LP ECONOMIZER TUBE LEAK (OUTLET SIDE)	H005	HRSG1 LP ECO TUBE LEAK		●		◎	●	○
		H006	HRSG2 LP ECO TUBE LEAK						

[Legend] ○: Training item ●: Finished condition check item ◎: Grasp item ■: Experience item

Classification	Training item	Training item details (E/T.G/H.S/OOO indicates the number of MF)		Common Basic (O&M)	Operation Foundation Stage	Application I Stage	Application II Stage	Administrative Supervision Stage	Team Strength Enhancing
				Biginner level	Intermediate level	Advanced I level	Advanced II level	Instructor developing	Improve Team Ability
Accident response	HRSG HP EVAPORATION TUBE LEAK (OUTLET SIDE)	H007	HRSG1 HP EVA TUBE LEAK		●		◎	●	○
		H008	HRSG2 HP EVA TUBE LEAK						
	HRSG IP EVAPORATION TUBE LEAK (OUTLET SIDE)	H009	HRSG1 IP EVA TUBE LEAK		●		◎	●	○
		H010	HRSG2 IP EVA TUBE LEAK						
	HRSG LP EVAPORATION TUBE LEAK (OUTLET SIDE)	H011	HRSG1 LP EVA TUBE LEAK		●		◎	●	○
		H012	HRSG2 LP EVA TUBE LEAK						
	HRSG HP SUPERHEATER TUBE LEAK (INLET SIDE)	H013	HRSG1 HP SH TUBE LEAK		●		◎	●	○
		H014	HRSG2 HP SH TUBE LEAK						
	HRSG IP SUPERHEATER TUBE LEAK (INLET SIDE)	H015	HRSG1 IP SH TUBE LEAK		●		◎	●	○
		H016	HRSG2 IP SH TUBE LEAK						
	HRSG LP SUPERHEATER TUBE LEAK (INLET SIDE)	H017	HRSG1 LP SH TUBE LEAK		●		◎	●	○
		H018	HRSG2 LP SH TUBE LEAK						
	HRSG LP ECO RECIRCULATION PUMP (A) ELECRICAL FAULT	H019	HRSG1 LP ECO RECIRC PUMP (A) FAULT		●		○	●	
		H020	HRSG2 LP ECO RECIRC PUMP (A) FAULT						
	HRSG LP ECO RECIRCULATION PUMP (B) ELECRICAL FAULT	H021	HRSG1 LP ECO RECIRC PUMP (B) FAULT		●		○	●	
		H022	HRSG2 LP ECO RECIRC PUMP (B) FAULT						
	HRSG FEED WATER PUMP (A) ELECRICAL FAULT	H023	HRSG1 HP/IP FWP (A) FAULT		●		○	●	
		H024	HRSG2 HP/IP FWP (A) FAULT						
	HRSG FEED WATER PUMP (B) ELECRICAL FAULT	H025	HRSG1 HP/IP FWP (B) FAULT		●		○	●	
		H026	HRSG2 HP/IP FWP (B) FAULT						

[Legend] ○: Training item ●: Finished condition check item ◎: Grasp item ■: Experience item

Classification	Training item	Training item details E/T.G/H.S/OOOindicates the number of MF		Common Basic (O&M) Beginner level	Operation Foundation Stage Intermediate level	Application I Stage Advanced I level	Application II Stage Advanced II level	Administrative Supervision Stage Instructor developing	Team Strength Enhancing Improve Team Ability
Accident response	HRSG HP DRUM LCV (A) STUCK CLOSE	H027	HRSG1 HP DRUM LCV (A) STUCK CLOSE		●		○	●	
		H028	HRSG2 HP DRUM LCV (A) STUCK CLOSE						
	HRSG HP DRUM LCV (B) STUCK CLOSE	H029	HRSG1 HP DRUM LCV (B) STUCK CLOSE		●		○	●	
		H030	HRSG2 HP DRUM LCV (B) STUCK CLOSE						
	HRSG IP DRUM LCV STUCK CLOSE	H031	HRSG1 IP DRUM LCV STUCK CLOSE		●		○	●	
		H032	HRSG2 IP DRUM LCV STUCK CLOSE						
	HRSG LP DRUM LCV STUCK CLOSE	H033	HRSG1 LP DRUM LCV STUCK CLOSE		●		○	●	
		H034	HRSG2 LP DRUM LCV STUCK CLOSE						
	HRSG HP BYPASS VALVE STUCK CLOSE	H035	HRSG1 HP BYPASS VALVE STUCK CLOSE		●		○	●	
		H036	HRSG2 HP BYPASS VALVE STUCK CLOSE						
	HRSG IP BYPASS VALVE STUCK CLOSE	H037	HRSG1 IP BYPASS VALVE STUCK CLOSE		●		○	●	
		H038	HRSG2 IP BYPASS VALVE STUCK CLOSE						
	HRSG LP BYPASS VALVE STUCK CLOSE	H039	HRSG1 LP BYPASS VALVE STUCK CLOSE		●		○	●	
		H040	HRSG2 LP BYPASS VALVE STUCK CLOSE						
	HRSG LP ECO INLET FW TEMP CV STUCK CLOSE	H041	HRSG1 LP ECO INLET FW TEMP CV STUCK CLOSE		●		○	●	
		H042	HRSG2 LP ECO INLET FW TEMP CV STUCK CLOSE						
	HRSG HP ISOLATION VALVE STUCK CLOSE	H043	HRSG1 HP ISOLATION VALVE STUCK CLOSE		●		○	●	
		H044	HRSG2 HP ISOLATION VALVE STUCK CLOSE						
	HRSG IP ISOLATION VALVE STUCK CLOSE	H045	HRSG1 IP ISOLATION VALVE STUCK CLOSE		●		○	●	
		H046	HRSG2 IP ISOLATION VALVE STUCK CLOSE						

[Legend] ○: Training item ●: Finished condition check item ◎: Grasp item ■: Experience item

Classification	Training item	Training item details E/T.G/H.S/OOO indicates the number of MF		Common Basic (O&M)	Operation Foundation Stage	Application I Stage	Application II Stage	Administrative Supervision Stage	Team Strength Enhancing
				Biginner level	Intermediate level	Advanced I level	Advanced II level	Instructor developing	Improve Team Ability
Accident response	HRSG LP ISOLATION VALVE STUCK CLOSE	H047	HRSG1 LP ISOLATION VALVE STUCK CLOSE		●		○	●	
		H048	HRSG2 LP ISOLATION VALVE STUCK CLOSE						
	HRSG HP SPRAY CONTROL VALVE STUCK CLOSE	H049	HRSG1 HP SPRAY CONTROL VALVE STUCK CLOSE		●		○	●	
		H050	HRSG2 HP SPRAY CONTROL VALVE STUCK CLOSE						
	HRSG HP SPRAY BLOCK VALVE STUCK CLOSE	H051	HRSG1 HP SPRAY BLOCK VALVE STUCK CLOSE		●		○	●	
		H052	HRSG2 HP SH SPRAY BLOCK VALVE STUCK CLOSE						
	HRSG RH-1 SPRALY CONTROL VALVE STUCK CLOSE	H053	HRSG1 RH SPRALY CONTROL VALVE STUCK CLOSE		●		○	●	
		H054	HRSG2 RH SPRALY CONTROL VALVE STUCK CLOSE						
	HRSG RH-1 SPRALY BLOCK VALVE STUCK CLOSE	H055	HRSG1 RH-1 SPRALY BLOCK VALVE STUCK CLOSE		●		○	●	
		H056	HRSG2 RH -1 SPRALY BLOCK VALVE STUCK CLOSE						
	ST NO.1 BEARING CONTACT WITH ROTOR	S001	VIBRATION HIGH		◎		●	●	○
	ST MAIN LUBE OIL PUMP(A) OUTLET LINE LEAK	S002	LUBE OIL LEAK						
	CONDENCER EXPANSION CRACK	S003	VACUUM PRESS LOW		◎		●	●	○
	HP MAIN STEAM PIPE LINE LEAK	S004	HP MAIN STEAM PIPE LINE BREAK		◎		●	●	○
	HP CONTROL VALVE STUCK CLOSE	S005	HP CONTROL VALVE STUCK CLOSE		◎		○	○	
	IP CONTROL VALVE STUCK CLOSE	S006	IP CONTROL VALVE(L) STUCK CLOSE		◎		○	○	
	LP CONTROL VALVE STUCK CLOSE	S007	LP CONTROL VALVE STUCK CLOSE		◎		○	○	
	HP MSV(LH) STUCK CLOSE	S008	HP MSV(LH) STUCK CLOSE		◎		○	○	
	IP MSV(LH) STUCK CLOSE	S009	IP MSV(LH) STUCK CLOSE		◎		○	○	
	LP MSV(LH) STUCK CLOSE	S010	LP MSV STUCK CLOSE		◎		○	○	

【Legend】○: Training item ●: Finished condition check item ◎: Grasp item ■: Experience item

Classification	Training item		Training item details EIT.GH-S○○○indicates the number of MF	Common Basic (O&M) Beginner level	Operation Foundation Stage Intermediate level	Application I Stage Advanced I level	Application II Stage Advanced II level	Administrative Supervision Stage Instructor developing	Team Strength Enhancing Improve Team Ability
Accident response	ST CONTROL OIL PUMP ELECTRICAL FAULT	S011	ST CONTROL OIL PUMP(A) FAULT		●		●	●	
		S012	ST CONTROL OIL PUMP(B) FAULT		●		●	●	
	ST MAIN OIL PUMP ELECTRICAL FAULT	S013	ST MAIN OIL PUMP(A) FAULT		●		●	●	
		S014	ST MAIN OIL PUMP(B) FAULT		●		●	●	
	ST LUBE OIL COOLER(A) PERFORMANCE DEGRADATION	S015	ST LUBE OIL COOLER(A) PERFORMANCE DEGRADATION		○				
		S016	ST LUBE OIL COOLER(B) PERFORMANCEE DEGRADATION		○				
	CONDENSER HOTWELL LEVEL CONTROL VALVE STUCK OPEN	S017	CONDENSER HOTWELL LEVEL CONTROL VALVE STUCK CLOSE		◎		○	○	
	CONDENSER RECIRCULATION CONTROL VALVE STUCK HIGH	S018	CONDENSER RECIRCULATION CONTROL VALVE STUCK CLOSE		◎		○	○	
	GLAND STEAM CONDENSER EXHAUST FAN ELECTRICAL FAULT	B001	GLAND STEAM CONDENSER EXHAUST FAN(A) FAULT		○		●	●	
		B002	GLAND STEAM CONDENSER EXHAUST FAN(B) FAULT		○		●	●	
	CONDENSATE PUMP ELECTRICAL FAULT	B003	CONDENSATE PUMP(A) FAULT		○		●	●	
		B004	CONDENSATE PUMP(B) FAULT		○		●	●	
	CONDENSER VACUUM VREAKER VALVE STUCK OPEN	B005	CONDENSER VACUUM VREAKER VALVE STUCK OPEN		◎		○	○	
	ST EXHAUST HOOD SPRAY VALVE STUCK CLOSE	B006	ST EXHAUST HOOD SPRAY VALVE STUCK CLOSE		◎		○	○	
	AUX STEAM HEADER ISOLATION VALVE STUCK CLOSE	B007	AUX STEAM HEADER ISOLATION VALVE STUCK CLOSE		◎		○	○	
	AUX STEAM HEADER PRESSURE CONTROL VALVE STUCK CLOSE	B008	AUX STEAM HEADER PRESSURE CONTROL VALVE STUCK CLOSE		◎		○	○	
	GLAND STEAM PRESSURE CONTROL VALVE STUCK CLOSE	B009	GLAND STEAM PRESSURE CONTROL VALVE STUCK CLOSE		◎		○	○	
	GLAND STEAM PRESSURE TRANSMITTER STUCK HIGH	B010	GLAND STEAM PRESSURE TRANSMITTER STUCK HIGH		◎		○	○	
	GLAND STEAM SPILLOVER CONTROL VALVE STUCK OPEN	B011	GLAND STEAM SPILLOVER CONTROL VALVE STUCK OPEN		◎		○	○	
	CLOSED COOLING WATER PUMP	B012	CLOSED COOLING WATER PUMP(A) FAULT		○		●	●	

[Legend] ○: Training item ●: Finished condition check item ◎: Grasp item ■: Experience item

Classification	Training item	Training item details (EIT.G#.S#OOO indicates the number of MF)		Common Basic (O&M) Beginner level	Operation Foundation Stage Intermediate level	Application I Stage Advanced I level	Application II Stage Advanced II level	Administrative Supervision Stage Instructor developing	Team Strength Enhancing Improve Team Ability
Accident response	ELECRICAL FAULT	B013	CLOSED COOLING WATER PUMP(B) FAULT		○		●	●	
	CLOSED COOLING WATER DIFFERENTIAL CONTROL VALVE STUCK OPEN	B014	CLOSED COOLING WATER DIFFERENTIAL CONTROL VALVE STUCK OPEN		◎		○	○	
	LEVEL TRANSMITTER SENSOR TRANSMITTER STUCK LOW	B015	CLOSED COOLING WATER TANK LEVEL TRANSMITTER SENSOR TRANSMITTER STUCK LOW		◎		○	○	
	ST CLOSED COOLING WATER HEAT EXCHANGER DEGRADATOR	B016	ST CLOSED COOLING WATER HEAT EXCHANGER(A) DEGRADATION		◎		○	○	
		B017	ST CLOSED COOLING WATER HEAT EXCHANGER(B) DEGRADATION		◎		○	○	
	CIRCURATING WATER PUMP ELECRICAL FAULT	B018	CIRCURATING WATER PUMP (A) FAULT		○		●	●	
		B019	CIRCURATING WATER PUMP (B) FAULT		○		●	●	
	CIRCULATING WATER PUMP OUTLET VALVE STUCK CLOSE	B020	CIRCULATING WATER PUMP OUTLET VALVE (A) STUCK CLOSE		◎		○	○	
		B021	CIRCULATING WATER PUMP OUTLET VALVE (B) STUCK CLOSE		◎		○	○	
	CIRCULATING WATER BOOSTER PUMP ELECRICAL FAULT	B022	CIRCULATING WATER BOOSTER PUMP (A) FAULT		○		●	●	
		B023	CIRCULATING WATER BOOSTER PUMP (B) FAULT		○		●	●	
	CONDENSER VACUUM PUMP ELECRICAL FAULT	B024	CONDENSER VACUUM PUMP (A) FAULT		○		●	●	
		B025	CONDENSER VACUUM PUMP (B) FAULT		○		●	●	
	GT COOLING WATER PUMP ELECRICAL FAULT	B026	GT COOLING WATER PUMP (A) FAULT		○		●	●	
		B027	GT COOLING WATER PUMP (B) FAULT		○		●	●	
	One of FAN ELECRICAL FAULT	B028	SOME FIN FAN AIR COOLERS FAULT		○		●	●	
	ALL of FAN ELECRICAL FAULT	B029	ALL FIN FAN AIR COOLERS FAULT		○		●	●	
	GT SFC FAILURE	E001	GT1 SFC RUN TIME OVER			○	○		○
		E002	GT2 SFC RUN TIME OVER						
	GTG 2V	E003	GT1G AVR TROUBLE			○	○		○

[Legend] ○: Training item ●: Finished condition check item ◎: Grasp item ■: Experience item

Classification	Training item	Training item details E/T.G.H.S OOOindicates the number of MF		Common Basic (O&M)	Operation Foundation Steps	Application I Stage	Application II Stage	Administrative Supervision Stage	Team Strength Enhancing
				Bisinner level	Intermediate level	Advanced I level	Advanced II level	Instructor developing	Improve Team Ability
Accident response	FUSE BELOW	E004	GT2G AVR TROUBLE						
	STG 2V FUSE BELOW	E005	STG AVR TROUBLE			○	○		○
	GTG 46GINV RELAY OPERATION (NEGATIVE PHASE SEQUENCE OVERCURRENT RELAY)	E006	GT1G 46GINV RELAY ACTUATED			◎	○		○
		E007	GT2G 46GINV RELAY ACTUATED						
	STG 46GINV RELAY OPERATION (NEGATIVE PHASE SEQUENCE OVERCURRENT RELAY)	E008	STG 46GINV RELAY ACTUATED			◎	○		○
	87G RELAY FAIL OPERATION (GENERATOR DEFFERENTIAL RELAY)	E009	GT1G 87G RELAY ACTUATED			◎	○		○
		E010	GT2G 87G RELAY ACTUATED						
		E011	STG 87G RELAY ACTUATED			◎	○		○
	87TE RELAY FAIL OPERATION (EXCITATION TRANSFORMER DEFFERENTIAL RELAY)	E012	GT1G 87TE RELAY ACTUATED			◎	○		○
		E013	GT2G 87TE RELAY ACTUATED						
		E014	STG 87TE RELAY ACTUATED			◎	○		○
	87TG RELAY FAIL OPERATION (GENERATOR TRANSFORMER DEFFERENTIAL RELAY)	E015	GT1G 87TG RELAY ACTUATED			◎	○		○
		E016	GT2G 87TG RELAY ACTUATED						
		E017	STG 87TG RELAY ACTUATED			◎	○		○

8.1.2 Development of Manuals for Pilot Training for Simulator

(1) Manuals developed for Pilot Training

The Trainers should utilize the manuals that will be developed, reviewed, and improved as shown in the following table to indicate the curriculum of the Pilot Training of Simulator.

Table 8.1-1 Textbooks & Manuals Developed for Pilot Training

No.	Name of Manuals / Target Participants	Contents / Objectives	Training Method
1	Outline of Simulator Equipment ・ For orientation and beginners (Operator/Programmer)	・The Trainers should acquire the structure of F type GT Simulator equipment, functions and software of PC for coaches, etcetera.	Lecture
2	Simulator instructor training materials ・For instructors and instructor candidates	・The Trainers should seek to enhance the skills of Trainees to enable the trainees to familiarize with the operational skills, gain knowledge, and actual experience on CCPP operation through hands-on in operating a Simulator equipment. ・The Trainers should obtain specific rules, ways and means to replicate the training, technical strength, etcetera that are required for the instructors to possess.	Lecture
3	Instructional details (18 cases) ・ For team strength enhancement courses	・The Trainers should prepare and practice items simulating accidents (accident setup and training levels) through training with 18 items for troubleshooting by equipment type.	Lecture + Practical training
4	Troubleshooting text (18 cases) ・ For team strength enhancement courses	・The Trainers should learn the causes and phenomena of accidents, grounds for setting alarms, and procedural flow through training with 18 items for troubleshooting by equipment type.	Lecture + Practical training

(Source: JET)

(2) Proposal

The following table shows the number of malfunctions by equipment type.

Table 8.1-2 Malfunction by Equipment Type

Equipment Type	Number of MF Items	Selection by the same type MF	Number of trips and load reductions *
GT (Gas Turbine)	66	33	16
HRSG (Exhaust Heat Recovery Boiler)	55	28	11
ST (Steam Turbine)	18	15	7
BOP (Auxiliary Equipment)	29	20	4
E,G (Electricity, Generator)	17	11	8
Total	**186**	**107**	**46**

Number of MF items by selected equipment in Pilot Training
1.GT：8 items
2. HRSG: 3 items
3. ST: 3 items
4. BOP:3 items
5.ELECTRIC/GENERATOR：1 item
Total 18 items

(Source: JET)

In order for the Trainers to be able to train for the Operation Simulator, it is important that the TA will develop and improve the following additional manuals on MF by equipment type, and that the TA has to encourage Trainers to obtain their actual experiences through participation in the troubleshooting training.

＜Additional Teaching Materials on MF by Equipment＞

(1) Instructional Materials (107−18＝89 Cases)

(2) Troubleshooting textbooks (107−18＝89 Cases)

8.1.3 Development of Manuals for the Maintenance Simulator Training

(1) The results of the discussion between JET and Trainers in charge of the Maintenance Simulator training of NTC for the improvement of manuals of the Maintenance Simulator (Netmation) are shown in the following table.

Table 8.1-3 Requests and Suggestions for Simulator Training and Discussion Results

Requests and Suggestions	Background and Reasons	Discussion Results
Improve professional skills of I&C and maintenance staff with training using the maintenance tools.	- The controller name of Gas Turbine is "Netmation". Gas Turbine is carried out in "Netmation Logic", while the Gas Turbine is operated from "Netmation operation graphics". In case the GT experience some trouble and GT operation needs to be changed, Netmation Logic or graphics also need to be changed immediately.	JET and trainers to jointly develop maintenance simulator teaching materials based on the DIASYS Netmation User's Guide List of MHPS.

(Source: JET)

Table 8.1-4 Diasys Netmation User's Guide List

No.	Title
1	**Graphic Parts Reference Manual**
2	**Graphic Creator Operation Guide**
3	**Loop Plate Operation Guide**
4	**ORCA- View Operation Guide**
5	**OPS・EMS・ACS Troubleshooting Manual**
6	**Work Space Manager (WSM) Operation Guide**
7	**ACS Service Operation Guide**
8	**List Creator Operation Guide**
9	**Logic Creator Operation Guide**
10	**Function Block Reference Manual**

(Source: JET)

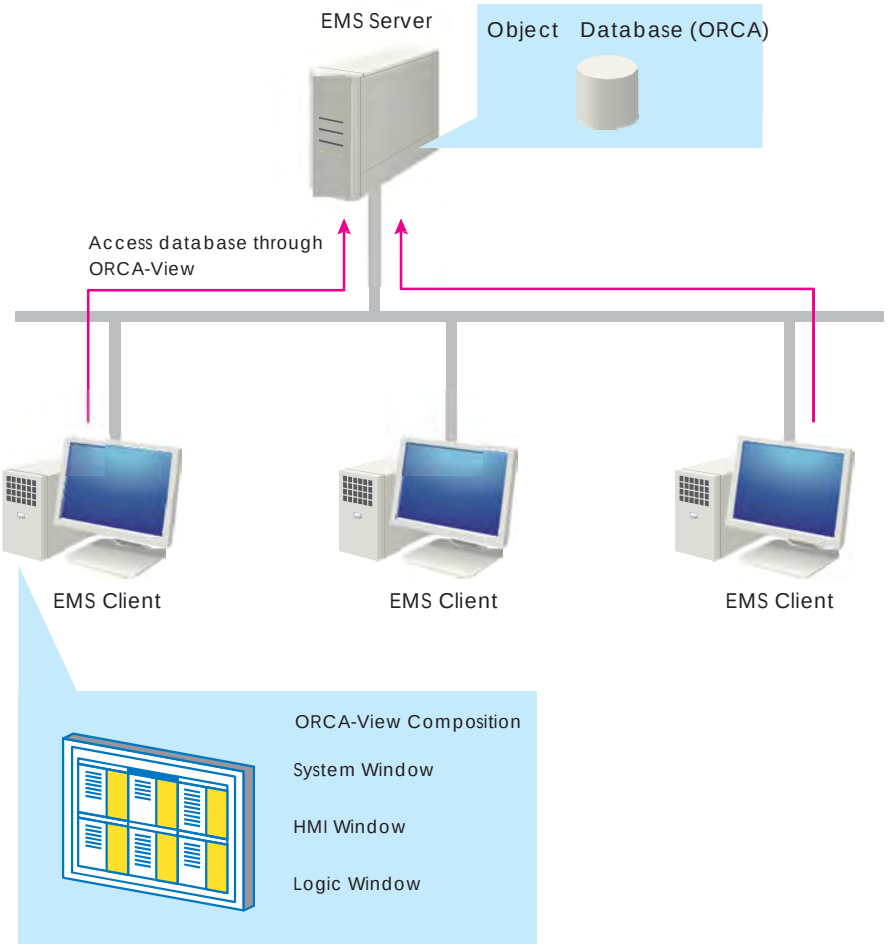
(2) Preparation of Manuals for the Maintenance Simulator (Netmation):

JET has improved the following manuals together with NTC wherein the revised manuals were submitted to NTC. Both JET and NTC have agreed to only prepare the manuals in English as the Russian version is not necessary.

<Manual>

・ORCA (Object Database) - View Operation Guide
・Graphic Creator User's Guide
・Function Block Reference Manual

＜Schematic Diagram of ORCA＞



（Source：JET）

Figure 8.1-2 Overview of ORCA

8.2 Training and Accreditation of Simulator Trainers for Operation and Maintenance

8.2.1 Accreditation of Simulator Trainers for Operation and Maintenance

8.2.1.1 Authorized Trainers for the Operation Simulator/Maintenance Tool

(1) Accreditation of Instructor as Candidates for the Operation Simulator/Maintenance Tool

1) With respect to the above, the discussion with NTC has been agreed as follows;

(a) Purpose: Selection and Development of Instructor Candidates for Operation Simulator and Instructor Candidates of Maintenance Tool by Navoi Training Center will be from Programmers or IC Staff.

(b) Timing for Selection: JET will decide after interviewing the Instructor as Candidates on the occasion of the 3rd JCC to be held at Navoi Training Center.

(c) Period of Development: The development will be completed before the full-scale operation of the Simulator System.

(d) The basic requirements on the selection of Instructor as Candidates for the Operation Simulator and Maintenance Tool are shown below.

(2) Qualification of Candidate Trainers

Trainers should be selected among Trainees with the following qualifications:

1) Trainers of the Operation Simulator:

Qualifications:

(a) Instructor as Candidates can understand and speak English.

(b) Instructor as Candidates have experienced in the operations of CCPP and have a general knowledge in the power plants.

2) Trainers of Maintenance Tool

Qualification:

(a) Instructor as Candidates can understand and speak English.

(b) Instructor as Candidates have completed Netmation training or have basic knowledge on the Netmation System.

(c) Instructor as Candidates have general knowledge on the concept of electronic control.

8.2.1.2 The selection results on the number of candidate trainers to participate in the following training courses are as follows:

Training Course	Number of Participants
Trainers of the Operation Simulator	10 Persons
Trainers of Maintenance Tools	4 Persons

Operation Simulator Instructor's Certifier List

14/06/2019

Operation Group			Title	Final Education / Graduation Subject	Year of Employment	Birth Date	Age
①		Mr. Fakhriddin BAZAROV	Navoi CCPP-1 Shift Manager	Tashkent State University of Technics Electrical Energy	2012 September	18.12.1987	31
②		Mr. Javlon AZIMOV	Navoi CCPP-1 Shift Manager	Tashkent State University of Technics Electrical Energy	2006 May	24.08.1984	34
③		Mr. Karim SAMANDAROV	Navoi CCPP-1 Shift Manager	Tashkent State University of Technics Thermal Energy	2010 April	06.02.1987	31
④		Mr. Jamshid PIRMANOV	Navoi CCPP-2 Leading engineer on TME	Navoi Mining Institute Electrical Energy	2012 July	12.03.1990	28
⑤		Mr. Nurali PIRNAZAROV	Navoi CCPP-2 Shift Manager	Tashkent State University of Technics Electrical Energy	2012 July	18.07.1989	29
⑥		Mr. Laziz MAKHSUDOV	Navoi CCPP-2 Shift Manager	Navoi Mining Institute Electrical Energy	2012 July	30.06.1988	30
⑦		Mr. Fakhriddin HAMROEV	Navoi CCPP-2 Shift Manager	Navoi Mining Institute Electrical Energy	2011 October	19.10.1988	30
⑧		Mr. Dilshod ASLONOV	Navoi CCPP-2 Shift Manager	Navoi Mining Institute Electrical Energy	2012 August	29.08.1990	28
⑨		Mr. Shukhrat BAYLIEV	Navoi CCPP-2 Engineer on TME	Navoi Mining Institute Electrical Energy	2013 December	12.02.1987	32
⑩		Mr. Lutfillo KHUDOYKULOV	Navoi CCPP-2 Seinior master on operation	Navoi Mining Institute Electrical Energy	2012 August	30.07.1989	30

Maintenance Group			Title	Final Education / Graduation Subject	Year of Employment	Birth Date	Age
⑪		Mr. Latif KHASANOV	Navoi CCPP-1 Leading Engineer-Programmer	Tashkent State University of Information Technology Programmer	2011 September	23.03.1988	30
⑫		Mr.Ulmas KADIROV	Navoi CCPP-2 Engineer Programmer	Tashkent State University of Information Technology Programmer	2018 August	12.02.1996	22
⑬		Mr. Khudoyor KHALILOV	Navoi CCPP-1 Engineer Programmer	Navoi Mining Institute Electrical Energy	2018 February	12.11.1994	25
⑭		Mr. Uktam KUVANOV	Navoi CCPP-2 Engineer I&C	Tashkent State University of Technics Electronics and Automation	2012 November	13.08.1989	30

8.2.2 Site Inspection of the Simulator Training Facility in Japan

Training of Simulator Trainers and Observation and Site Inspection of the Simulator Training Facility in Japan

(1) Participants

Navoi CCPP-1 : Mr. Alisher MUSAYEV (Leading Engineer),
Mr. Latif KHASANOV (Leading Engineer Programmer)

【 JET】: Mr. Murata, Mr. Wakabayashi, Mr. Iwashita, Mr. Umid

(2) Implementation Plan

Period	Location	Purpose of Observation
November 9, 2018	Kansai Electric Power Company Co. Ltd. Himeji #2 Power Station	① To gain knowledge in the Operation systems and Operating equipment in the Central Control Room of up-to-date F type GT plants, four (4) O&M staff in Navoi CCPP-3 have acquired knowledge during the inspection tour of the training facility. ② To observe training demonstrations and acquire the roles as Simulator Trainers, a tour were conducted in the F-type GT Simulator training course.
November 12, 2018	Kansai Electric Power Company Co. Ltd. Capacity Development Center	⓵ To observe training demonstrations and acquire the roles as Simulator Trainers, a tour was conducted in the conventional plants of the Simulator training course.

(3) Site Visit of Simulator Training at Himeji No.2

Comments of Trainers of NTC on the Site Visit of Simulator Training at Himeji No.2

1) It is understood that the five (5) Operators who participated the simulator training are capable enough to operate and monitor the six (6) units of Simulators at Himeji No.2 Power Station. Simulator training has enabled the participants to be highly effective on their routine work at CCPP.

2) The conduct of the simulator training has provided technical knowledge, skills and enthusiasm to the trainees.

3) The trainers have envisioned that the trainees are looking forward to the final goal of the simulator training.

4) The trainers of NTC have considered it very important to have a review discussion with the

trainees after each session of the simulator training. The review discussion shall be organized with sufficient time to encourage for more interactions between trainers and trainees.

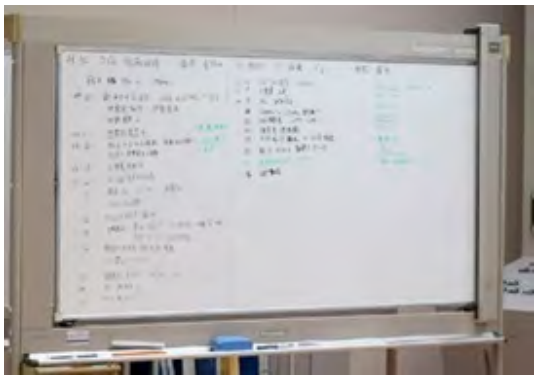
(4) The results of the observation tour in Japan

1) Date：November 9, 2018 **2) Site /Location：Kansai Electric Power Company Co. Ltd. Himeji #2 Power Station**
【 Centralized control room : Commissioning of #5 Unit after Periodic inspection】
 
 
【 Inside the Turbine Room】

<table>
<tr><td>  </td><td>  </td></tr>
<tr><td colspan="2">【 Visit of Simulator Training Site】</td></tr>
<tr><td>【 Orientation】</td><td>【Instructor Room】</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>【 Power failure in Power Plant : Lights off 】</td><td>【 Conduct of inspection and monitoring】</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td colspan="2">【 Implementation of Troubleshooting Training】</td></tr>
<tr><td>  </td><td>  </td></tr>
</table>

	
1. Date：November 12, 2018 **2. Site /Location：Kansai Electric Power Company Co. Ltd. Capacity Development Center**	
【 Simulator Training: Oil-fired conventional type】	
【 Orientation】	**【Instructor Room】**
	
【Instructor Room】	
	
【Operator Room】	**【Troubleshooting Training】**

【Troubleshooting Training】



【 Discussions on Proper Response to Accidents 】

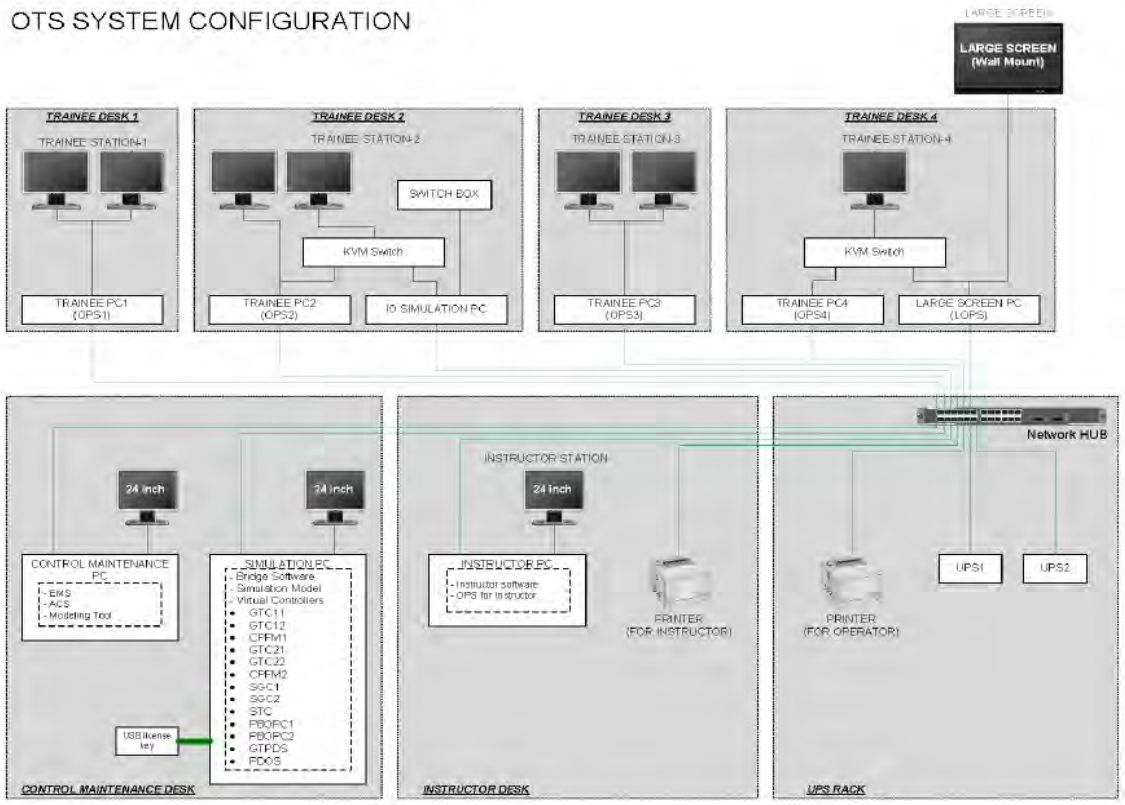
The Shift Heads taught the Trainees on proper response to water leakage from the boiler tubes. The Trainees learned to make immediate decisions and performed the appropriate solutions to the water leakage.

8.2.3 Pilot Training of the Simulator Trainers

8.2.3.1 Orientation: June 14, 2019 (Friday)

(1) JET explained to the lecturer the attached “Outline of Simulator Equipment” as follows:

1) F type gas turbine simulator： Outline of 2 (GT x 2) on1 (ST x 1) equipment configuration
2) Functions, characteristics, and handling methods of instructor desks, etcetera
3) Overview of Operation Training Simulator (OTS) equipment system and software equipment



(2) Overview of the functions of the four (4) software

Table 8.2-1 Software Functions of Simulator Systems

No.	Items	Function
1	**MPS:** **Multiple Process Station**	MPS is a controller CPU that manages the input and output to the Site, and control logic execution. In the OTS, it is simulated as a Virtual Controller
2	**OPS:** **Operator Station**	OPS is CRT operation device in CCR Graphic display of system diagram Control loop plate (control panel) Alarm display Trend display Monitoring of logic operation status
3	**ACS:** **Accessary Station**	ACS is used for storage and management of various long-term data of facilities. ACS

		units are equipped with the following data management functions to support operation: - Reports - Data logging - List display and so on
4.	**EMS: Engineering and Maintenance Station**	EMS is used for maintenance of various services the DIASYS Netmation offers. Configuration of control systems Creating and updating control logic for MPS Creating graphics for display on OPS Configuration of OPS functions. Drawing management

(Source: JET)

(3) Overview of Major Simulation Functions

Table 8.2-2 Summary of Simulation Function

No.	Items	Functions	Remarks
1	**Maintenance Function**	- OTS system startup/shut down - System monitoring	
2	**Simulator Control Function**	Reset function to set or change the Initial Conditions (IC) file.	Various plant or operation conditions can be set from the IC file list, snapshot file list or backtrack file list at any time during the OTS run. The maximum number of registered IC files is 200.
		Snapshot function to temporarily save the current simulation status.	The maximum number of registered snapshot files is 100.
		RUN/FREEZE function Run: Starts the simulation. Freeze: Pauses the simulation.	
		Backtrack function The past simulation status automatically saved as a backtrack file every two minutes	60 backtrack files can be stored at maximum.

		Simulation time scale or speed can be changed (×2, real time, ×1/2, ×1/4)	Even though simulation speed is changed, time clock count is not changed.
3	**Malfunction Function**	Setting the abnormal conditions in the simulation models.	186 malfunctions are supplied. Instructors can insert the malfunction for all instruments and valves. Detailed specification of Malfunctions are described in D4-J205“MALFUNCTION SPECIFICATION FOR TRAINING SIMULATOR”
4	**Remote function**	The external parameters of simulations can be changed, and some equipment which cannot operate from CCR can be operated	Remote function list is attached in this document
5	**Monitoring Function**	Parameter and Trend Monitoring	The trend and parameters are displayed on the Trainer station in real time.

(Source: JET)

(4) Overview of Hardware Devices Used for Each Position in the Simulator Room

Table 8.2-3 Hardware Equipment for Simulator Room

Room Name	Staff Positioning	Hardware Equipment
Instructor Room	Instructor : 1 person	・Instructor PC (1 set) ・Simulation PC (1 set) ・Control Maintenance PC (1 set) ・ Monitor (3 pieces) ・USB license Key (2 pieces) ・Emergency Telephone (2 pieces) ・Laser Printer (1 set)
Operator Room	Shift Director : 1 person Operator : 3 people Operation support /	・Trainee's PC (4 sets) ・Monitor (7 pieces) ・Emergency Stop Button (3 pieces)

	Record : 1 person	・Large Screen (1 piece) ・Large Screen PC (1 piece) ・IO simulation PC (1 piece) ・Network HUB (1 piece) ・KVM: Keyboard, Video, Mouse Changeover Switch (2 pieces) ・UPS (2 pieces) ・Emergency Telephone (2 pieces) ・Transceiver (1 piece) ・White Board (1 piece) ・Laser Printer (1 set)
Patrol Room	Patrol Staff : 1 person	・Transceiver (1 piece)

(Source: JET)

8.2.3.2 Training by TA

(1) Training by TA on Proper Response to Incidents

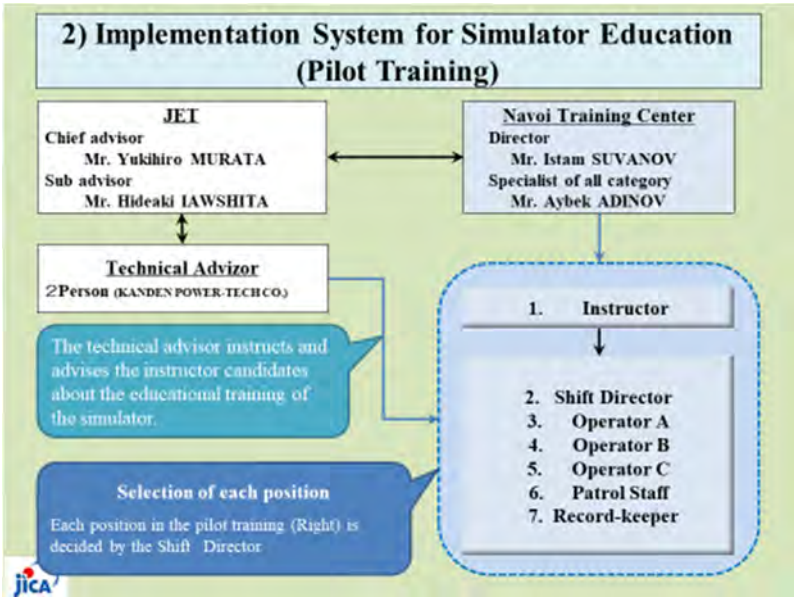
1) Period: June 17-28, 2019 (Monday-Friday)

2) Number of Participants: 102 Persons from Navoi CCPP (Cumulative)

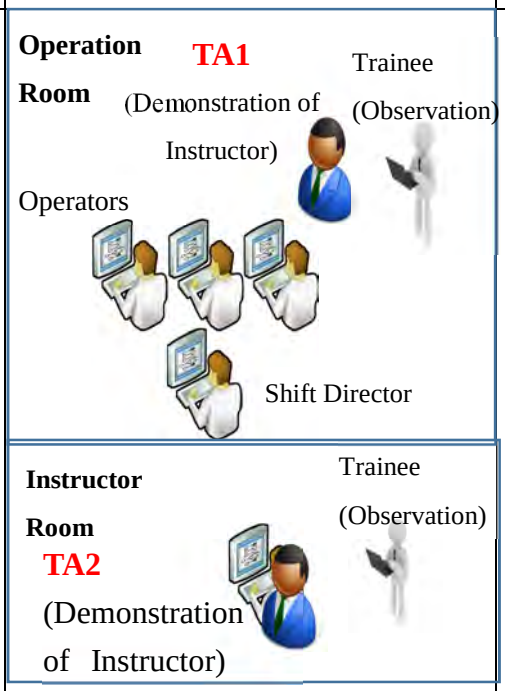
3) Objective:

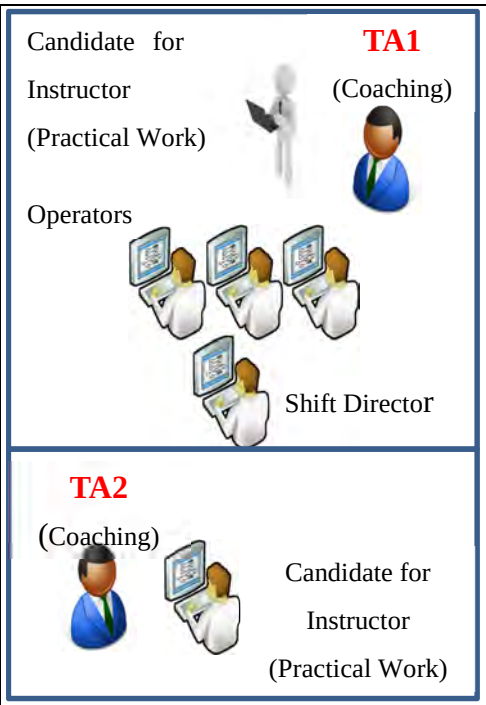
(a) To acquire Trainers and Trainer Candidates who can teach the basic knowledge on Simulator training of CCPP

(b) To provide experience effectively in trouble management through lecture and practical applications.

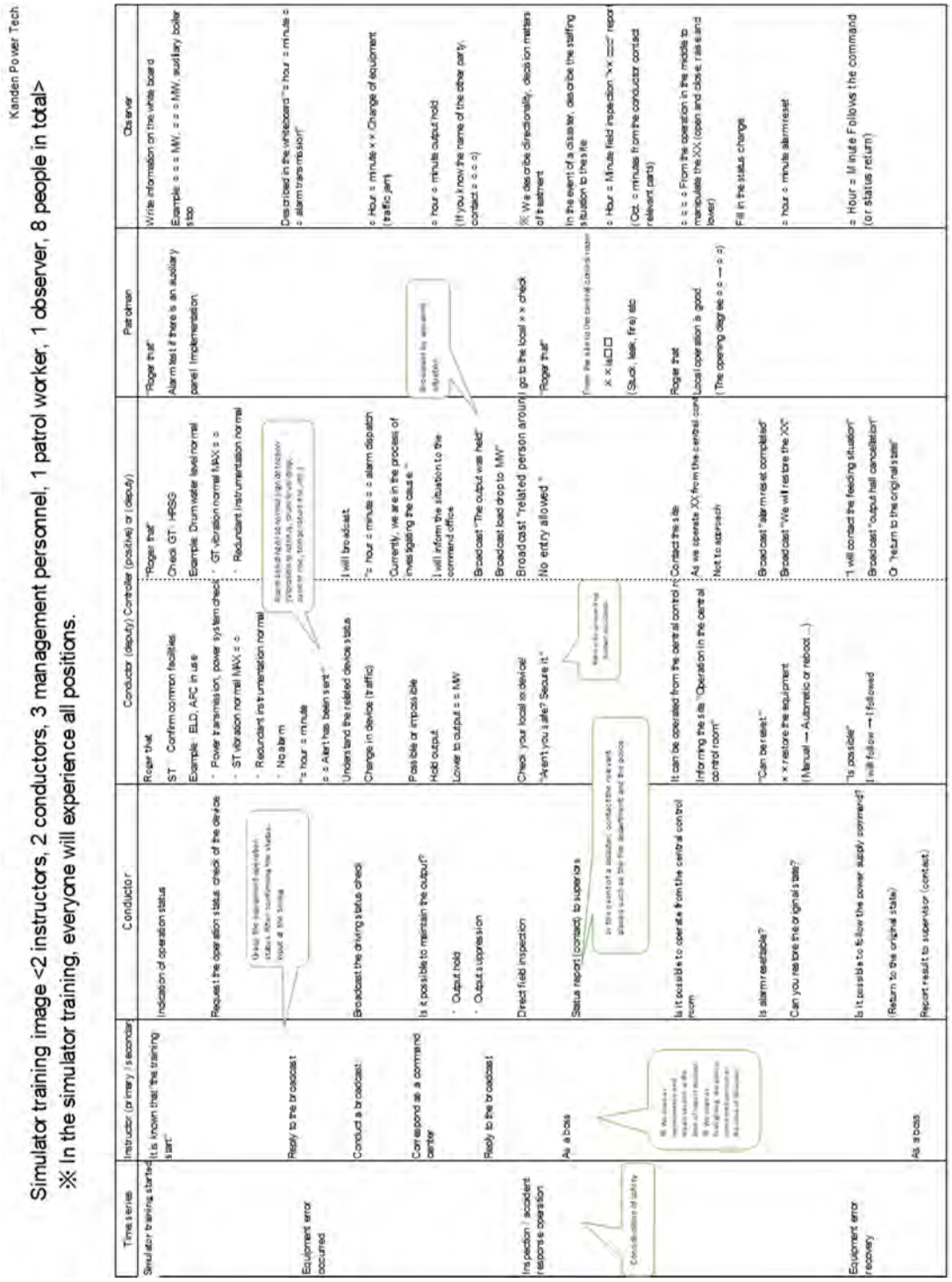


(2) Process of Troubleshooting Training and the role of TA (Technical Adviser)

<table>
<tr>
<td>[Classroom Lecture]
・Mental preparation in development and coaching
・Creation of the accident set items</td>
<td>  </td>
<td>[Procedures]
・Mental preparation and posture in development And coaching
[Roles of TA]
Trainees will be made conscious of key points, etcetera of training methods through exchange of ideas.</td>
</tr>
<tr>
<td>[Practical Work]
Improvement of Trainers' technical capabilities</td>
<td> 
</td>
<td>[Procedures]
Demonstration of response from Shift Staff and Trainers to start-ups and shutdowns, typical malfunctioning items, etcetera
[Roles of TA]
TA1 ⇒ Commentary on coaching and response by Shift Staff
TA2 ⇒ Demonstration of Instructor's role with commentary.</td>
</tr>
</table>

[Practical Work-] Development of Candidates for Trainers		**[Procedures]** Conducting the training of Shift Staff and Candidates for Instructors, and acquisition of coaching methods and technique using literature and check sheets. [Roles of TA] TA1 ⇒ Commentary and coaching of Candidate for Instructor in the Operator room TA2 ⇒ Commentary and coaching to Candidate for Instructor in the Instructor Room

(3) An image of troubleshooting training



(4) Troubleshooting Training: 18 Malfunctions carried out in NTC

Number of MF items by equipment selected in this pilot training
1. GT：8 items
2. HRSG: 3 items
3. ST: 3 items
4. BOP: 3 items
5. ELECTRIC/GENERATOR：1 item　　Total：18 items

The outline of the 18 trouble-shooting in this pilot training

Table 8.2-4 Pilot Simulator Training Items from CCGT equipment (GT: F type)

A：Analog Function, D：Digital Function

A/D	MF No.	Malfunction (Plant condition)	Cause &Event
1.	Malfunction (G：Gas Turbine)		
A	**G007**	GT1 FUEL GAS HDR PRESS LOW (GT 100% load) ※・ Load reduction ・Fuel gas press low trip	GT1 FUEL GAS SUPPLY LINE LEAK 1) Fuel gas header press decrease 2) GT Runback
A	**G013**	GT1 DISC CAVITY TEMP HIGH (GT 100% load) ※Vibration High Trip	GT1 2C COOLING AIR SUPPLY LINE LEAK 1) Disc cavity temp increase 2) Bearing rotor vibration increase
A	**G019**	GT1 FGH TUBE LEAK (GT 100% load ,TCA/FGH mode is feed water)	GT1 FGH TUBE LEAK (OUTLET SIDE) 1) Fuel gas temp decrease 2) FGH drain level increase 3) FGH drain level high trip
A	**G021**	GT1 TCA TUBE LEAK (GT 100% load , TCA/FGH mode is feed water)	GT1 TCA TUBE LEAK (OUTLET SIDE) 1) GT Cooling air increase 2) TCA drain level increase 3) TCA feed water increase 4) TCA performance decrease 5) TCA drain level high trip
D	**G027**	GT1 LUBE OIL TEMP HIGH (GT 100% load)	GT1 GT LUBE OIL TEMP CONTROL VALVE close stuck

			1) LUBE OIL TEMP CONTROL VALVE full close (bypass side) 2) Lube oil temp increase 3) Lube oil temp high alarm 4) High lube oil temp, and high trip
D	**G037**	GT1 FUEL GAS TEMP LOW (C/C) (GT 100% load , TCA/FGH mode is feed water) ※GT Load hold during fuel gas temp low ANN ON	GT1 FUEL GAS TEMP CONTROL VALVE(C/C) close stuck 1) FUEL GAS TEMP CONTROL VALVE full close (bypass side) 2) Fuel gas temp decrease 3) Fuel gas temp low alarm 4) Fuel gas temp low GT Runback
D	**G041**	GT1 ROTOR COOLING AIR TEMP HIGH (S/C) (GT 100% load , TCA/FGH mode is radiator)	GT1 TURBINE COOLING AIR COOLER FAN (A) FAULT 1) Turbine cooling air cooler FAN (A) fault 2) Speed for Turbine cooling air cooler FAN (B)/(C) increase 3) TCA outlet air temp increase 4) Rotor Cooling Air Temp High Runback
D	**G063**	GT1 BLEED MIDDLE PRESSURE BLEED VALVE ABNORMAL(Open) (GT 100% load)	SOLENOID VALVE FOR GT1 COMPRESSOR MIDDLE PRESSURE BLEED VALVE LEAK GT1 Compressor Middle Pressure Bleed Valve Abnormal Open Trip
2.	**Malfunction (H：HRSG)**		
D	**H007**	HRSG1 HP EVAPORATOR TUBE LEAK (PLANT 100% load) ※Open Level control valve	HRSG1 HP EVAPORATOR TUBE LEAK (OUTLET SIDE) 1) HP Drum level decrease
D	**H027**	HRSG1 HP DRUM LCV (A) STUCK CLOSE (PLANT 100% load) ※Stop GT	HRSG1 HP DRUM LCV (A) STUCK CLOSE 1) HRSG1 HP feed-water flow decrease 2) HRSG1 HP DRUM water level decrease 3) ST trip due to HRSG1&2 HP Drum Level Low
D	**H053**	HRSG1 RH SPRALY CONTROL	HRSG1 RH SPRALY CONTROL VALVE

		VALVE STUCK CLOSE (PLANT 50% load) ※Plant stop	STUCK CLOSE IP SECONDARY REHEATER outlet temperature increase
3.	**Malfunction (S: Steam Turbine)**		
A	**S003**	VACUUM PRESS LOW (PLANT 100% load) ※Plant stop	CONDENSER EXPANSION crack 1) Condenser vacuum press decrease 2) Standby condenser vacuum pump (B) automatically starts 3) ST load decrease 4) ST Bearing rotor vibration increase
A	**S008**	HP MSV (LH) STUCK CLOSE (PLANT 100% load)	HP MSV (LH) stuck close 1) ST HPSV HP MSV (LH) SERVO LOOP Abnormal Alarm 2) HP TURBINE INLET STEAM temperature decrease 3) HP TURBINE INLET STEAM pressure decrease 4) ST HP/IP FLOW Unbalanced Trip
A	**S015**	ST LUBE OIL COOLER (A) PERFORMANCE DEGRADATION (Anytime ST MAIN OIL PUMP running ST LUBE OIL COOLER (A) is selected) ※ST Manual Trip	ST LUBE OIL COOLER(A) PERFORMANCE degradation 1) ST BEARING temperature increase 2) #X BRG. METAL TEMP.-* High Trip (MANUAL TRIP RQ) Alarm
4.	Malfunction (B: Balance of Plant)		
D	**B003**	CONDENSATE PUMP (A) FAULT (PLANT 100% load CONDENSATE PUMP (A)is running) ※When both pumps fail, ST trip due to LP Economizer water level low	CONDENSATE PUMP (A) electrical fault 1) Condensate pump (A) trip 2) Standby condensate pump (B) automatically starts
D	**B008**	AUX STEAM HEADER PRESSURE CONTROL VALVE STUCK CLOSE (During PLANT START UP)	AUX STEAM HEADER PRESSURE CONTROL VALVE stuck close 1) AUX STEAM HEADER and GLAND STEAM HEADER pressure

			continue low valve 2) ST Bearing rotor vibration increase 3) ST Rotor Position Abnormal
D	**B018**	CIRCURATING WATER PUMP(A) FAULT (Anytime CIRCURATING WATER PUMP(A) is running) ※One GT stop When both pump (a) and (b) fail, GT runback	CIRCULATING WATER PUMP(A) electrical fault 1) Condenser vacuum press increase 2) Cooling water temp for each heat exchanger in service water increases
5.	**Malfunction (E：ELECTRIC/GENERATOR)**		
D	**E006**	GT1G 46GINV RELAY ACTUATED (GT 100% load) ※Recovery Operation Reset Lockout Relay for restart after malfunction cancels	46GINV RELAY FAIL OPERATION (NEGATIVE PHASE SEQUENCE OVERCURRENT RELAY) 1) 46GINV Relay Operation 2) 86GGA/86GGB Lockout Relay Operation 3) 51G,41E, SFC Trip Request

(Source: JET)

Daily Report of Simulator Pilot Training (June 17~20, 2019)

Simulator Pilot Training

17-Jun-19

[Participants: 5 instructor candidates: ④⑨⑫⑬⑭]

- **Explanation of training operation**
- **Maintenance training etc.**

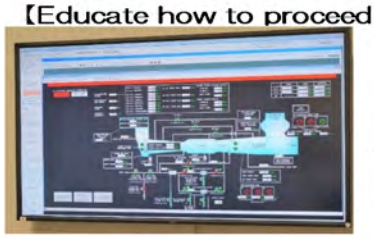
- 1. B-003 CONDENSATE PUMP (A) FAULT (participant: ④⑨⑫⑬⑭)

※ In training instructors, experience how to proceed with simulator training divided by simulator trainees and instructors.

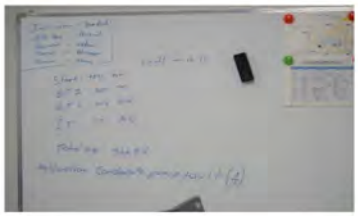
※ All instructor candidates will be educated on how to proceed with simulator training while changing the operator's five positions.

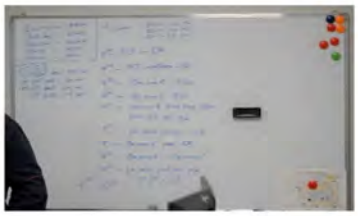
[Training operation explanation, training for medical preparation etc..]

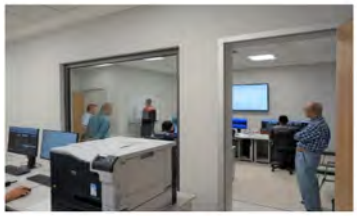
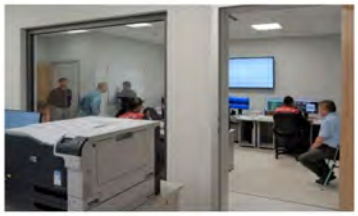

【Educate how to proceed simulator training】








Simulator Pilot Training

18-Jun-19

[Participants: 6 instructor candidates: ④ ⑨ ⑩ ⑫ ⑭ ⑭ + 5 direct staff]
※ Shift staff breakdown (1 person for ST operator, 4 persons for patrol)

- **2. G-013 GT1 DISC CAVITY TEMP HIGH**

※ Patrol staff do self-study for about 1 hour to get used to the screen operation. The patrol staff also created a trend screen corresponding to malfanction.

- **12. S-015 ST LUBE OIL COOLER (A) PERFORMANCE DEGRADATION**

※ In this training item, we will teach the instructors how to use Malfunction for the purpose of continuing the ST operation by switching the lubricant cooler.

[Instructors explain the simulator training specification overview to shift staff]



[Explanation of how to proceed with instructor]

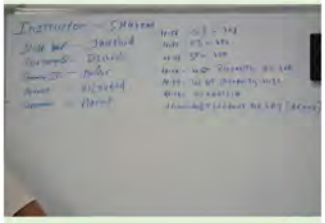
[Screen operation etc. of shift staff]


【GT1 DISC CAVITY TEMP HIGH】

[Troubleshooting operation]



[Progress record at the time of trouble]




【Review meeting after the training】



Simulator Pilot Training

19-Jun-19

[Participants: 6 instructor candidates: ④⑨⑩⑫⑬⑭+8 shift staff]
※ Breakdown of shift personnel (2 person for GT operator, 2 person for ST operator, 1 gas compressor, 3 person for patrol)

- 3. G-063 GT1 BLEED MP VALVE ABNORMAL (CLOSE)

※ Patrol staff do self-study for about 1 hour to get used to the screen operation. The patrol staff also created a trend screen corresponding to malfanction.

- 4. G-021 GT1 TCA TUBE LEAK
- 15. B-018 CIRCUIT WATER PUMP (A) FAULT

[Explanation of how to lead lecturer]

[Mastery of screen operation etc. of shift staff]

【GT1 BLEED MP VALVE ABNORMAL(CLOSE)】

[Troubleshooting operation]

[Progress record at the time of trouble]

【Review meeting after the training】

Simulator Pilot Training

20-Jun-19

[Participant: 6 instructor candidates: ④⑨⑩⑫⑬⑭ +12 shift staff]
※ Breakdown of shift staff (1 leader, 1 sub-leader, 1 GT operator, 1 ST operator, 8 patrols)

- 18. E-006 STG AVR TROUBLE

※ The patrol staff is trained for one hour to get used to the screen operation.
In addition, we also create a trend screen corresponding to the Malfunction.

- 5. G-007 GT1 FUEL GAS HDR PRESS LOW
- Malfunction contents list making (It is made about eight items carried out by today and the morning)

※Instructors operate the simulator and create a document that serves as a manual to educate instructor candidates on optimizing various settings, assuming malfunction factors, and establishing prerequisites for malfunction functions.

[Instructors explain the simulator training specification overview. to shift staff]


[Mastery of screen operation etc. of shift staff]


[Explanation of how to lead lecturer]



【GT1 DISC CAVITY TEMP HIGH】

[Troubleshooting operation]


[Progress record at the time of trouble]

【Review meeting after the training】

(5) The results of the training survey

The results of the training survey questionnaires conducted for the 6 trainers are above average "5 points".

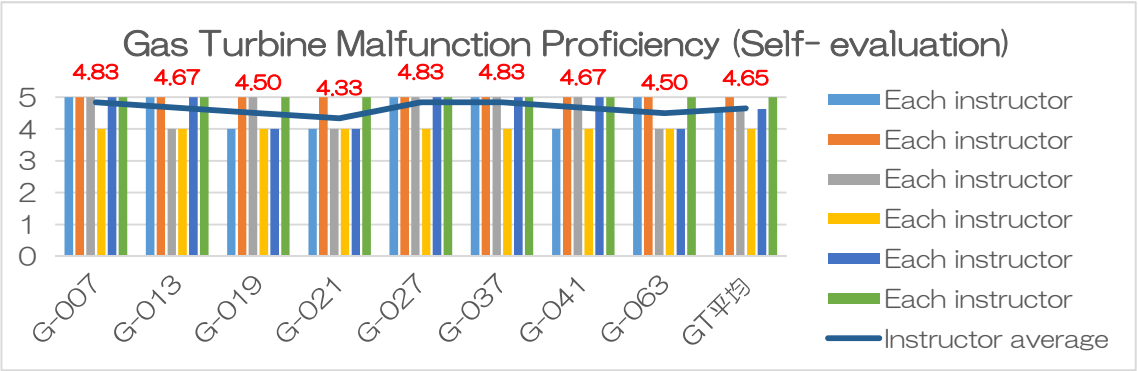
1) Level 1, Training Satisfaction: Good (10 points); Fair, (5 points); Poor (2 points)

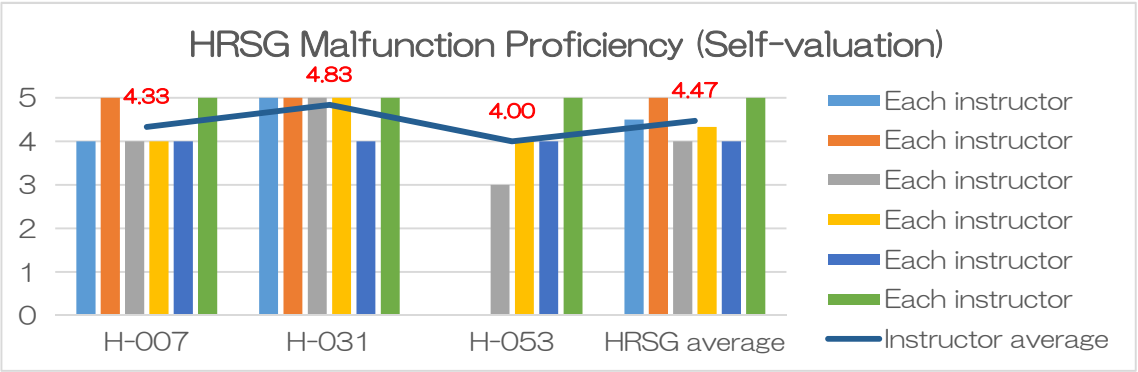
Survey Results of satisfaction

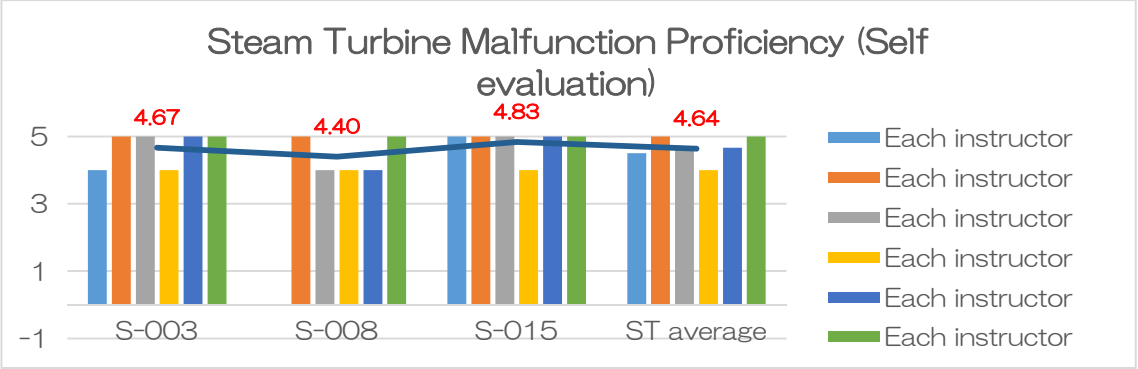
No.	Questionnaire content / Item	Name	Instructor						Average
			Jamshid PIRMANOV	Shukhrat BAYLIEV	Uktam KUVANOV	Ulmas KADIROV	Khudoyor KHALILOV	Khudoyarlov LUTFULLO	
		Department	Navoi CCPP-2	Navoi CCPP-2	Navoi CCPP-2	Navoi CCPP-2	Navoi CCPP-1	Navoi CCPP-2	
		Position	Leading Engineer of TME	Engineer of TME	I & C Engineer	Program Engineer	Program Engineer	Head Master	
		Instructor candidate number	④	⑤	⑥	⑫	⑬	⑭	
1	How do You feel as a whole participating in this training?		10.00	5.00	5.00	5.00	5.00	5.00	5.83
2	To what extent can this training be used to develop teaching materials? Please circle the applicable items in the following items and enter the reason.		5.00	5.00	5.00	10.00	5.00	5.00	5.83
3	Teaching materials		5.00	5.00	10.00	10.00	10.00	5.00	7.50
	How to proceed with training		5.00	5.00	10.00	5.00	10.00	5.00	6.67
	Training content		5.00	5.00	10.00	5.00	10.00	5.00	6.67
Average			6.00	5.00	8.00	7.00	8.00	5.00	6.50

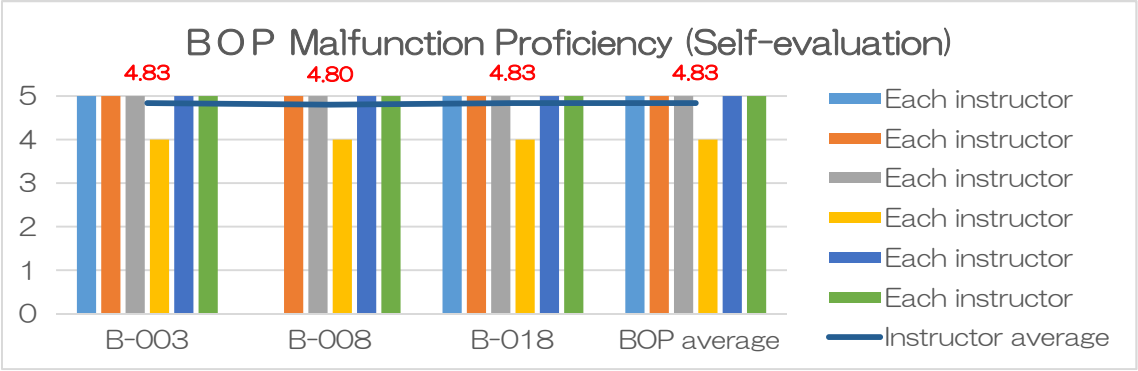
2) Level 2: Training level: All trainers were under Skill Level 4 or higher as shown in the table below.

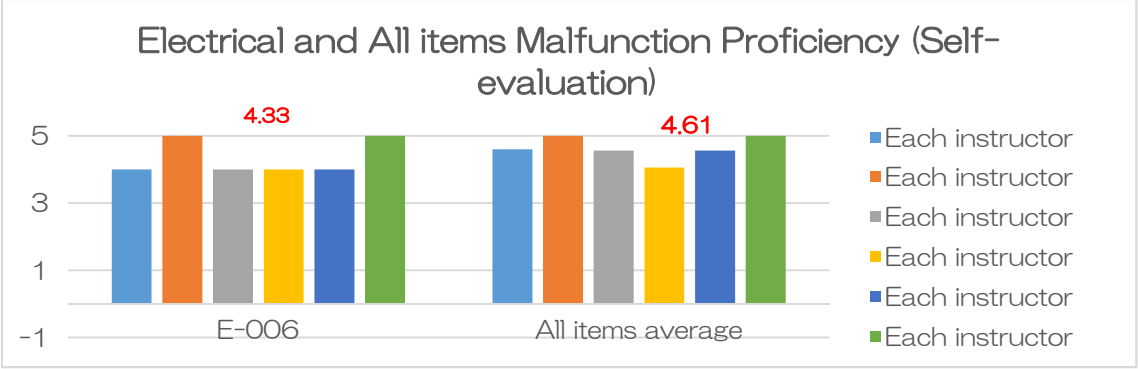
Skill Level 5	:	Accurate response to malfanctions through a series of countermeasures
Skill Level 4	:	Possible to cope with malfanctions with some advise.
Skill Level 3	:	Possible to cope with malfanctions by frequent advise.
Skill Level 2	:	Even if there is advice, it cannot cope with malfanctions

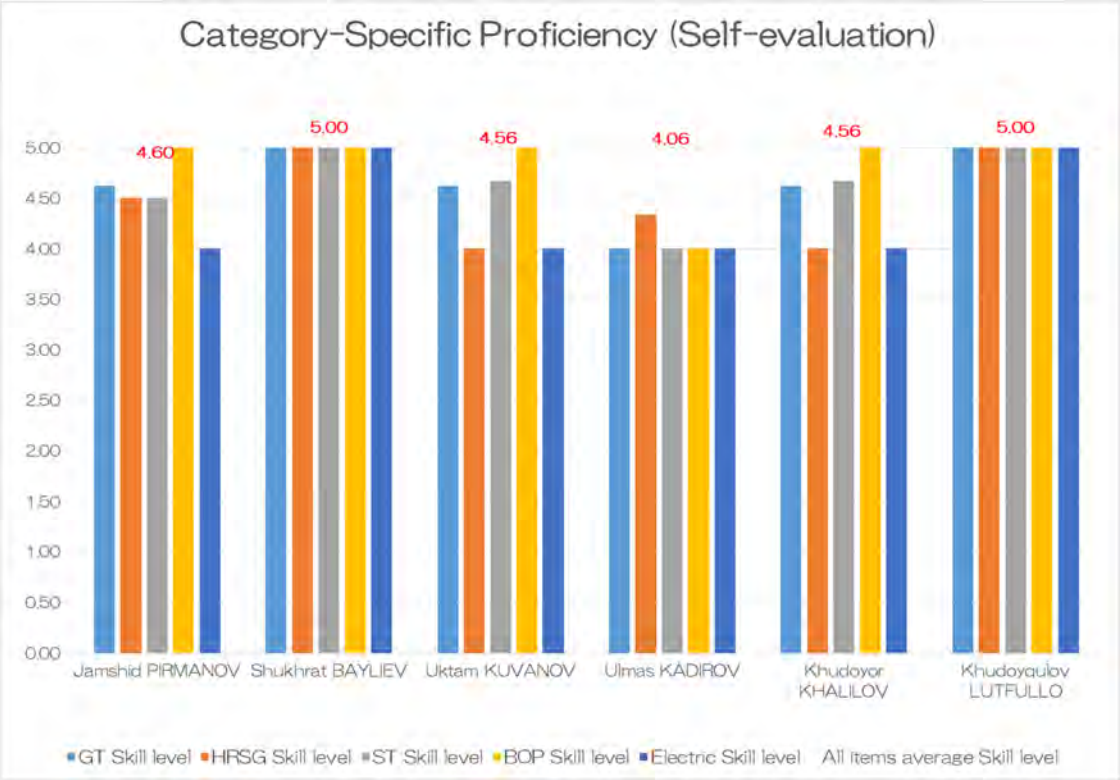



HRSG Malfunction Proficiency (Self-valuation)
5
4
3
2
1
0
4.33
4.83
4.00
4.47
H-007
H-031
H-053
HRSG average
Each instructor
Each instructor
Each instructor
Each instructor
Each instructor
Each instructor
Instructor average


Steam Turbine Malfunction Proficiency (Self evaluation)
5
3
1
-1
4.67
4.40
4.83
4.64
S-003
S-008
S-015
ST average
Each instructor
Each instructor
Each instructor
Each instructor
Each instructor
Each instructor


BOP Malfunction Proficiency (Self-evaluation)
5
4
3
2
1
0
4.83
4.80
4.83
4.83
B-003
B-008
B-018
BOP average
Each instructor
Each instructor
Each instructor
Each instructor
Each instructor
Each instructor
Instructor average


Electrical and All items Malfunction Proficiency (Self-evaluation)
5
3
1
-1
4.33
4.61
E-006
All items average
Each instructor
Each instructor
Each instructor
Each instructor
Each instructor
Each instructor



(6) Comprehensive Assessment of the Pilot Training

1) Results of the survey questionnaire that was administered to the six (6) Trainers

(a) Level 1: With respect to the response of the Trainers to the questionnaire on their satisfaction on the training has resulted to an average of 6.5 points against the highest which is 10 points. There was also a comment from the trainer, among others, that Simulator training is very important in enhancing the knowledge and capabilities of O&M staff.

(b) Level 2: The self-assessment of the training is under Level 4 or higher (against the highest level of 5) for all the Trainers. However, while the Trainers have noted that the role of the operators is not only limited to “Start” and “Stop” operations and monitoring for the occurrence of accidents, the trainers were able to achieve coaching level in discussion on the flow of troubleshooting training.

※ Trainers were also conducting training to other CCPP operators on the following Beginner Course items.

(a) Normal start/stop of the unit

(b) Monitoring of spin and turning operation

(c) Load operation (control mode, automatic load adjustment)

(d) Automatic synchronization
(e) Special operation (load runback/automatic stop)
(f) Emergency Stop (GT/ST trip)

2) Observation on the results of the troubleshooting training in selected 18 common Malfunctions

During the review meeting after each sessions of the training, the Trainers have identified the following for the improvement of next trainings:

(a) Carefully observe the behaviors, judgments, etcetera of the Team, i.e. Shift Head /Operators of GT, ST, and BOP/ Patrol staff and record keeper.
(b) Comprehend the adaptability of the individual behaviors and judgments.
(c) Provided sound advice both on good points and bad points of trainers and the operating staff.

The "good points" and "bad points" of the trainer and the operating staff are shown in the table below.

<Trainers>

Good Points	Bad Points
The Trainers have noted that training is not just allowing the trainees to observing and operating the "start" and "stop" to prevent the accident and situations.	While it is important for trainers to carry out the pilot training according to the trainee's needs, it is also necessary to control the entire conduct and discussions of the training to prevent it from deviating from the scenarios presented by the instructor.
It was not so clear to the trainers on how to handle and implement the training session, and yet, the trainers have fully recognized the need and ability to control the conduct of the training session.	In the actual exercises, if the trainees have failed to execute troubleshooting, the Trainers shall provide the necessary coaching to the trainees and have to identify the causes of the failure in order for the trainees to learn their mistakes rather than the Trainers have to criticize the failure of the trainees for not able troubleshoot.
The trainers fully understand the discussions in the training and actively participated by asking questions to the TA to clarify issues and	Trainers are required to carefully observe the behaviors, judgments, etcetera of the Team (Shift Head, Operators (of GT, ST, and BOP),

concerns from the discussions and the interactions has deepen the understanding of the trainers.	Patrol staff and record keeper), comprehend the adaptability of the individual's behaviors and judgments, and gave sound advice on the good and bad points during the conduct of the feedback mechanism after the training session
-	Many of the Trainers' comments at the review meeting were intended for individuals who still lacks the necessary skills and require more training to further develop their skills and capabilities.

<Shift Head (Conductor)>

Good Points	Bad Points
Conductors can communicate and report basic operations.	The conductor was not able to give proper instructions to the Operator (GT / ST / BOP).
–	The conductor has not given a clear instructions to the Patrol Staff.

<Operator (GT・ST・BOP)>

Good Points	Bad Points
The Operators were able to answer their own questions.	Operators were unfamiliar with some parts due to differences in equipment for CCPP-1.
Operators experienced the Pilot training and were able to enhance their knowledge on the challenges that Navoi CCPP-2 are facing.	Operators did not give specific instructions to the Patrol staff.
Operators have increased their knowledge and experiences through repeated exercises of incidents, and at the review meeting after the training, their own good points and bad points have been determined from a third-party perspective.	–

<Patrol Staff>

Impression
In the Pilot training, the Patrol staff has actively participated only in some instances, thus, it is difficult to make a right assessment.
Patrol staff usually have no opportunity to operate in the CCR, and when they participated in the training as an operator, they were actively seeking instructions from the shift head.
Patrol staff were a little puzzled not knowing what to do because there were no specific

instructions.

<Record-keepers>

Good Points	Bad Points
The Record-keepers have recognized their importance in the Pilot training.	Record-keepers did not able to see their role in practical operations.
Record-keepers have good working attitude on unfamiliar assignments. They recognized first of all that it is important to take action.	Some record-keepers maintained poor records because they have no skills on proper record keeping, Developing and enhancing the skills on proper record keeping is a real challenge.
Record-keepers are actively collecting information and though gradually, the contents and items they describe have been increasing. This means they have a deep understanding of the importance of record-keeping.	There are parts in which record-keepers do not understand what kind of contents they are to keep because they were not aware of the existence of any supervisor in record-keeping.

8) Proposal for Improvement.

No.	Items	Contents
1	Accuracy and speedy implementation of the Trainers' troubleshooting exercises	Through training with 18 items of troubleshooting by equipment type, Trainers experienced a good training environment, but they lack the required speed and accuracy in troubleshooting.
2	Creation of a system where more than one full-time Simulator Instructor is assigned.	① The existing Trainers are all part-timers. Therefore, it is important that Chief of Navoi Training Center has to put more efforts to create an organizational structure wherein additional full-time Instructors will be posted. ② It is important that Trainers will prepare the annual process-control charts for Simulator training in order to effectively utilize Simulator equipment.
3	Preparation of Accident Managing Operation Manual for Simulator Training ※Accident Managing Operation Manual for Simulator Training is	Trainers conducted training using the following manual that JET had developed, wherein the typical 18 items of troubleshooting by equipment type were described. ① Reoccurring items in accidents to include the set-up of accidents simulation and preparing training reports. ② Troubleshooting Textbook： The Trainers have sufficient comprehension on the contents

	supposed to be developed by Navoi Training Center	of the Simulator Manual, it will be crucial for the Trainers to develop and prepare the Accident Managing Operation Manual as part of the training to provide hands-on and transfer of technical skills. However, considering the part-time status of the existing Trainers, completion of the manual might be challenging due to time constraint and the lack of focus in its preparation. ＊JET's comments: If the Trainers will not be able to complete the training due to the given situation, the effect of the Pilot training will lose its substance, this will require on the continuing coaching and advise by the TA to the Trainers.
4	Preparation of Manuals to Manage Serious Accidents	In order to manage future accidents, it is very important that JET will develop the "Manuals to Manage Serious Accidents (at least for 3 cases)," and utilize the Manuals as reference of the lecture to the Instructor Development Course of the Simulator Training.
5	Future Trainings for Trainers	Navoi Training Center recognizes that in order to train new Trainers, it is crucial to enhance the experiences of Trainers' in troubleshooting by improving the following manuals for Simulators and conducting training for the remaining 89 items of troubleshooting by equipment type as well as it is required to have a continued coaching and advising by TA to Trainers ① Reoccurring items in Accidents to include setting up of accidents scenarios, and preparation of training reports ② Troubleshooting Textbook ③ Operation Manual for Management of Accident
6	Implementation of Simulator Training in Japan	It is important for Trainers (in charge of Operations and Maintenance Tools) to study the demonstrations by Japanese Trainers at a power plant with F-type and J-type Simulators, and conduct hands-on exercises on the Simulators to enhance their technical knowledge and capabilities.
7	Development and Management of Trainees	Navoi Training Center recognizes that in order to manage the development of the existing capabilities of the Trainees, it is very important to establish a Management System.

8	Upgrading of Equipment in the Simulator Room	① Procurement of video-recording function equipment (2 pieces of Video cameras): Trainers should document the conduct of the training and the trainees through video-recording for follow-up references by the trainees for their future improvement of their technical skills. ② Procurement of broadcasting equipment (2 sets of microphones and speakers): Progress related to the training including Instructor's instruction and coaching should be properly disseminated by the Instructor's announcement from the Instructor Room. Also, the Trainers should document and record the communication exchanges with the trainees. A good communication device able the Trainers and trainees to have a clear exchange and a good grasp of instructions during the conduct of the training. ③ Procurement and installation of switches for lighting in Operator Room: Lights should be switched off during the training for plant power failure in order to make the situation a reality.

Chapter 9

9. Activities of Assistance for the Establishment of an Operation System

9.1 To confirm System of O&M in CCR of CCPP

9.1.1 Work Shift System at Navoi CCPP

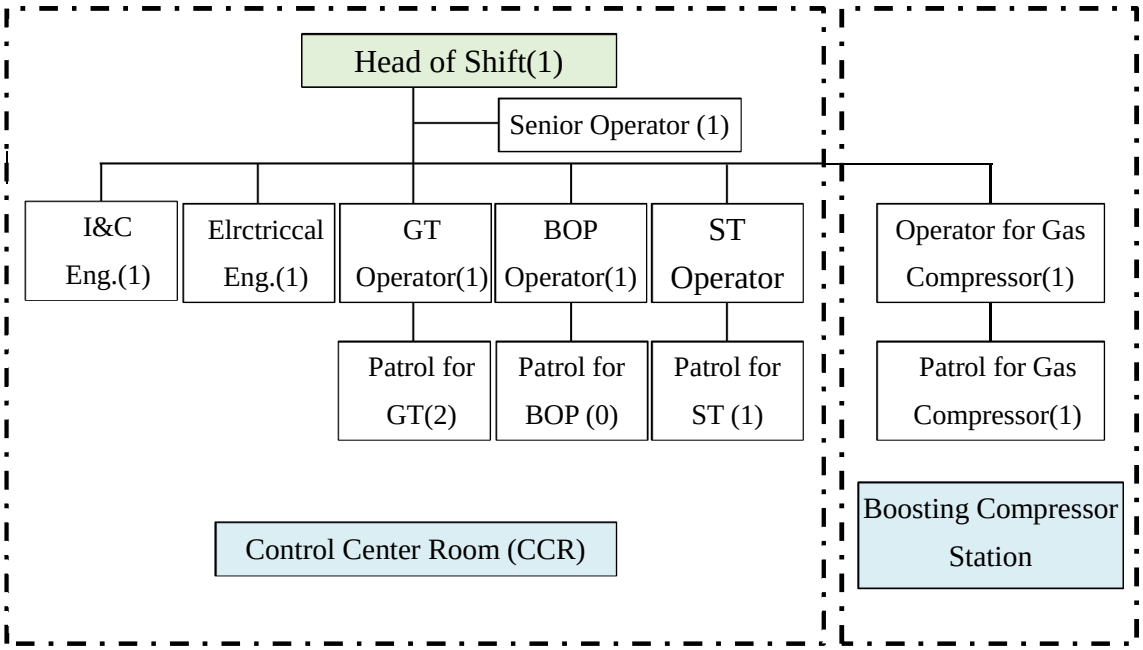
The work shift system at Navoi CCPP is shown below.

(1) System of duty: 3 shifts, 5 groups

(2) Time for duty:

1) The 1st Shift: 08:00～16:00
2) The 2nd Shift : 16:00～00:00
3) The 3rd Shift: 00:00～08:00

(3) The figure below shows the organizational chart of Navoi CCPP-1 Operators per Shift.



9.1.2 Number of Operators per shift

The number of operators per shift of Navoi and Talimarjan CCPP is shown in the table below.

	Navoi CCPP-1	Navoi CCPP-2	Talimarjan CCPP-1&2
Number of CCR	**1**	**1**	**1**
Head of Shift	**1**	**1**	**1**
Senior Operator	**1**	**1**	**1**
GT Operator	**1**	**1**	**1**
BOP Operator	**1**	**1**	**1**
ST Operator	**1**	**1**	**1**
Patrol for GT	**2**	**1**	**1**
Patrol for BOP	**0**	**1**	**1**
Patrol for ST	**1**	**1**	**1**
Operator for Gas Compressor	**1**	**GT Operator**	**4**
Patrol for Gas Compressor	**1**	**1**	**1**
I&C Specialist ※1)	**3**		**2**
Electrical Engineer	**1**	**1**	**1**

※1 Total Number of Technical Personnel of Navoi and Talimarjan CCPP is shown in the table below.

		Navoi CCPP-1	Navoi CCPP-2	Talimarjan CCPP-1&2
I&C Specialist		**12**	**12**	**10**
I&C Engineer		**1**	**1**	**15**
Programmer (Engineer)		**2**	**3**	**1**
Electrical Engineer		**4**	**4**	**-**

※There are two (2) I&C maintenance companies for Navoi CCPP, they are the JSC ESAN and technical personnel composed of about 4-5 members who are always present at the plant site.

9.2 Proposed Tasks in the Existing Training Center

(1) The General Director of NTPP, Mr. K. Ganiev has agreed the proposed organizational structure of NTC as shown in the table below.

Staff of Navoi Training Center

Job Position/ Assigned Staff	Category
・Training Center Director (1person) (Mr. Istam SUVANOV)	Managing
・Master of Production Training（ 1person） (Mr. Aybek ADILOV)	Administration
・Specialists (3-2persons) (Mr. Utkir Hamroev and Mrs. Yulduz ADILOVA)	Specialist
Total 4 persons	

The activities in the existing training center is focused in the construction management of the new training center. Therefore, it is necessary to establish immediately an organizational structure and system to enable the personnel in the training center to carry its main tasks.

(2) Issues and Tasks

(1) To select and assign staff with comprehensive management skills who can estimate and manage annual working capital and the same time able to plan and handle the operational budget.

(2) The staff of the existing NTC are engaged in the construction of CCPP-2 as part-timers. Their involvement will disrupt in the smooth implementation and promotion in the training business of NTC.

(3) Part-time trainers at NTC are mainly responsible for O&M of CCPP-1or 2. In the event that there will be an emergency shutdown in the operation or any accident at CCPP -1 or 2, these trainers have to immediately response to the event and/or accident, thereby, disrupting the main tasks of the trainers in the NTC training business.

(4) To select and assign trainers for a specific topic from the training module.

(5) To select and assign staff who can conduct surveys, analysis and evaluation of trainings implemented.

(6) To select and assign staff who can manage and maintain the training facilities including but not limited to the training equipment as well as to facilitate the administration such as registration and accommodation of the trainees to the NTC.

(7) To select and appoint staff who can formulate action plans including but not limited to the enhancement of the existing training programs of CCPP so that it can globally compete in the international business.

9.3 Assistance to the New Training Center in Establishing the Operation System and Organizational Structure

9.3.1 Organizational Structure and System for the future operation

JET proposed the following "Organizational Structure and System for the future operation of Navoi Training Center (draft) ".

＜Proposal Content＞

(1) The creation for the position of a Deputy Director of NTC to assist the Director in planning, managing and monitoring annual working capital and operational budget.
(2) The establishment of a Training Department that will composed of a total of four (4) full-time instructors that will be individually assigned to handle the machinery, equipment, electricity/instrumentation and to act as leader in the simulator. The full-time instructors will be in charge to formulate the annual training plans as well as to develop and update the teaching materials.
(3) In addition, the full-time instructors will adjust the scheduling of the part-time instructors, who will conduct the surveys, analysis and evaluation of the trainings implemented.

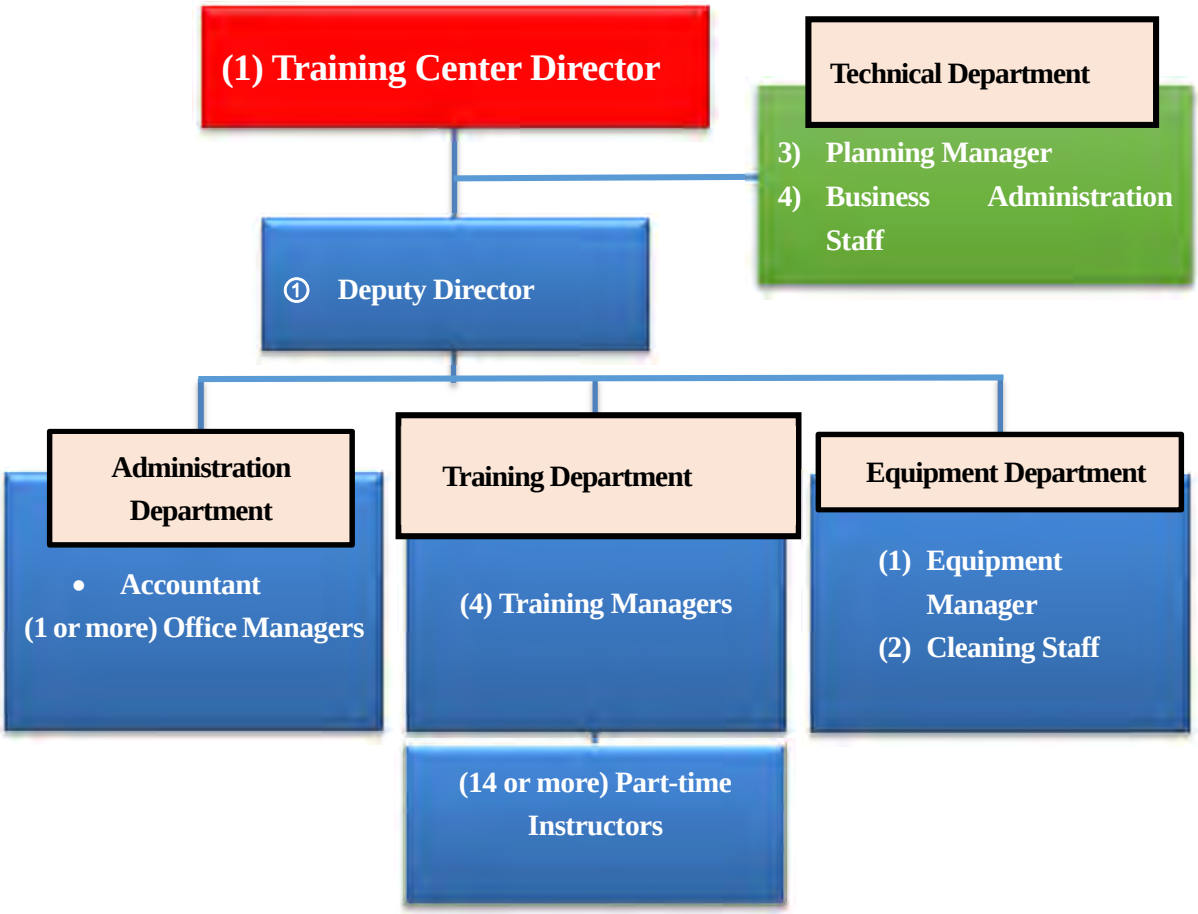
※The following topics for development and related activities are currently under discussion and consideration by NTC/NTPP.

1) Safety and Rules for O&M Staff
2) English version of the teaching materials for O&M Staff (review of existing text)
3) Basics of Electricity
4) Acquisition of computer units for the use of NTC/NTPP staff
5) Installation Procedure for Small Fan and Small ump installation procedure
6) Wastewater treatment equipment

(4) The set-up of an Administrative Department wherein accounting and general affairs staff will be assigned to ensure smooth operation will be provided to the participants in the training program.
(5) The establishment of an Equipment Department in which managers will be assigned to maintain the training facilities and equipment.
(6) The establishment of a Technical Department to be handled by planning and management staff to develop programs and activities to and expand the training business.

9.3.2 Comments from Navoi Training Center

Figure 9-3-1 reflected the proposal of JET which is the “Organizational Structure and System of the future operation of Navoi Training Center (draft)”, will assist NTPP/NTC to immediately secure the necessary staff to implement the training business of NTC.



(Source: JET)

Figure 9.3-1 Organizational Structure of Navoi Training Center (draft)

The proposed organizational structure of NTC as shown in Figure 6.2-1 is reflecting the comprehensive situation in 2016. However, the basic policy of Uzbekistan government has changed, this include changes in the staff from the top management of the chairman and the deputy chairman of UE. Currently, discussions regarding the management and the identification on the site of NTC is still unresolved.
Although it was planned to use the old building of the conventional power plant as the site of the NTC facilities. However, the government of Uzbekistan did not permit to use the old building which resulted to a six (6)-month delay in the construction of the NTC project. In order to recover the construction delay, Uzbekistan government has decided to use the available new CCPP-2 building as the NTC facilities.

On the other hand, in reviewing the situation in December 2018 and taking into consideration of the improvement of the former organizational structure (Figure 6.2-1), JET proposed another organizational structure of NTC that was drafted in May 2019.

In the latest proposal, a Technical Department will be established as a new department together with the new function of a Deputy Director to improve the comprehensive function of the existing organizational structure of NTPP.

Among the new function is the creation of a "Special Technical Capacity to Manage Training", which

enables to formulate and provide a training policy covering training management with the technological perspective as well as to practice the training along its policies and plans. Moreover, the new function also includes continuing improvement of the training program to keep updated with the new and emerging technologies as component for a sustainable training business.

Likewise, the "Special Business Management Capacity to Manage Training," aimed to pursue a sophisticated business management for the training program of NTC that is anchored with its Financial Management Plan and Comprehensive Business Plan.

Furthermore, the. "Special Business Management Capacity to Manage Training", will also be responsible to develop plans, policy and other related activities that support to the business management of the training program of NTC, such as but not limited to the following: ① Staff Reshuffling and Recruitment Plan for Trainers; ② Evaluation of Trainers and Regular Estimation of Manpower Cost of Trainers; ③ Maintenance, Replacement and Procurement of Training Equipment (i.e. CCPP Operational Simulator); ④ Formulation of Annual, Medium and Long term Cash Flows; and Establishment of a Dividend Policy to include the identification of a reasonable ratio for the Shareholders and Parent company.

Regarding the registration for a Joint Stock Company among NTC, NTPP/NTC and JSC TPP, the parties are encouraged to have frequent discussions and come up the best solution to immediately implement the training business of NTC.

Chapter 10

10. Level of Achievement in the Project

As initially planned, the scope of the "Main Task" was to implement only the procurement of "GT Cut Model" and "Simulator." However, the Uzbekistan government has requested to include in the task the conduct of a Pilot Training for the Simulator in order to initiate the Simulator Training which is part of the Comprehensive Training Program of NTC, and JICA approved the request in December 2018. Moreover, additional changes that was carried from the initial plan was to cover the preparation of a purchase order for the procurement of both the "GT Cut Model" and "Simulator" and were approved for submission to MHPS without undergoing the procurement process of a competitive bidding. This has resulted to the issuance of the purchase order in December 2017, which was ten (10) months delayed from the original plan.

On the other hand, the Simulator Training was only executed on available time within the duration of the project implementation which limits to the coverage of accident cases discussed to the trainers to only '18 accident cases" out of the total of "186 accident cases. The overall work program of the project including the additional activities requested, and technology transfer were carried out and has been completed based on the latest agreed plan among all stakeholders of the Project. However, the deadline set for the Uzbekistan government to achieve the overall goal which is "to strengthen the operation and maintenance on the capacity of CCPP" is still in March 2022 while the timeline for the execution of its business plan may become extremely tight due to the delayed commissioning of the training program of NTC as a result to the several reasons being considered by the Uzbekistan government in their decision.

The target participants of "530 O&M staff to be trained" and "20 trainers to be trained and assigned" were set to promote the accomplishment of the overall goal of the Training Program. As a tool in measuring the progress of the target participants, JET has instructed NTPP/NTC officials to implement the technical transfer for NTPP/NTC participants for them to fully understand on how to implement "Monitoring and Evaluation". A manual and format for periodical report were presented referring the practical procedure of "Monitoring and Evaluation." JET continued to provide the NPP/NTC officials with practical advice every mission visit since July 2018 [8] until the termination of the final mission in July 2019.

There are four (4) "Results" to be achieved in the PDM of "the Project". Among the four (4) targeted results, two (2) are directly related to "the Task" as follows:

(1) Output 3: Developed and implemented the CCPP Operation and Maintenance Training Curriculum, Textbooks, Manuals and Training Equipment.

(2) Output 4: Trained and Secured Trainers for CCPP Operation and Maintenance Training

[8] 【Mission of the Project】July 2018 (# 12 Mission), September 2018 (# 13 Mission), March 2019 (14th Mission) 【Mission of the Work】December 2018 (# 5 Mission), May 2019 (# 6 Mission), June 2019 (# 7 Mission) Advising the staff of NTPP / NTC during a total of 6 trips did.

10.1 Implementation of the Procurement of GT Cut Model

10.1.1 Background of Procurement of GT Cut Model

The level of achievement in the procurement of "GT Cut Model" is reviewed according to the contents of the "Results" as described in the PDM below:

Output 3: Developed and implemented the Curriculum, Teaching Materials, and Training Equipment for the CCPP Operation and Maintenance Training

10.1.2 Process and Results of Procurement of GT Cut Model

The activity related to the procurement of the training equipment [9] for the "Project" was already completed in September 2018 while the procurement of the "GT Cut Model", which is one of the component in the procurement of the training equipment under the "Main Task", the implementation has been delayed in December 2017. However, the design and manufacturer were exactly according to the planned technical specifications, and the approval at on-site testing, and delivery to Uzbekistan was completed and all operations were implemented accurately. Below is the milestone in the Procurement-delivery-handover of the GT Cut Model that was completed in May 2018:

(1) April 9, 2018 - Factory witness test at MHPS Takasago Factory, Japan
(2) April 17, 2018 - Pre-shipment inspection at Nissho Logistics Co., Ltd. Urayasu Warehouse
(3) May 5, 2018 - On-site witness test on trial operation/hand over at the entrance of NTPP

GT Cut Model was handed over to the Uzbekistan government according to the process and work ratio shown in the table below. The work ratio is estimated in consideration of the period required to implement the procedure of the necessary step of work to effect technical transfer.

Table 10.1-1 Process in the Procurement of GT Cut Model

Step of Works	Work Ratio	Progress	Schedule
To finalize specification	10%	Done: 10%	Nov. 2016～Apr. 2017
Manufacturing & Tuning	50%	Done: 50%	Dec. 2017 ～Mar. 2018
Factory acceptance test	10%	Done: 10%	Mar. 28 2018
Pre-shipment inspection	10%	Done: 10%	Apr. 17 2018
Transportation & delivery	10%	Done: 10%	Mar.～Apr. 2019
Site acceptance test / Hand over	10%	Done: 10%	May 5 2018

（Source：JET）

The technical details of GT Cut Model are described in "7.1 Implementation on the Procurement of the GT Cut Model".

[9] Five equipment are provided as follows; "Vibration analyzer" and "Non-destructive inspection equipment" in the Mechanical field, "SFC (Static Frequency Converter)" and "Control Box" in the Electrical field, and "3D model of GT Blade and Vane" in the Equipment field.

10.2 Implementation of the Procurement of Simulator

10.2.1 Background of Procurement of Simulator

The purpose of this section is to describe the level of achievement in the “Procurement of a Simulator" wherein the contents of the "Results” is reviewed if it is in accordance to what is proposed in the PDM especially on the activities under the "Main Task."

Output 4: Developed and implemented CCPP Operation and Maintenance Training Curriculum, Teaching Materials and Training Equipment.

The “procurement of a simulator”, as part in the training equipment under the “Main Task “has been delayed from the original schedule, After the conduct of the field test of the simulator, through joint activity with MHPS, it was confirmed that it was created based from the original technical specifications. The delivery and hand over of the said simulator was completed in May 2019. The procurement milestone was carried out as follows:

(1) November 6~9, 2018 - Factory witness test at MHPS Takasago Factory
(2) March 7, 2019 - Pre-shipment inspection at Ryowa Electric Instrument Co., Ltd. Takasago Factory
(3) April 17~May16, 2019 - On-site witness test for hand over at NTC

10.2.2 Process and Results of the Procurement of Simulator

Some deficiencies in the program were found during the witness test but it was properly corrected within the test period in consultation with the trainers and the TA. Based on the above mentioned background of the simulator, its delivery to the Navoi Training Center was carried out and all operations were completed. The simulator was handed over to the Uzbekistan government through the process and work ratio shown in Table 10.2-1. The work ratio is estimated in consideration of the period required to implement the procedure of the necessary step of work to effect technical transfer.

Table 10.2-1 Process in the Procurement of Simulator

Step of Works	Work Ratio	Progress	Schedule
To finalize technical specification	20%	Done: 10%	Nov.2016～Apr.2017
Manufacturing & Tuning	30%	Done: 30%	Dec.2017～Aug.2018
Factory acceptance test	15%	Done: 15%	Nov.2018
Pre-shipment inspection	5%	Done: 5%	Feb.2019
Transportation & delivery to NTPP	5%	Done: 5%	Apr.6 2019
Inspection, Assemble & cabling	5%	Done: 5%	Apr. 17 2019
Site acceptance test	15%	Done: 15%	Apr.13～May13 2019
Training of operation / Hand over	5%	Done: 5%	Apr.14～17 2019

（Source：JET）

JET and the officials of Navoi Training Center have thorough discussions during the 5th mission visit in December 2018 on the former's proposal to NTPP/NTC that the on-site witness test should be handled by the selected simulator trainers. The officials of Navoi agreed to JET's proposal, and has selected and assigned 5 out from the 13 trainers to work on a daily basis and jointly carried out the activities with the TA.

The on-site witness test of the simulator was implemented by the 4 Technical Advisors that was dispatched by MHPS. The 2 teams were organized with the 2 advisor as members that participated in the conduct of the witness test for a period of 2 weeks for the respective team totaling to 31 days to complete the test. Below is the detailed activity of the test:

(1) MHPS original activity: 5 days
(2) Unpacking and equipment inspection: 1 day
(3) Installation/wiring: 3 days
(4) Hardware test: 2 days
(5) System test: 2 days
(6) Instructor function test: 4 days
(7) Simulation model test (start/stop): 2 days
(8) Simulation model Malfunction test: 5 days
(9) Operational briefing/orientation: 2 days
(10) Operating instructions (OPS): 2 days
(11) Operating instructions (EMS): 2 days
(12) Completion report / cleaning: 1 day

Within the reviewed period shown above, it has already included the number of days that the trainers were not able to participate because of their daily work at CCPP-1 & 2 while the days that were covered during the national holidays in Uzbekistan were allocated to MHPS's own activities.

The details of the supply range of simulator and technical specifications are described in "7.2 Procurement and Maintenance of Simulator."

10.3 Implementation of Pilot Training for Simulator

10.3.1 Overview of Pilot Training for Simulator

There are a total of 13 simulator trainers that were selected in December 2018 prior to the start of the simulator field test or simulator training. Screening of documents was conducted for shift managers and others who have sufficient experience with CCPP-1 operation, and program engineers in charge of maintenance of CCPP-1. In selecting the 13 trainers, JET conducted individual interviews and data gathering such as age and educational background and experience.

Kanden Powertech, the sub-contractor for simulator training, signed the agreement in February 2019 before the commissioning of the "Pilot Training" for simulator scheduled in June 2019. The contractor started preparing textbooks and manuals for training both in Japanese and English versions. As mentioned earlier, due to the time constraint, the range of sample accidents for the training of trainers are only limited to "18 accident cases" out of "186 accident cases."

The breakdown of accident cases are summarized as follows.

Gas Turbine	:	8 cases
Steam Turbine	:	3cases,
Balance of Plant	:	3cases
HRSG	:	3cases
Electricity	:	1case

The following are the textbooks and manuals for the "Pilot Training" prepared by Kanden Powertech :

(1) Simulator Training Method (A4, page 7)
Contents: Outline of Training Schedule and On-Site Training,
Schedule for respective activities of groups, etcetera

(2) Textbooks of Training of Simulator Instructor (A4, page 38)
Contents: Instructor's Attitude and Training know-how

(3) Instruction Details (A4, page 13)
Contents: Textbooks for Trainers (Instruction Guidelines, How to set abnormal state, and etc.)

(4) Textbook on Trouble Response
Contents: Textbooks for Operators (Troubleshooting Method, Confirmation Items, etcetera)

10.3.2 The Results of the Pilot Training

Kanden Powertech, the sub-contractor for the "Simulator Training", has dispatched two (2) Japanese experts as Technical Advisors to NTPP/NTC to conduct "Pilot Training" for NTC trainers. The main

purpose of the training is to impart skills as simulator trainers. The outline of the training is as follows:

(1) Friday, June 14: Orientation by JET
(2) Monday, June 17: Lecture on "Preparation as a Lecturer" and "How to Proceed with Simulator Training"
(3) Monday-Friday, June 17-28 Technical Transfer for 18 accident cases
(4) No sessions on Saturday and Sunday

In the training, explanations were given from the following different points in order to make the malfunction accident case easy to understand:

1) Explanation of Instruction Details (Description of Instruction Details as summarized in the Malfunction Contents List)
2) Explanation of Cause of Accident Setting
3) Explanation of the Objective of the Training on the Selected Malfunction
4) Explanation of each Training Lesson/Experience

Preparation for the "Pilot Training" started in December 2018. The table below shows the work process and work ratio that entails towards the implementation of the "Pilot Training." The work ratio is estimated in consideration of the period required to implement the procedure of the necessary step of work to effect technical transfer.

Table 10.3-1 Business Process to conduct Pilot Training

Step of Works	Work Ratio	Progress	Schedule
To nominate Simulator Trainers	20%	Done: 20%	December 2018
To agree quotation & training spec.	20%	Done: 20%	February 2019
Conclusion of a contract	5%	Done: 5%	Feb. 22 2019
Textbooks (Eng. & Jpn) completion	30%	Done: 30%	May 2019
Pilot Training	25%	Done: 25%	June 2019]

（Source：JET）

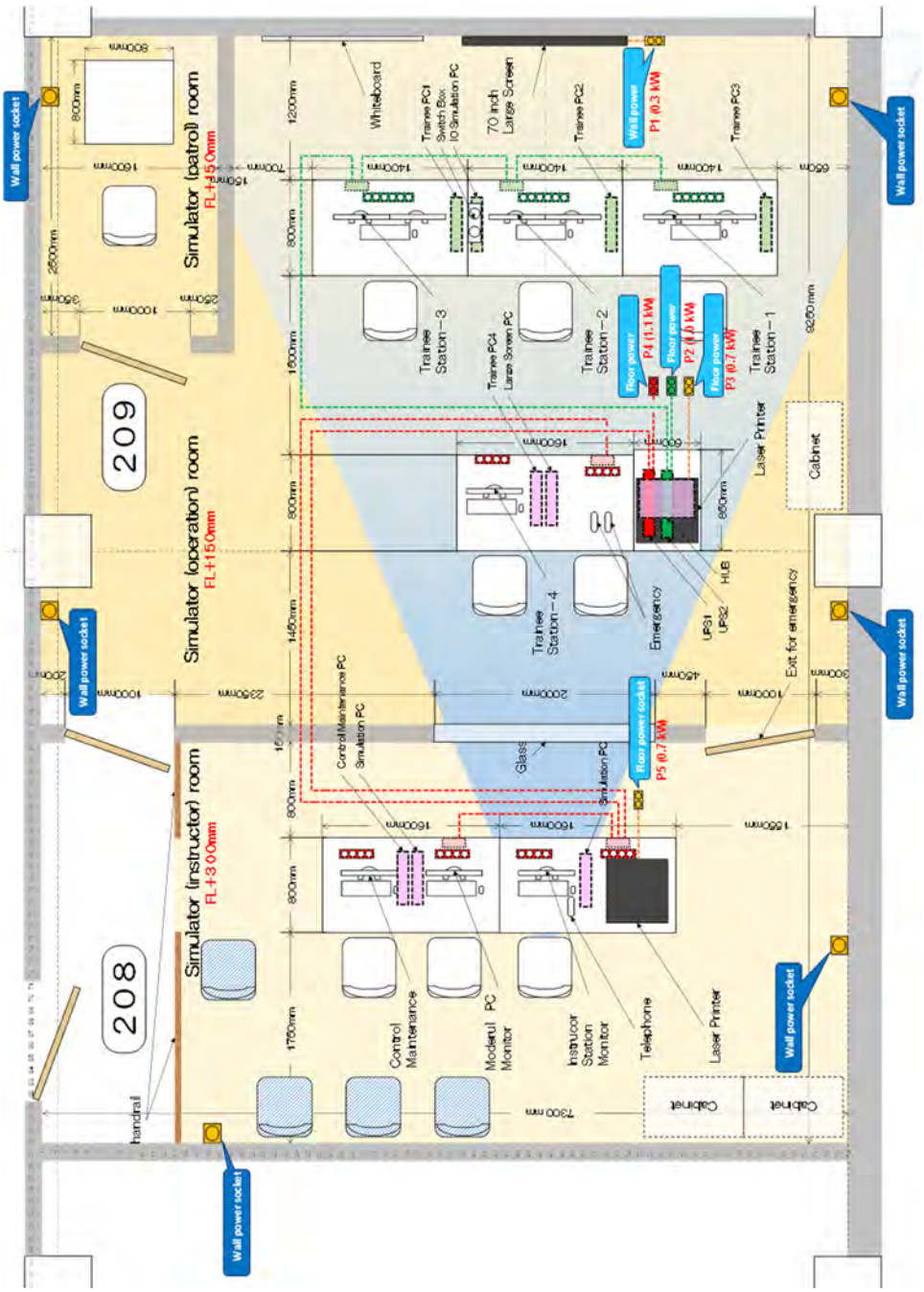
"Chapter 8 Activities for Pilot Training of Simulator" includes technical details.

Chapter 11

11. Tasks and Proposals for Business Operation

11.1 Advice on the Construction of the New Simulator Room

JET prepared the layout drawing of the equipment and cable wiring in the simulator room as shown below, and advised on the design and construction related to the simulator room.



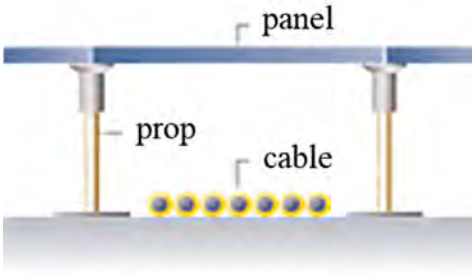
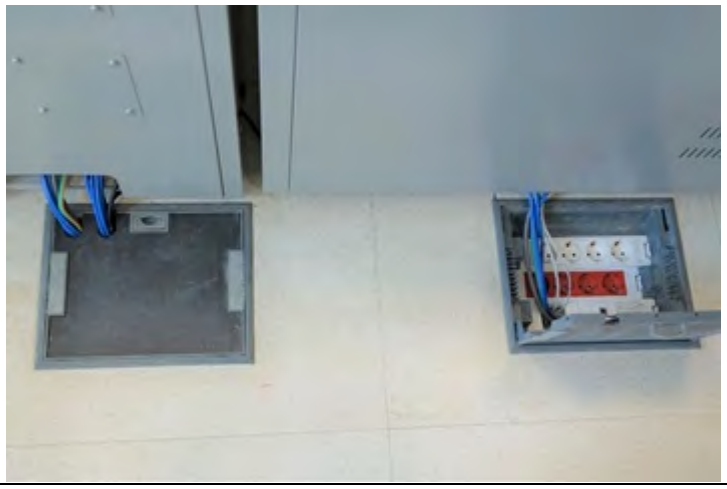
(Source: JET)

Figure 11.1-1 Layout of Simulator Room

The following table are the summarized points of surveyed and requested by JET;

Table 11.1-1 Survey results of requests for the design and construction of the Simulator Room

No.	Requests for the Simulator Room	Survey results
1.	Prepare the simulator room under the following conditions: (1) Temperature: 10 ~ 35 deg. C (2) Humidity: 20 ~ 80% (3) No condensation is acceptable at any time. 	・The ceiling air conditioner has been installed in the room and is ready for use.
2.	Add acoustic insulation on the inside walls of the simulator room for noise prevention. 	・An acoustic insulator for noise countermeasures has been attached to the indoor walls
3.	Construct an access floor/raised floor inside the simulator room. (1) Floor level in the following rooms: ① Operation and Patrol room: FL+150 mm ② Instructor room: FL+300 mm (2) The flooring system should be flexible for layout change.	・The indoor access floor has been completed with a raised floor.

4.	 Power Source:  (1) Provide surge protection for the equipment power supply. (2) Install at least 6 AC outlets for lighting and others. 	・ The planned installation is shown on the left image.

(Source: JET)

11.2 Proposals and Requests to the Management of Navoi Training Center

11.2.1 Proposals and Requests to NTC

The following table shows the requests and suggestions concerning the operation of the training business and the comments to Navoi Training Center.

Table 11.2-1 Proposals and Requests to the Management of NTC

No.	Contents of Proposals and Requests	Background and Reasons for Proposals and Requests	NTC Comments
1	The necessity to allocate budget at an early stage for the Direct Costs on the conduct of NTC Training to cover travelling and accommodation expenses, daily allowances and expenses for the instructor	The NTC instructor candidates are currently working as training volunteers.	NTC has entered an agreement with Instructor Candidates, which is under negotiation.
2	Requests for instructors to educate trainees as part of Off the Job Training (1) Coaching in advance: ① Unit Managers or focal persons shall help the trainees to fully understand in their daily routines as well as to provide appropriate advice and coaching when the trainees take the Training Courses. ② Unit Managers or focal persons shall ensure the trainees to accomplish the preliminary questionnaires for submission to NTC three weeks before the training. (2) Coaching at a discussion session: ① To review the trainees in their opinions as an entire group. ② To ensure trainees record their respective task before going	In order to enrich training contents and enhance training results at NTC, Instructors shall require the trainees to submit the following after completion of the training courses: i) Preliminary Questionnaires, ii) Daily Reports, iii) Questionnaire after the Training Courses, iv) Reports on Educational Session, and v) Minutes of Discussion Session. The Instructors are then required to evaluate the submissions and design training modules that are appropriate to the individual trainee's training needs. ● Main contents of Preliminary Questionnaires: (1) Name of Training Course (2) Contents of instructions given by Unit Managers or focal persons on a specific training course (3) Self-imposed tasks from	NTC agrees to JET's proposal for the following reasons: (1) JET's proposal which is the Plan-Do-Check-Act (PDCA) mechanism is very effective (2) This effort for PDCA cycle is very useful for polishing the contents of textbooks and manuals. (3) It is also helpful in improving Instructor's knowledge.

	back to the assigned work-station/s. ③ To ensure that comments and takeaways by the individual trainee and as a group raised during the discussion session are reflected in the next Training course to improve and more effective (3) Post-action coaching: After the completion of the Training course, the Unit Managers or focal persons shall require the trainees to submit the following: ① Reports after taking the Educational Session ② Minutes of Discussion Session after Taking Courses,' ③ Follow up on trainees' tasks.	Specific Training course ● Main contents of Daily Reports: (1) Results of completed Training course (Confirmation of the main training agenda) (2) Feedback and questions ● Main contents of Questionnaire after completion of the training course: (1) How did you feel when you participated in this Training? (2) What do you think of the Training procedures? (3) Did you understand the contents of this Training? (4) Other opinions and requests ● Main contents of Reports after completion of the Educational Session: (1) Self-imposed tasks from this Training (2) What are the learnings acquired from this Training; how the trainees applied the learnings in his/her present tasks/assignment (3) Future follow up on training topics such as self-imposed tasks left from this Training course ● Main contents of Minutes of Discussion Session after completion of the Courses: (1) Summary of feedback, etc. (2) Requests for improvements, etc. of Training.	

3	"Mental preparation of JSC Thermal Power Plants and Instructors" during Orientation and Discussion Session after the completion of the Training: Instructors are requested to utilize the Orientation and Discussion Session after Training, and have trainees fully understand the following advantages of On-the-Job Training. (Advantages) (1) Acquired Knowledge and skills which cannot be acquired by On the Job Training (These should complement the acquisition of knowledge and practical skills). (3) Those who need necessary Training can receive such Training. However, if trainees receive Training without a definite purpose, they would neither be able to apply the Training results on their practical operations nor be able to learn and acquire knowledge for personal and or skills enhancement. Therefore, Instructors are requested to discuss with trainees during the orientation: "What they achieve to learn," and after the completion of the Training, "About how well they understand the learnings," "How they able to apply the learnings in the training, etc.	Off the Job Training is a Training conducted for many trainees gathered in one place. It requires not only direct costs such as travel expenses and daily allowance associated with Training, but also indirect costs such as decrease in productivity due to withdrawal of trainees after the duration of the On the Job Training. On that basis, it is necessary to have trainees fully understand that taking On the Job Training also has some advantages and disadvantages to the company.it	According to the experience, Merit (1) and Merit (2) are completely consistent with the wishes of JSC Thermal Power Plants. Also, in perceiving the training results of the Trainees, an orientation and social gathering after finishing training are good occasions for playing a very significant role. Before and after trainings, it is important to set up regular meetings for discussion within the NTC/NTPP based on the training results. It is also important to implement the cycle rotation of P (Plan) to D (Do) to C (Check) and to A (Action).
4	Strengthen the Training System: The operation of the regular Meetings are as follows.	It is important to set up regular meetings within the NTC to discuss the results of the training rather than on the "Purpose of" the training, and	NTC agrees with the JET proposal.

	(1) Frequency: once a month (2) Meeting Venue: Naoi Training Center (3) Composition of Members: ① Training Center Director ② Training Center Vice-Director (Also serves as the chief reviewer of the meeting) ③ Instructor at Training Center ④ Members of the Technical Department ⑤ The necessity of a Chief Reviewer. (4) Discussion and deliberation on the following main subjects: ① Training report of the current month and plans of future training ② Performance report and monitoring of activities in the Training Center ③ Issuance of certificates to trainees that has completed training on special skills ④ Discussion for concrete measures on important issues and for the trainees ⑤ Other matters deemed necessary by the chief reviewer (5) The Secretariat of the meeting will be the Chief Instructor of the Training Department.	to absolve P (Plan), D (Do), C (Check) and A (Action) mechanism	
5	(1) Establishment of the base business of NTC: NTC will provide training on development of O&M to staff for all thermal power plants (existing and for construction), including CCPP of JSC Thermal Power Plants, such	Currently, the training is free of charge for new employees in the O&M staff of the NTC and in CCPP undergoing construction. (1) The participation of a member of the Instructor of Naoi TPP who is	(1) JSC Thermal Power Plants have decided to conduct development program for their human resources through education of staff in the O&M in the following

	that it has plans for expansion: ① NTC will conduct training to staff engaged in maintenance work at the maintenance subsidiary company of JSC TPP power stations (existing and under construction) to expand clients of its training business. ② NTC will conduct training for staff assigned at O&M of other CCPP and IPP to expand clients of its training business.	familiar of the teaching materials should be requested to discuss the curriculum of the training as well as inquire for information on the development and plan of the training for the next fiscal year. (2) By participating in the training, the Instructor can contribute to the improvement of the trainees' knowledge and skills, as well as able to demonstrate the safety and quality of inspections and construction timeline will be implemented thus to ensure to achieve a stable supply of electricity.	eight thermal power plants at NTC. ① Naoi TPP ② Talimarjan TPP ③ Turakurgan TPP ④ Tahiatash TPP ⑤ Syrdarya TPP ⑥ Tashkent CHPP ⑦ Tashkent TPP ⑧ Fergana CHPP (2) In the future, it is necessary to review the training plan for maintenance staff in the maintenance subsidiary company. Also, the training which is intended for O&M staff of CCPP such as Fergana CHPP, IPP and, etc. will be conducted. This is in an effort to expand the clients in its training business.

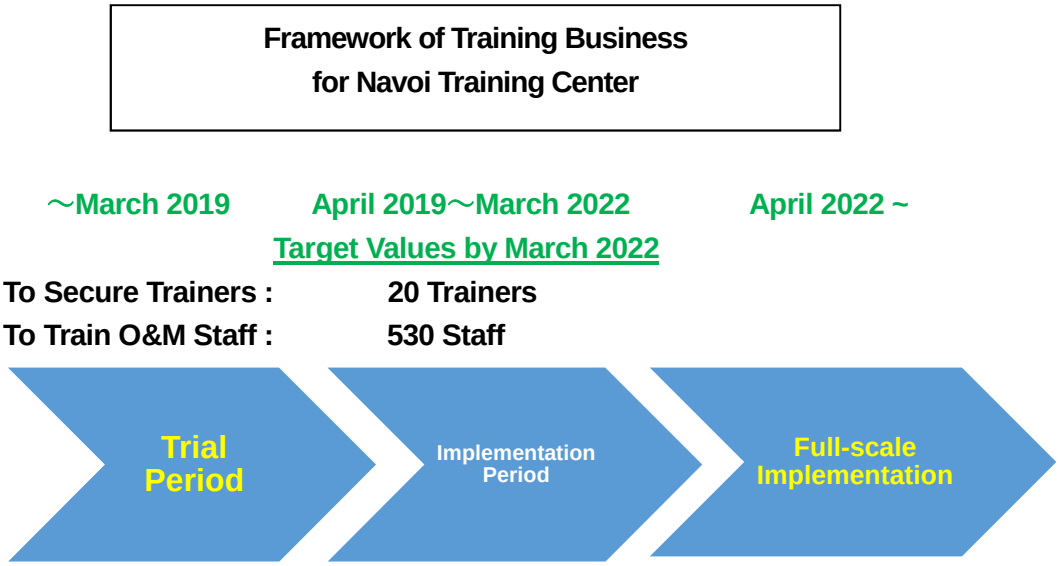
(Source : JET)

11.2.2 Guidelines for the Business Plan of NTC

(1) Operational Framework of Navoi Training Center

As described in 6.3.1 for the procurement of GT Cut Model and Simulator, the “Target Values” will be used to evaluate the achievement of the overall goal approved at JCC held in March 2019. Specifically, at the end of March 2022, the aim is to achieve 20 instructors and 530 trained O&M staff for CCGT. Figure 11.1-2 “Overall Goal Target Numbers and Training Projects” should be used as a guideline when planning a training business plan. As shown in Figure 11.1-2, JET planned the business stages dividing into three in-time categories of the NTC training business. The first “Trial Period” of the three categories is the period up to March 2019 at the end of this project, which has already ended. Currently, it is considered as the category of “Implementation Period”, but this period is equivalent to three years during the completion year of the “Project” in March 2022. The “Implementation Period” is still under JICA's management and is treated as a JICA project. However, from April 2022 onwards, it will be at a stage of its “Full-scale Implementation”, which means that starting April 2022, NTC's training project will be implemented independently, leaving the control of JICA, and NTC can develop an independent business of training program for O&M staff.

The Target Values are based on the CCPP construction plan as of September 2018, which should be regularly updated reflecting the latest construction plan. At present, training 530 O&M staff is the comprehensive condition to formulate the business plan of NTC.



(Source: JET)

Figure 11.2-1 Target values of Overall Goal and Training Business

(2) To secure Management Members and Trainers of Navoi Training Center

NTC, as a training organization under JSC TPP, will train the O&M staff to carry out O&M works for each CCPP in Uzbekistan. All CCPP are obliged to secure and promote to generate profits for JSC TPP's power generation business and provide with a sustainable business environment for thermal power generation sector through the contribution of the trained O&M staff and in securing its own profit for each CCPP, in order to select and appoint trainers under this project, 13 trainers to lecture for 12 training courses and 14 simulator trainers will be selected, trained and appointed.

NTC is currently a part of NTPP, but will eventually be registered as a JSC. As of July 2019, the NTC training business has been manned only by two members, including the Director. The situation of absolute manpower shortage in conducting training for large number of O&M trainees in the near future is a critical concern for JET, Nonetheless, JET is proposing the organization and system (draft) on the future of Naoi Training Center as shown in Figure 9.3-1 describing the organizational structure, and program to sustain the training business. This also call for JET to design for an appropriate fiscal package to include judicious salary scheme and allowances, certain fringe benefit and other monetary benefits for its management, staff and trainers.

(3) Securing Management Resources for Training Business

The most important resource in the training business is human resources, such as but not limited Trainers, Management and staff, including a Director who will operate and manage the implementation of the training programs and facilities (i.e. lecture rooms and simulator room is described in (2).

As part of the Project, construction of the whole new building was completed on the site of CCPP-2 facility. Apart from the existing CCPP-1 building the new structure is an addition in the NTC training facilities. Moreover, JET and NTPP/NTC already completed in the joint preparation of textbooks for 12 courses for classroom lectures. In addition, necessary training equipment including a simulator has been successfully installed. In June 2019, the government has issued an approval to NTC as a training organization. In pursuit for NTC to operate a sustainable training business, a system to accept trainees as well as managed its training revenues and a mechanism to secure training business funds have been already established,

(4) Uzbekistan's Future Activities

1) Rotation of Trainers

Since current trainers of NTC appointed within the Project will have to leave their positions at certain time, resulting to promotion or staff changes. Given this condition, it is necessary to rotate trainees of NTC periodically or regularly. In order to effect the rotation, the experiences of "Training of Instructors" implemented by JET in the Project scheme during 2016 and March 2019 and the Pilot Training of the simulator conducted in June 2019 were utilized and will served as the basis in its implementation. If NTPP/NTC successfully repeats what JET and NTPP/NTC have done in the Project, the following activities will enable NTPP/NTC to secure a sustainable and sufficient pool of trainers;

(a) Select candidate trainers by NTPP / NTC together with current trainers
(b) Current trainers will train other candidate trainers to complete technology transfer to be trainers.
(c) Candidate trainers will be accredited trainers by NTPP / NTC management.

2) Maintenance program for the training equipment

In the meantime, NTC has installed expensive training equipment including simulators. In the training business, the equipment must be used continuously, so maintenance program is most important. Therefore, it is necessary to secure enough funds for the implementation of regular maintenance activities as well as replacement of the equipment when it is damaged or obsolete in the future.

3) Four "Outputs" to be achieved in the next project and specific "Activities" to be done

As part of the power sector reform in Uzbekistan, NTPP is expected to face a tough business environment resulting in the implementation of the principle of independent profitability as an organization under JSC TPP. NTC, is currently one of the departments of NTPP, is expected to experience the same situation with NTPP, since NTC is registered under JSC TPP.

The Target Values which are “To assign 20 trainers” and “To train 530 O&M staff” has been officially approved and being monitored on how the achievement of the Overall Goal will be promoted. NTC is aiming to realize these “Target Values” during the “Implementation Period”, until the end of March 2022 through the training business.

A new "Activities" to realize each “Result” of the New Targets under Japanese support project are proposed as follows. The deadline for achievement of “Outputs” and “Activities” by end of March 2022, this is exactly the same deadline to achieve the “Overall Goal”.

1. Output 1: Strengthened the Capacity of Business Management of Training Business at Naoi Training Center

1-1 Current situation analysis (including comparison) of cash flow and budget control among JSC TPP (including Tashkent Training Center) and NTPP / NTC

1-2 The following technology transfer will be carried out in order to develop business plans aiming to secure profits from the activities in the training business and to acquire business management skills especially for financial management.

(1) Establishment of management system for financial planning and financial management of Navoi Training Center
(2) Study the reasonable size of the Working Capital of Navoi Training Center
(3) Study possible ways to maintain the Profitability including the review and discussion of governmental assistance and support
(4) Establishment of reasonable training fees to secure efficient turnover
(5) Formulate methodology on cost control through review of the existing cost structure of NTC
(6) Development of a Dividend Policy

1-3 Directors of NTPP and NTC and staff in administrative departments should regularly discuss with the departments related to training in addition to the personnel department of JSC TPP. The purpose of the discussion is to identify solutions to remove the obstacles of the implementation of training and formulation of training program of NTC to train O&M staff of CCPP.

2. Output 2: Navoi Training Center shall ensure technical knowledge about the maintenance of equipment and financial knowledge to secure the profits to generate necessary funds to enable sustainable use of training equipment.

2-1 NTC should create an incentive program which will enhance the trainer's capacity and NTC should provide trainers with such incentives.

2-2 NTC and the trainers should discuss regularly to improve roles of trainers.

2-3 Trainers should improve their skills of conducting training and management for maintenance of training equipment through a continuing self-study by the trainers.

2-4 NTPP/NTC shall create an incentive program and provide incentives to enable the Directors and Staff of NTC to improve their capacity on business and financial management.

3. Output 3 Establish a Communication Program through a sustained discussion among JSC TPP, NTPP and NTC to maintain the training business of Navoi Training Center, and to establish a sustainable training program to secure O&M staff of CCPP working under JSC TPP.

3-1 NTC and JSC TPP should conduct regular discussions. The purpose of the discussion is to exchange information on the latest CCPP construction plans in order to obtain the target number of O&M staff of CCPP under JSC TPP to be employed and trained. NTPP / NTC will formulate an annual training plan for staff training of NTC based on the information discussed and obtained through the regular discussions.

3-2 Periodic discussions in 3.1 should be held at JSC TPP every 6 months.

※The chairperson of the discussions should be the head of "Foreign Economic Relations and Investment Department" and the vice-chairman should be the head of "Work with Personnel Department".

3-3 Training plan for O&M staff of CCPP and its updates should be based on what was carried out through the Project for an effective the technical transfer from JET to NTPP/NTC.

4. Output 4: Trainers for O&M staff of CCPP should continuously, regularly and appropriately trained with smooth rotation in order to secure the necessary numbers of trainers.

4-1 JSC TPP and NTC should conduct regular discussions. The purpose of the discussions is to analyze the current training plan for training of instructors, confirm the required number of trainers, update and formulate the latest training plan for training.

4.2 Regular discussions described in 4.1 will be held at NTC every 6 months.

※ The chairperson of the discussions should be the Director of NTC, and the Vice Chairperson should be the Vice Director of NTC.

4-3 "Training plan for training of instructors" will be updated every quarter based on "Training plan for staff training".

11.3 Tasks and Proposals for Training and Securing Simulator Trainers

11.3.1 Tasks and Proposals on Training of Instructors

JET made the following requests and suggestions;

(1) "Basic Policy on Human Resource Development" should be reviewed annually for the sustainable improvement.

Cycle of P (Plan), D (Do), C (Check) and A (Action) is helpful and necessary for smooth operations.

Tasks on Training of Instructors

To enhance or equalize the Level of Instructors' Teaching Capacity

Tasks	**1. Improve the points to be focused in Teaching**		**2. Improve the Instructors' Communication's Methodology in the Conduct of Lectures**
Specific measures	**Preparation of Instruction Manual**	**Periodical meeting for discussion**	**To study Instruction Manual by Working Group (newly established)**
	Preparation and drafting of textbooks highlighting items of priority and methods of teaching in the conduct of the training	**(1) Mutual assessment by trainees among other trainees** **(2) Promote "awareness" of trainees through self-assessment and mutual assessment**	**To learn how to improve t teaching and communication methodology through training course implemented by external organizations**

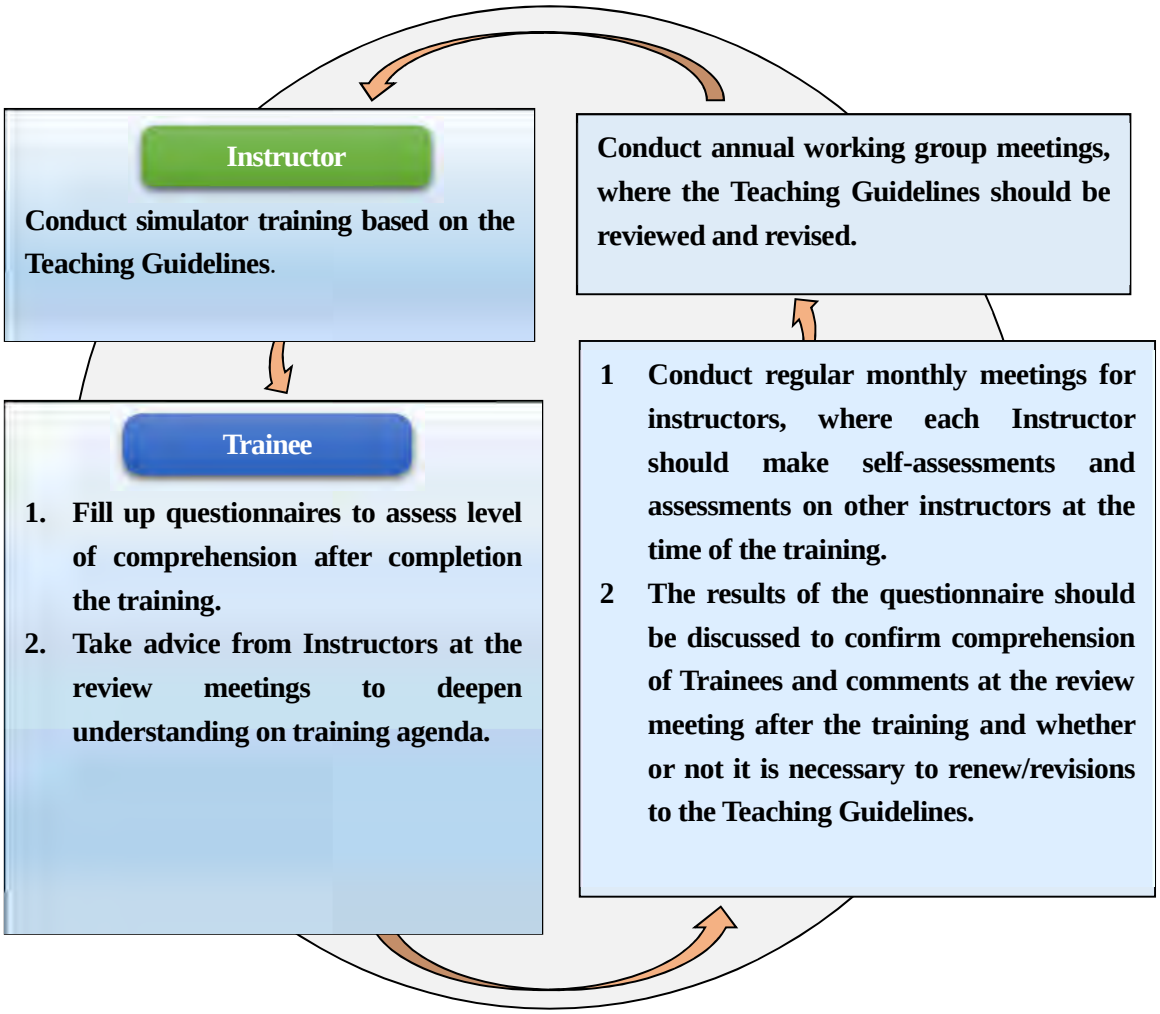
Trainees should study specific measures at working group discussions.

11.3.2 Comments of Navoi Training Center

It is important for NTC to make efforts to improve and to equalize the "Level of Teaching Capacity of Instructors" as challenges of the NTC. The proposed draft on Human Resources Development by

JET is sufficient reference to assist NTC to implement cycle of P (Plan), D (Do), C (Check) and A (Action) for them to be able to formulate its action plan. Specifically, NTC considers “Preparation of Instruction Manual” and “Periodical meeting for discussion” reviewed above as essentials activities to be achieved.

［Image］



(Source: JET)

Figure 11.3-1 Tasks on Simulator Training (Image)

11.4 Tasks and Proposals for Technical Transfer

Handing over the textbooks and equipment to NTC, JET carried out and completed the Technical Transfer to Instructors of NTC. In order to promote NTC to implement the human resource development correctly, JET reviewed "Basic Policy for Human Resources Development (Draft)" and proposed and suggest Uzbekistan side to formulate and approve "Basic Policy for Human Resources Development" as the Basic Policy of Navoi Training Center. Navoi Training Center agreed the proposal and suggestion of JET.

Basic Policy for Human Resources Development (Draft)

【Basic concept】

Ensure safety of CCPP personnel and equipment to achieve the most appropriate operation of CCPP, and at the same time aims to enhance knowledge and capabilities of O&M personnel.

【Specific policies】

- **Put emphasis on the comprehensive basis and promote the participation to training program to boost knowledge and capabilities. For instance, improving skills of new employees through training in order to obtain knowledge and skills in which they only know during the performance of their respective routine tasks.**
- **Have Trainees voluntarily work on their jobs with confidence and pride. For instance, training which allows Trainees to enhance their awareness on their respective responsibility and role. Assessment of the training and follow –up activities will be conducted.**
- **Conduct training which will boost teamwork and communication to ensure that Trainees exert their collective strengths. For instance, training in communication will be enhanced: ensure that measures in case of an emergency can be resolved or addressed through teamwork.**
- **Create an environment where Trainees always revisit and assess feedback on their work results and devote themselves to their studies. For instance, preparing an environment for personal development where immediate managers motivate their subordinates' "can-do spirit" so that they can achieve their goals and results, and simultaneously can efficiently carry out their work in cooperation with their colleagues from within and other workplaces.**

Opinions/Judgement of the Top Management

11.5 Proposals and Requests for Training

JET proposed the further technical assistance for Uzbekistan as follows;

1. **Simulator Training to master complete packages of Malfunctions**
2. Training of Technical Skills of O&M to maintain Proper Operation of CCPP
   (1) **Procurement of Small Valves including Development of Textbooks**
   (2) **To develop Textbooks and Manuals for "Basics for Instrumentation and Control (Common Basics)"**
   (3) **To develop Textbooks and Manuals for "Basics for Instrumentation and Control - Basic I Course"**
3. **Training of Quality Control Skills for Periodical Inspection and Replacement Work for Parts**

The details of each proposal indicated above are reviewed and described as follows;

Proposal 1 : **Simulator Training to master complete packages of Malfunctions**

<Background and reasons for the requests and suggestions>

(1) Pilot training was carried out with minimum required programs (i.e. Number of troubleshooting items: 18 malfunctions). Said training was based on the Training Guidelines and Troubleshooting Textbooks prepared by TA.
(2) Through the training, trainers understand that their roles are not only limited to operate "Starts" and "Stops" in accidents during the simulation activity. Moreover, trainers of NTC are also aware that the training that has been conducted by TA did not cover the complete flow in trouble shooting.
(3) Also, trainers of NTC have an actual experience on how "to conduct simulator training" in the Pilot training, but trainers recognized that, in the near future, repetitive trainings are required to improve skills in Troubleshooting with speed and accuracy based on training modules and advice by TA.
(4) In order to boost the effectiveness of simulator training, it is necessary to conduct further training as the part of "Pilot Training" program. JET's immediate concern is that, if the simulator training is interrupted only with the Pilot training done in June 2019, the results of "Pilot Training" will not fully achieve its goal.

< Basic Concept for Proposal>

(1) Continuous conduct of the training is the best solution to be able to achieve a successful training for instructors. However, prior to the conduct of further trainings, NTC will allow trainers to have more time to review among themselves what they have learned during the Pilot training to ensure that the conduct of further training will be enhanced and effective.

JET will provide the following supports to complete technical transfer of Simulator trainings;

<Arrangement by JICA Uzbekistan Office>

(1) Procurement of recording equipment (2 video cameras)
(2) Procurement of broadcasting equipment (2 sets of microphone and speaker)

<Arrangement by Navoi Training Center>

(1) Procurement and installation of lighting switches in the operator room

<Works in Japan>

(1) Preparation of summary edition of Operation Manual for Management of Accident consisting of eighteen (18) items of troubleshooting that has been trained and implemented in the Pilot training program.
(2) Improvement both of training details and Troubleshooting manuals of 89 items out of 107 items of Troubleshooting by equipment type.
(3) Preparation of Manuals for Measures against Serious Accidents (3 cases).
(4) Preparation of specifications of equipment for further procurement

<Local Works>

Simulator Training

(1) 8th mission: (about 15 days)
(2) 9th mission: (about 30 days)
(3) 10th mission: (about 25 days)
(4) 11th mission: (about 25 days)

<Training in Japan>

(1) One-week Training course in Japan with a total of 7 participants consisting of 6 trainers and a manager. The training is scheduled after the 11th mission:
(2) Requests and suggestions for acquiring maintenance technology to maintain proper operation conditions:

Proposal 2 (1): **Procurement of Small Valves including Development of Textbooks**

<Background and reasons for the requests and suggestions>

In the existing CCPP, the following operational problems are expected to occur in the near future;

(1) Corrosion of expansion joints of HRSG
(2) Problems of leakage from valves of steam/water system and drain system excluding gas system

NTC plans to implement “Training of Maintenance of Small Valves” for O&M staff using “1/4 cut models of small valves,” which is the same equipment type as “Cut models of small valves”

displayed in the Training Center of Japan. However, since there are no manufacturing companies, which own technology of cutting valves, it is difficult in Uzbekistan. to procure cut models of small valves and to prepare textbooks and manuals.

＜Works in Japan＞

To prepare the draft of specifications of cut model (1/4 cut model) for small valves as shown in the table below

(1) Witness for Factory test and Pre-shipment inspection (in Japan)
(2) Development of textbooks for "Small Valve Maintenance Training" (Power point)

＜Local Works＞

(1) Site witness test of equipment for handover
(2) Selection of Instructors
(3) To draft One Presentation for Lecture

The following Table shows typical Cut-models of Small valves in Japan.

Cut-Models of Small Valves in JAPAN

Type	Size	Class	Material of Valve box
Gate valve	**3B**	**300LB**	**SCPH2**
Globe valve	**3B**	**150LB**	**SCPH2**
Check valve	**3B**	**150LB**	**－**
Butterfly valve	**3B**	**10K**	**－**
Ball valve	**3B**	**10k**	**－**
Diaphragm valve	**3B**	**10K**	**－**
safety valve	**1-1/2B**	**300LB**	**－**
Control valve (needle valve)	**2B**	**－**	**－**

Proposal 2 (2): **To develop Textbooks and Manuals for "Basics for Instrumentation and Control (Common Basics)"**

<Background and reasons for the requests and suggestions>

(1) In order to acquire professional skills on the main engine of CCPP (knowledge: structure, fundamentals, characteristics, etc. of the core equipment), Operators, I&C staff and programmers are to attend the training course provided by the manufacturers (e.g. Training for Gas Turbine control equipment).
(2) The Operational Shift System of the existing CCPP in Uzbekistan consists of Operators, I&C staff and Electric Engineers. Although, their tasks and responsibilities are clearly separated

from each other.

(3) However, in order for the above 3 functions to maintain proper operating conditions at BOP equipment, it is very important to make efforts to acquire professional skills, knowledge and to create “technological basis.”

(4) Also, in order for I&C staff to obtain technical capacity to carry out routine tasks properly, participation to the training on “Instrumentation and Control Basic I Course” is recommended for them to acquire professional skills and knowledge.

<Works in Japan>

To prepare textbooks and manuals for “Basics for Instrumentation and Control (Common Basics)”

<Training in Japan>

(1) Training period: 10 days

(2) Training Methodology : “Lecture” plus “Practical training” with English handouts

(3) Participants: 10 trainees consisting of Operators, I&C staff and Electric Engineers of Trainers of NTC

<Local Works>

(1) Accreditation of Trainers including prior discussion with NTC/NTPP and JSC TPP (about 5 days)

(2) Develop Textbooks and Manuals for lecture of “Basics for Instrumentation and Control (Common Basics)”. (About 1 week)

Proposal 2 (3) : **To develop Textbooks and Manuals for “Basics for Instrumentation and Control - Basic I Course”**

< Works in Japan >

(1) Preparation of textbooks and manuals of "Instrumentation and Control Basic I Course"

<Training in Japan>

(1) Training period: 5 days

(2) Training Methodology: Lecture + Practical training will be conducted with a training menu with English handouts

(3) Participants: 5 consisting of instructors, I&C staff and a Manager

<Local Works>

(1) Accreditation of Trainers including prior discussion with NTC/NTPP and JSC TPP (about 5 days)

(2) Develop Textbooks and Manuals for lecture of “To develop Textbooks and Manuals for “Basics for Instrumentation and Control - Basic I Course”. (About 1 week)

Proposal 3: **To Master Quality Control in Routine Work (Periodical Inspection works and Replacement work for parts)**

<Background and reasons for requests and suggestions>

(1) The number of experiences in Major Inspection by O&M staff of CCPP of JSC TPP is only one time at Naoi CCPP-1 in 2018. Thus, the value of quality control of O&M staff on CCPP is limited.

(2) A total of 10 maintenance staff, i.e. 4 staff of CCPP, 3 staff of Talimarjan CCPP and 3 staff of Turakurgan CCPP, are to attend in the Training in Japan.

(3) The training will be conducted twice with 15 days, and 21 days. The participants are expected to obtain an enhanced knowledge and capacities on Quality Control in the Overhaul Inspection.

< Basic Concept>

(1) At the Major Inspection of GTs of a Japanese electric power company, Training will be conducted for Quality Control Skills with 10 participants each of the two trainings in Spring and Autumn.

(2) Objective equipment of the trainings should be limited to Generators of GT and ST.

<Works in Japan>

(1) Handouts required for training should be prepared in English. (prepared in 1.5 months)

<Training in Japan>

(1) The training in Japan will be for about 3 weeks in total. 5 days for lecture and 10 days for On-site Inspection tour and Practical Skill Training."

<Local Works>

(1) Prior discussion with NTC and JSC TPP (5 days)

End

Appendix

Appendices

1. 【Work Flowchart (project start)】
2. 【Overall Activity Plan/Record】
3. 【Company Standard】
4. 【No. 1 Manual for Human Resource Development Planning】
5. 【No. 2 Manual for Positioning Plan of O&M Personnel】
6. 【No. 3 Manual for Preparation (draft) of Development Policy and Plan for O&M of CCPP】
7. 【No. 4 System for O&M and Manual for Consolidating and Improving Future Regulations】
8. 【No. 5 Process Supporting Manual for Development of Draft Rules and Rulemaking for the O&M Policy and Plans】
9. 【No. 6 Manual for Safety and Quality Control for Periodic Inspection Work and Large Scale Improvement Work】
10. 【2015-2016 Production-Economic Training Program for Engineer-Technicians】
11. 【2015-2016 Production-Economic Training Program for staff】
12. 【Turakurgan personnel】
13. 【Request to confirm the progress of the Project】
14. 【PP458 TTC Training Plan】
15. 【Manual for Training Plan_Draft_Final】
16. 【Manual for Lecture-Lesson Plan】
17. 【Manual for Authorization of Trainer under the Project】
18. 【Manual for Appointment and Role of Trainer of NTC】
19. 【Monitoring report of NTC Training Format】
20. 【Signed Confidentiality Agreement】
21. 【Evaluation Format of Mock-up】
22. 【MM 1st JCC】
23. 【MM 2nd JCC】
24. 【MM 3rd JCC】
25. 【Request Individual Training Program】
26. 【Work Flowchart (project completion)】
27. 【Lecture Plan Draft】
28. 【Confirmation Note】
29. 【MM 4th JCC】
30. 【List of Collected Data】
31. 【Supplementary document for Section 2.1.1.2】
32. 【PDM Ver.0 - Ver.6】
33. 【Certificate of Handover】

34. 【Detailed Activity Plan】
35. 【Resolution of the President No PP3981 dated 23 Oct 2018】
36. 【Summary Report of TOT in Japan】

Following data are recorded only in CD-R.

A.【Job Description】

B.【Individual Training Program】

C.【Record of Monthly Meetings】

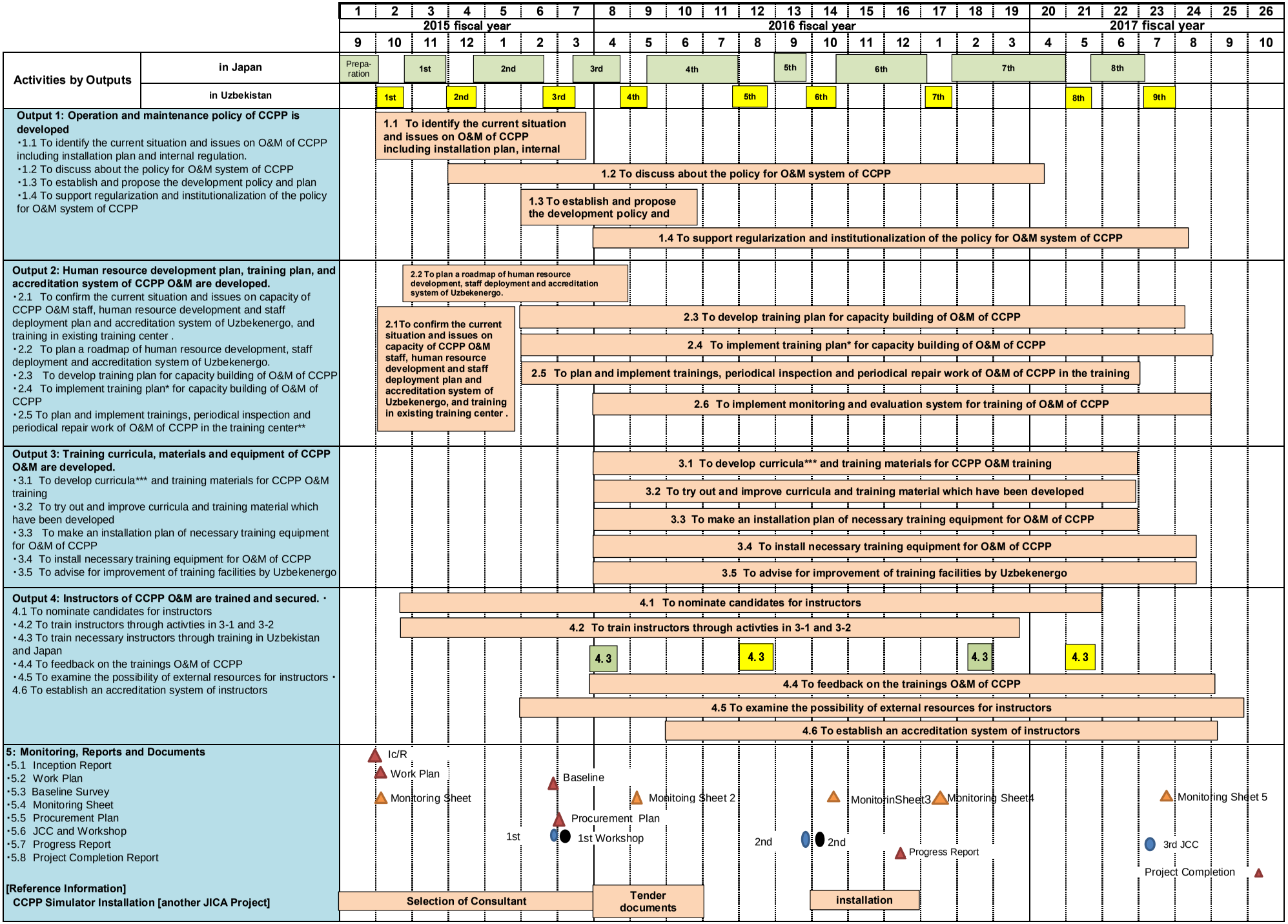
D.【Implementation Report of TOT in Japan】

Data of D in English version CD-R is summary report.

Detailed data of D is only in Japanese version CD-R.

Appendix 1

Work Flow for the 1st Phase

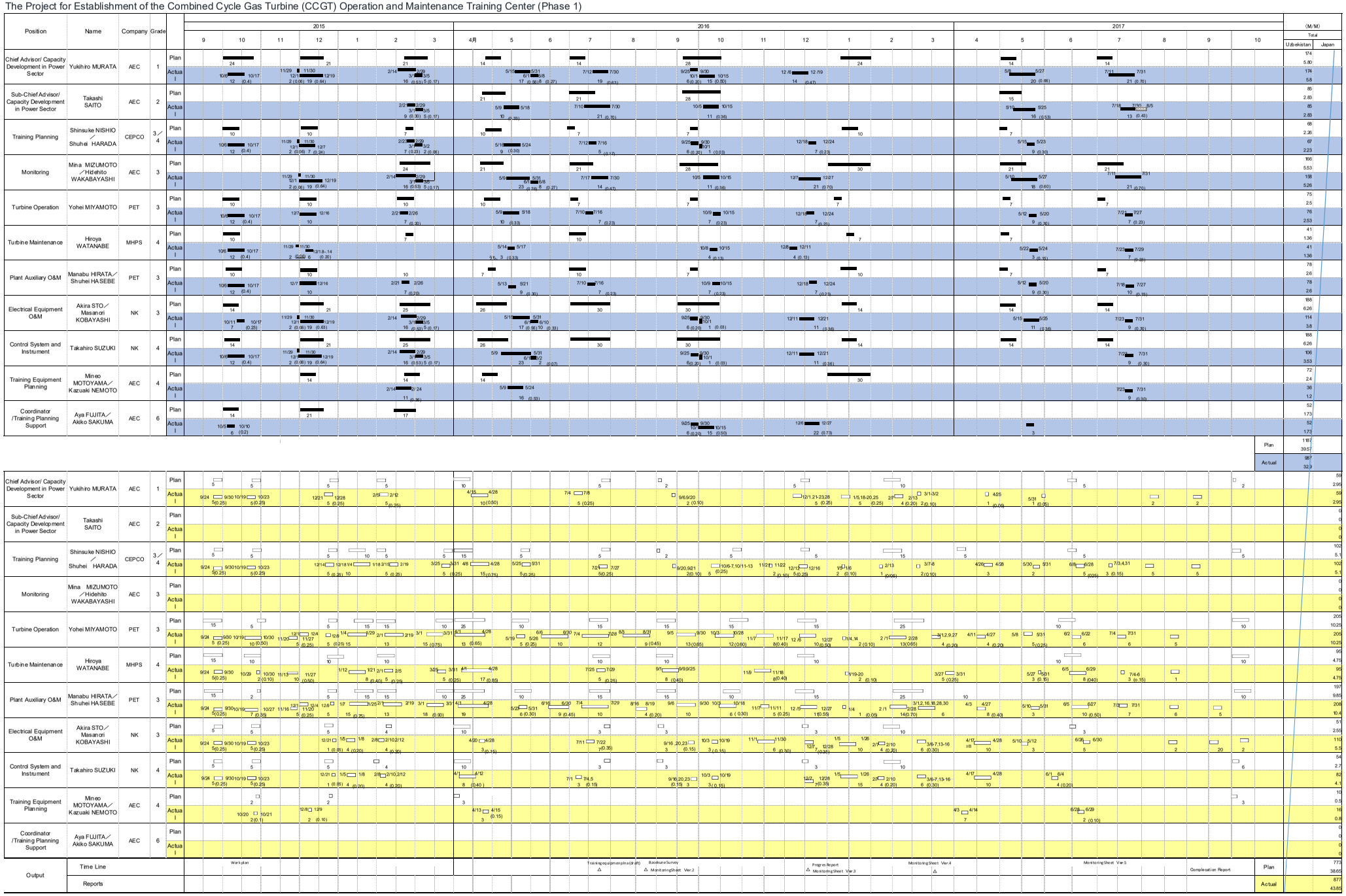


Work Flow for the 2nd Phase

Activities by Outputs		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
		2017 fiscal year				2018 fiscal year											
		12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
	in Japna	Prepa-ration			1st			2 nd		3 rd			4th				5th
	in Uzbekistan		1 st				2 nd		3rd			4th				5th	
Output 1: Operation and maintenance policy of CCPP is developed. ・1.1 Support for development and institutionalization of the policy and plan of CCPP O&M		1.1 Support for development and institutionalization of the policy and plan of CCPP O&M															
Output 2: Human resource development plan, training plan, and accreditation system of CCPP O&M are developed. ・2.1 Improvement of Human Resource Development, personnel distribution and accrediation system for CCPP ・2.2 Improvement of operational status of training plan (training system / operation plan / schedule etc.) on CCPP ・2.3 Established sustainable management system by C/P ・2.4 Implementation of CCPP O&M training in Navoi training center ・2.5 Continuous implementation of monitoring and evaluation system for CCPP		2.1 Improvement of Human Resource Development, personnel distribution and accrediation system															
		2.2 Improvement of operational status of training plan (training system / operation plan / schedule															
						2.3 Established sustainable management system by C/P											
						2.4 Implementation of CCPP O&M training in Navoi training center											
		2.5 Continuous implementation of monitoring and evaluation system for CCPP O&M training															
Output 3:Training curricula, materials and equipment of CCPP O&M are developed. ・3.1 Support for establishment of management system ・3.2 Curricula and training materials for CCPP O&M training are tried out and revised in actual training ・3.3 Support for procurement of training equipment		3.1 Support for establishment of management system															
		3.2 Curricula and training materials for CCPP O&M training are tried out and revised in actual training															
		3.3 Support for procurement of training equipment															
Output4: Instructors of CCPP O&M are trained and secured. ・4.1 Fostering of trainers ・4.2 TOT in Uzbekistan ・4.3 TOT in Japan ・4.4 Improvement of the accrediation system		4.1 Fostering of trainers															
			4. 2		4. 3		4. 2		4. 2			4. 2				4. 2	
		4.4 Improvement of the accrediation system															
5: Monitoring, Reports and Documents ・5.1 Inception Report ・5.2 Work Plan ・5.3 Monitoring Sheet ・5.4 JCC and Workshop ・5.5 End Line Survey ・5.5 Project Completion Report		Inception Report Work Plan			Monitoring Sheet 5			3rd JCC	3rd Workshop	Monitoring Sheet6		End Line Survey		Monitoring Sheet7 4th JCC		4th Workshop Project Completion Report	

Appendix 2

The Project for Establishment of the Combined Cycle Gas Turbine (CCGT) Operation and Maintenance Training Center (Phase 1)



The Project for Establishment of the Combined Cycle Gas Turbine (CCGT) Operation and Maintenance Training Center (Phase 2)

Position	Name	Company	Grade		2017 12	1	2	3	2018 4	5	6	7	8	9	10	11	12	1	2	3	4	5	(M/M) Total Uzbekistan	Japan
Chief Advisor/ Capacity Development in Power Sector	Yukihiro MURATA	AEC	1	Plan	14				16		22			25					22				99	3.3
				Actual	1/16 18/1 16 (0.53)		2/20 2/28 3/7 9 (0.30) 7 (0.23)				6/26 6/30 7/1 7/25 5 (0.17) 25 (0.83)			9/16 9/30 10/1 10/10 15 (0.50) 10 (0.33)					3/8 3/19 12 (0.40)				99	3.3
Sub-Chief Advisor/ Capacity Development in Power Sector	Takashi SAITO	AEC	2	Plan	18	11			24					24					24				101	3.36
				Actual	1/23 1/31 2/1 2/10 9 (0.30) 10 (0.33)		3/5 3/13 9 (0.30)				6/24 6/30 7/1 7/11,18-25 7(0.23) 19 (0.63)			9/23 9/30 10/1 10/20 8 (0.26) 20 (0.67)					3/1 3/19 19 (0.63)				101	3.36
Training Planning	Shuhei HARADA ／Akira OGAWA ／Gen KUBO	CEPCO	4／5	Plan	9	6			13					13					13				54	1.8
				Actual	1/23 1/31 9 (0.30)						6/24 6/30 7/1 7/12 7 (0.23) 12 (0.40)			10/1 10/11 11 (0.37)					3/6 3/19 14 (0.47)				53	1.76
Monitoring	Hidehito WAKABAYASHI	AEC	3	Plan	16	14			22					25					22				99	3.3
				Actual	1/16 1/27 12 (0.40)		2/21 2/28 3/1 3/13 8 (0.27) 13 (0.43)				6/26 6/30 7/1 7/25 5(0.17) 25 (0.83)			10/ 10/25 25 (0.83)					3/6 3/19 14 (0.47)				102	3.4
Turbine Operation	Yohei MIYAMOTO	PET	3	Plan	9				11					13					11				44	1.46
				Actual	1/21 1/29 9 (0.30)				7/9 7/16 8(0.26)						10/15 10/23 9(0.30)				3/6 3/19 14 (0.47)				40	1.33
Turbine Maintenance	Hiroya WATANABE	MHPS	4	Plan	8				8					9									25	0.83
				Actual			2/6 2/11 6 (0.20)				7/13 7/21 9 (0.30)							1/22 /26 5 (0.17)					20	0.66
Plant Auxiliary O&M	Shuhei HASEBE	PET	3	Plan	9				11					12					11				43	1.43
				Actual	1/21 1/29 9 (0.30)				7/9 7/18 10(0.33)						10/10 10/23 14 (0.47)				3/6 3/19 14 (0.47)				47	1.57
Electrical Equipment O&M	Masanori KOBAYASHI	NK	3	Plan	16	15			18					19					15				83	2.76
				Actual	1/26 1/31 2/1 2/10 6 (0.20) 10 (0.33)						6/25 6/30 7/1 7/12 6 (0.20) 12(0.40)			9/25 9/30 10/1 10/8 6 (0.2) 8(0.26)					3/1 3/19 19 (0.47)				67	2.23
Control System and Instrument	Hiroaki NIIMI	NK	5	Plan	16	15			18					18					15				82	2.73
				Actual	1/26 1/31 2/1 2/8 6 (0.20) 8 (0.27)						6/25 6/30 7/1 7/9 6 (0.20) 9(030)			9/23 9/30 10/1 10/6 8 (0.26) 6 (0.20)					3 /11 3/19 9 (0.47)				52	1.73
Training Equipment Planning	Kazuaki NEMOTO	AEC	4	Plan	9	10			7					7									33	1.1
				Actual			3/6 3/13 9 (0.30)				6/25 6/30 7/1 7/3 6 (0.20) 3(0.10)			9/23 9/29 7 (0.23)									25	0.83
Coordinator /Training Planning Support	Akiko SAKUMA	AEC	6	Plan					6					6					6				18	0.6
				Actual	1/16 /27 12(0.40)						7/8 7/12 5 (0.16)			10/1 10/10 1 (0.03)					3/6 3/19				18	0.6
																							681	22.7
																							624	20.8
Chief Advisor/ Capacity Development in Power Sector	Yukihiro MURATA	AEC	1	Plan	3		2	10		4				5					4	5			33	1.65
				Actual	1/10 1/12 3 (0.15)		2/5-8,16 5 (0.15)	3/14-15,29-30 4 (0.20)	4/11-12 2 (0.10)	5/30-31 2 (0.10)	6/4-5,20-21 4 (0.20)	7/26-27 2 (0.10)		9/10-11 2 (0.10)	10/31 1 (0.05)		12/17,20 2 (0.10)	1/9-11,23 4 (0.20)	2/28 1 (0.05)	3/6 1 (0.05)			33	1.65
Sub-Chief Advisor/ Capacity Development in Power Sector	Takashi SAITO	AEC	2	Plan																			0	0
				Actual																			0	0
Training Planning	Shuhei HARADA ／Akira OGAWA ／Gen KUBO	CEPCO	4／5	Plan	6		4	7		5				6					6	6			40	2
				Actual	1/10 1/16～19 6 (0.30)		2/19-21,23 4 (0.30)	3/5-8 4(0.20)	4/25-27 3(0.15)	5/10-11 2 (0.10)	6/19-21 3(0.15)	8/8 (0.05)		9/3,4,6,11-13 6 (0.3)	9/19-20 2 (0.1)	10/23-24 2 (0.1)	11/14-16 3 (0.15)	12/19-21 2 (0.1)	1/18 (0.05)	1/28 1 (0.05)			40	2
Monitoring	Hidehito WAKABAYASHI	AEC	3	Plan	5		2	10		4				5					4	5			35	1.75
				Actual	1/9-11 29-30 5 (0.25)		2/9,16 2(0.10)	3/21-22,29-30 4 (0.20)	4/12 1 (0.05)	5/22,25,28 3 (0.15)	6/15,18-22 6 (0.30)					11/12-15 4 (0.20)		12/3-7,26-27 7 (0.35)						32	1.6
Turbine Operation	Yohei MIYAMOTO	PET	3	Plan	8		5	25		6	14			14					9	5			86	4.3
				Actual	1/9-12,15,19 9 (0.45)		2/13-16,19-23 9 (0.45)	3/6,9,12-15,19-20,26,29-30 11 (0.55)	4/6,9,11-12,16,19,23-24,26 9 (0.45)	5/22,28-29 3 (0.15)	6/1,4-6,12-13,27 7 (0.35)	7/2-5,18-19,23,27 8 (0.40)	8/16,17,20,23 (0.20) 4	9/1,5,10-11,18,26 6 (0.30)	10/9,10,12,24-26,29-31 6 (0.45)	11/1,5-7 (0.20) 4							79	3.95
Turbine Maintenance	Hiroya WATANABE	MHPS	4	Plan	10			10						10					10	5			45	2.25
				Actual	1/18-19,22-26,29-31 10 (0.30)			3/1-7,27-29 10 (0.30)						9/3-7,10-14 10 (0.50)				10	8				48	2.4
Plant Auxiliary O&M	Shuhei HASEBE	PET	3	Plan	8		5	25		6	14			11					9	5			83	4.15
				Actual	1/4-5,9-11,15-19,31 11 (0.55)		2/1 2/16 5 5 (0.40)	3/5-8,12,14,26-29 10 (0.50)	4/4,9,13,16,26 5 (0.25)	5/21,22,29-31 5 (0.25)	6/1,4-8,11-15,19-22,26,27-29 19 (0.95)	7/2,4-6,20,23,25,27 9 (0.45)	8/16,17,20,21,23 (0.25) 5	9/7,12,19,26-28 6 (0.30)	10/2-5,7-9,25,26,29-31 12 (0.60)							90	4.5
Electrical Equipment O&M	Masanori KOBAYASHI	NK	3	Plan	10				10		6		8		9/13,14, 18-21 6 (0.30)			12/17-21 7 (0.35)	6	5			45	2.25
				Actual	1/10 1/2 10 (0.5)	2/15 2/21 5 (0.25)					6/4,12-15,18,22 6 (0.30)	7/3,18,19,20,23,30 6 (0.20)	20-22 3 (0.15)		10/24-26 3 (0.15)		25,28 7 (0.35)	1/11,15-18, 21,22 7 (0.35)		3/25,26,27 2.8 (0.14)			55.8	2.79
Control System and Instrument	Hiroaki NIIMI	NK	5	Plan	10				10		6		9		9/11,14, 18-21 8 (0.40)			12/12-14,17-21, 27 1.1 (0.45)	6	5			40	2.3
				Actual	1/10 1/23 10 (0.5)	2/15 2/21 5 (0.25)					6/4,12-15,18,22 6 (0.30)	7/3,17,19,20,23,29 6 (0.20)	20-22 3 (0.15)		10/25,26,31 3 (0.15)			1/11,15-18, 21-23,30-31 10 (0.50)		3/2,5,26,27,28 4 (0.20)			66	3.3
Training Equipment Planning	Kazuaki NEMOTO	AEC	4	Plan	5	5		5						7									22	1.1
				Actual		1/22 1/26 5 (0.25)	2/19 2/23 5 (0.25)		4/23 4/27 5 (0.25)						12/17-21, 25,26 7 (0.35)									22	1.1
Coordinator /Training Planning Support	Akiko SAKUMA	AEC	6	Plan																			0	0
				Actual																			0	0
																							0	0
Output	Time Line				△ Work Plan (2nd Phase) △ Monitoring Sheet Ver.5 △									Monitoring Sheet Ver.6 △						Monitoring Sheet Ver.7 △ Project Completion Report Draft △		△ Project Completion Report Draft		435	21.75
	Reports																						465.8	23.29

Appendix 3

COMPANY STANDARD

REGULATIONS OF COMBINED CYCLE GAS TURBINE UNIT

JOINT STOCK COMPANY "NTPP"
Navoi
KSt 202-810: 2015

Preface

1. DEVELOPED AND INTRODUCED by the Unit of Combined cycle gas turbine of JSC "NTPP"

2. APPROVED AND IMPLEMENTED by the order of JSC "NTPP" dated №

3. INSTEAD OF KSt 202-810: 2011

Approved by
Director General of JSC "NTPP"

Ganiev K. H.

COMPANY STANDARD

REGULATIONS OF COMBINED CYCLE GAS TURBINE UNIT

Valid from to

1. Area of application

This provision is developed on the basis of the Charter of JSC «NTPP», Qualification handbook for managers, specialists and employees, plant's instructions on operation and maintenance of gas turbine equipment, plant's instructions on operation and maintenance of steam turbine equipment, plant's instructions on operation and maintenance of heat recovery unit (HRSG), plant's instructions on operation and maintenance of gas booster unit, in order to identify the main tasks and functions of the personnel of combined cycle gas turbine unit (CCGT) is mandatory for personnel of the unit.

2 General provisions

2.1 CCGT unit is an independent department of JSC «NTPP».

2.2 Administratively the CCGT unit is subordinate to the Director General, and in the production and technical activities - to the director of the production of the plant.

KSt 202-810:2015

2.3 The main purpose of the CCGT plant is the operational and technical servicing of the equipment assigned to the unit.

2.4 The equipment under the CCGT plant are: boilers and gas-steam turbine units with auxiliary equipment and pipelines; gas booster compressor units; cooling towers with circulation pumps; heating systems; plant's communications

(raw water, industrial waste water, discharge from cooling towers, gas pipeline, potable and fire water, network pipelines).

2.5 The CCGT unit operates on annual and monthly work plans approved by the plant's management.

2.6 In its activities the CCGT unit is guided by the regulatory and technical documents and guidelines:

- "Rules of technical operation of power plants and networks", Tashkent 2011;
- "Rules of the organization of work with the staff at energy production enterprises", registered by Ministry of Justice of Uzbekistan dating 04.10.2002 №1178;
- "HSE rules during operation of thermal mechanical equipment of power plants and heat networks" Tashkent 2012;

- RH 34-400: 2008 "Regulations on the occupational health and safety management system in the energy sector";
- RH 34-418: 2006 "Regulations on departmental control over the state of gas industry at thermal power plants and heating plants of SJSC "UzbekEnergo";
- "Rules for safe operation of instruments and devices ";
- "Rules of fire safety at energy enterprises" Tashkent 2013;
- RH 34-077: 2008 "Rules of organization of technical service and maintenance of equipment at power stations";
- Provision on investigation and registration of occupational accidents at production sites. Tashkent 1997;
- RH 34-114: 2007 "Regulations on disciplinary responsibility of employees of the Uzbek energy system ";
- RH 34-475: 2007 «Internal work rules of employees of the executive office of JSC" UzbekEnergo", its branch "EnergoSotish" and unitary enterprises";
- RH 34-451: 2006 "Regulations on incentive of employees of JSC "UzbekEnergo".
- KSt 202-036: 2007 "Internal work rules of employees of JSC «NTPP»;
- "Safety rules in the gas sector of the Republic of Uzbekistan" Tashkent 2004;
- Orders and instructions of management of JSC "Uzbekenergo";
- Regulations on the occupational health and safety management system.
- By instruction PP - 56;
- "Regulations on investigation and recording of accidents and other damage to the health of workers at production site "approved by the Cabinet of Ministers dating 6 June 1997;

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RH 34-114: 2007 "Regulations on disciplinary responsibility of the employees of the Uzbek energy system";

- By the Resolution of the Cabinet of Ministers of the Republic of Uzbekistan dated 02.01.1999 № 140 "On measures to strengthen executive discipline";

- By the Law of the Republic of Uzbekistan "On Electroenergetics» № 225 dated 30.09.2009;

- By the Resolution of the Cabinet of Ministers of the Republic of Uzbekistan № 245 dated 22.08.2009 "On Approval of rules for use of electricity and thermal energy";

- By this provision.

2.7. Methodical management of CCGT unit's activities is carried out by operation and repair service of thermal and mechanical equipment of UEE JSC "Uzbekenergo".

3. The main objectives

3.1 Fulfillment of the dispatching schedule of electrical load of power plant.

3.2 Fulfillment of tasks of production of electricity and thermal energy.

3.3 Ensuring reliable operation of main and auxiliary equipment of the unit.

3.4 Providing of normative efficiency indicators of primary and auxiliary equipment.

3.5 Maintenance of main and auxiliary equipment of CCGT unit in constant readiness to withhold the nominal electric and thermal loads.

3.6 Fulfillment of production and business plans of CCGT unit.

3.7 Increasing productivity through better organization of work, use of advanced methods of maintenance and repair of equipment of the manufacturers, reducing the maintenance costs, organization of work on rationalization and invention, protecting the environment and people from harmful effects of production.

4 Functions

4.1 Monitoring of work and external state of equipment, machinery, devices and facilities administered by the CCGT unit by rounds and inspections for the purpose of timely detection and elimination of defects.

4.2 Monitoring the performance and condition of the equipment of CCGT unit from control panel.

4.3 Maintain a specified working mode of the equipment, conducting of routine switches of the equipment.

4.4 Operational and technical maintenance of equipment assigned to the CCGT unit.

4.5 Taking of timely measures to eliminate damage and eliminate the emergency condition of the equipment.

4.6 Participation in the investigation of the causes of accidents and failures of thermal and mechanical equipment, record-keeping and analysis, carrying out emergency works, taking measures against emergencies on the acts of investigations of accidents and failures.

4.7 Participation in the investigation into the causes of accidents with the personnel of CCGT unit, implementation of measures to prevent such cases in accordance with acts drawn up in accordance with H-1 form.

4.8 Organization and holding in the CCGT unit of activities to fulfill the requirements of the Fire safety in accordance with RH 34-400: 2008 "Regulations on the labor protection management system in the energy sector";

4.9 Organization and holding in the CCGT unit of activities to fulfill the requirements of the rules operating and maintenance, State Technical & Mining Inspectorate, HSE, IS.

4.10 Development and implementation of organizational and technical measures to improve the reliability and efficiency of the work of the equipment assigned to the CCGT unit, as well as the safety of spare parts of equipment, materials, tools, etc., assigned to the unit.

4.11 Development of annual and long-term plans of repairs, reconstruction and modernization of thermal and mechanical equipment, matching them with VET(maybe production-technical department?) and participation of VET(maybe production-technical department?) in their implementation.

4.12 Submission of applications for withdrawal of equipment of CCGT for repair, preparation of workplaces for repair and permitting of repair crews to work.

4.13 Control the deadlines, volumes and quality of repair of CCGT unit equipment, participation in the acceptance from repair and in the pretention work on the quality of the repaired equipment.

4.14 Organization and participation in the acceptance, commissioning and testing of the unit’s equipment after the repair.

4.15 Organization of implementation of approved scientific and technology activities, reconstruction and modernization of the installed equipment in order to improve its work reliability and efficiency.

4.16 Organization and participation in the conduct of technical inspection of mechanisms and facilities, registered and unregistered within the bodies of the SI "SanoatKonTexNazorat".

4.17 Analysis and generalization of experience of operating equipment in order to improve its performance.

4.18 Upkeeping of fire-fighting equipment in the unit.

4.19 Determining the workshop's need for spare parts and equipment manufactured abroad, tools, materials and clothing, timely filing in Outage and LD departments.

4.20 Provision of workplaces with necessary equipment, tools, documentation.

4.21 Organization of rationalization and inventive work among the personnel of the unit and implementation of rationalization proposals agreed with the manufacturers of the main equipment.

4.22 Development and coordination of new and periodic review of existing production and job descriptions, including descriptions on labor protection for all workers in a timely manner.

4.23 Training of the newly employed personnel and raising skills among the unit's staff in accordance with the "Rules of the organization of work with the staff at the enterprises of energy production", registered by Ministry of Justice of Uzbekistan dated 04.10.2002 N1178.

4.24 Record keeping and preparation of reporting on manufacturing activity of the unit, keeping of technical documentation.

4.25 Maintaining the equipment, facilities and areas assigned to the unit in cleanliness.

5 Rights

5.1 Take urgent measures to shutdown or reduce the load of equipment, stop the performance of works by employees of any unit in the event of danger to people and equipment.

5.2 Issue permits and give instructions for performance of repair works on the equipment of CCGT

5.3 Apply for transfer to repair of CCGT equipment.

5.4 Sign the planning and reporting documents within the unit.

5.5 Submit proposals to the management of the power plant and participate in the development of measures aimed at implementing the main tasks of management, improve its technical and economic parameters and conditions of the personnel department.

5.6 Give technical and administrative instructions to subordinate staff.

5.7 Monitor the staff's compliance of labor and production discipline, the requirements of the rules and regulations on occupational safety, industrial hygiene and HSE.

5.8 Stop the performance of works on the equipment and remove from the work of persons who violated HSE and IS regulations, or in the absence of the required work permits.

5.9 Submit proposals to the management to impose a penalty and reduce the size of the bonus to persons whose actions or negligence in official duties led or

could lead to accidents and emergencies, or unjustified shutdown of CCGT equipment.

5.10 Submit proposals to the management on employment, transfer and dismissal of personnel in accordance with applicable law.

5.11 Submit proposals to the Director of the power plant on the promotion of distinguished employees of the unit.

6 Interactions

6.1 Interactions of CCGT unit with other divisions of the plant shall be established by this Regulation and by the document approved by the plant management on division of boundaries of service of the equipment, buildings and structures between units.

6.2 With electrical unit

6.2.1 The CCGT staff shall:

- keep a constant control over the work, starting and shutdown of turbine generators, exciters, other electrical units and their cooling systems within the manufacturing instructions;
- inform the staff of the electrical of all faults in the electrical equipment to record in of repair logs of electric unit;
- take measures to prevent the ingress of water, oil, steam on electrical equipment;
- transfer to repair the CCGT equipment, in which the electrical equipment should be repaired or replaced;
- transfer the electrical power tools and protective means at CCGT to audit and testing;
- maintain cleanliness the external surfaces of electrical equipment in the CCGT;
- carry out activities on process equipment, observing the fire and industrial safety rules during the repair of electrical equipment;
- provide area for reserve electrical equipment, testing units and stands, as well as for the repair of electrical equipment in the CCGT;
- taking to the plant’s balance all the main and auxiliary equipment installed at the CCGT .

6.2.2 The personnel of electric unit must:

- perform technical service and repair works of equipment, communication devices, lighting, installed in the CCGT unit;
- monitor, together with the CCGT the work of electrical equipment, communications and lighting;
- ensure the acceptance, storage, regeneration of "dirty" oil;

- make the necessary entries on the starting cabinets, electrical engines and in lighting network, on panels of lighting and welding, panels of relay protection and electrical automated systems;

- assign permits the staff to repair electrical units at CCGT, with the permit of the shift supervisor of CCGT;

- participate in operations to check the automatic transfer switch(Maybe AVR?) of the CCGT equipment, audit and produce electric power tools and tests of protective means at CCGT;

- timely review the operating instructions of electrical equipment and make the necessary changes in the electrical circuits.

6.3. With the centralized repair unit (CRU)

6.3.1 Staff of CCGT must:

- determine the volume, the necessity and possibility of repairs of the CCGT equipment;

- ensure transfer of equipment to repair in the prescribed manner and permit the CRU personnel to repair of the equipment, having conducted the HSE activities;

- exercise control over the fulfillment of volumes, quality and deadlines of repair and carry out the acceptance of equipment from repair;

- log all malfunction of equipment into defects journal. Identify the nature of defect, its boundaries and the degree of danger. Fence the danger zone.

- Attract CRU to conduct inspection of facilities, registered and unregistered in the bodies "SanoatKonTexNazorat" of Uzbekistan;

- participate in fault detection of equipment before and after repair;

- make use of fire water network for technical and clarified water within the territory of the CCGT;

- conduct internal service of heating system within the territory of CCGT .

6.3.2 The staff of CRU must:

- determine the amount and timing of current and emergency repairs of the CCGT equipment;

- repair the CCGT equipment;

- eliminate defects, faults in equipment as recorded in the journals of defects;

- transfer the repaired equipment to the CCGT personnel together with drawing up of acts and making the respective entries in the defects journal;

- service the lifting mechanisms at CCGT and be responsible for their technical condition;

- participate in the examination of the facilities registered and non-registered in the bodies "SanoatKonTexNazorat" of Uzbekistan;

- ensure cleanliness and order during the repair of equipment.

6.4 With the unit of thermal automated systems

6.4.1 The staff of CCGT must:

- supervise the operation of equipment of instrumentation and automated systems, installed in CCGT and ensure its safety;
- when malfunction is detected of instrumentation equipment and notify the staff of thermal automatics and measurements (TAM) unit with making a record in the operational log of CCGT;
- take measures to prevent the ingress of water, steam, oil on the equipment of instrumentation and automated systems;
- service the primary shut-off devices on the impulse lines of measurement, automation and protection equipment;
- carry out activities to ensure compliance with the HSE, fire safety rules and regulations of "SanoatKonTexNazorat" during the repair of equipment of instrumentation and automated systems.

6.4.2 The staff TAM unit must:

- ensure the performance, efficiency, reliability equipment of instrumentation and automated systems installed in the CCGT .
- train make the CCGT staff on operation, blocking, protection, alarm, measuring instruments and automated systems;
- timely review the operating instructions of instrumentation equipment at CCGT;
- permit the staff to repairs and commissioning of instrumentation equipment installed at the CCGT, with the knowledge and permission of the CCGT shift supervisor.

6.5 With chemical unit

6.5.1 The CCGT staff must:

- maintain water chemistry mode in accordance with the operating and maintenance requirements and instructions of the chemical plant;
- take urgent measures to restore the water chemistry mode during deviation of indicators;
- service the dosing pumps, conduct preservation of equipment during downtime in the reserve or repair;
- carry out chemical cleaning under the supervision of chemical unit of the CCGT equipment (pipes of the boiler, turbine condensers, etc.).
- ensure normal working conditions of sampling points till the primary shut-off valve.

6.5.2 The staff of chemical unit must:

- ensure maintenance of optimal water chemistry mode of thermal mechanical equipment of CCGT;
- provide the CCGT with chemically demineralized and purified water in sufficient quantity and quality, chemicals for corrective treatment of boiler and feed water;
- carry out chemical control of water, steam, condensate, gas and oil;
- participate in the internal inspection and acceptance of the purity of elements of boilers, heat exchangers, oil tanks and oil system;
- carry out acceptance to the Sewage treatment complex of waste water after the washing and chemical cleaning of heat-mechanical equipment;
- monitor and set the mode of preservation of CCGT equipment according to the recommendations of the manufacturers, to determine the need for and the technology of chemical cleaning equipment.
- supervise the regulation of water chemistry mode of boilers and other equipment;
- participate in the thermal mechanical testing of CCGT equipment;
- monitor the air at gas hazardous dangerous areas.

6.6 With the staff of Electrical adjustment unit (EAU)

6.6.1 The staff of CCGT must:

- maintain the operation mode of the equipment according to the issued mode charts and the recommendations of the manufacturers;
- ensure the maintenance of a given mode of operation for testing thermal and mechanical equipment;
- report to Electrical adjustment unit all deviations from the set modes.

6.6.2 The staff of EAU must:

- coordinate with the CCGT the plans, programs, deadlines and volumes of tests;
- conduct tests of thermal and mechanical equipment;
- draw up and issue CCGT the mode charts of the equipment, inform the CCGT of the results of the adjustment, testing of any changes in the modes of operation of the equipment, as well as on the detected defects;
- take part in identifying the causes of deviations from the normal operation of the equipment;
- conduct training with the staff of CCGT for safe and economical operation of the equipment

6.7. With the laboratory of metals

6.7.1 The staff of CCGT must:

- prepare the workplaces and the permit to the control over the state of the metal;

- organize the works to address the comments identified during the control process;

- monitor compliance with the deadlines and fulfillment of the volumes of work on the control of metal;

- take measures to replace the metal that has exhausted its resources.

6.7.2 The staff of Laboratory of metals must:

- develop and approve the metal control schedules;

- monitor the metal control according to the approved deadlines;

- during the repair process carry out quality control of metal and welded joints and their compliance with the requirements of "SanoatKonTexNazorat"; .

- conduct diagnostics and forecasting of the reliability of the metal;

- submit for approval the results of planned metal control;

- prepare the documentation to the expert committee for extending the life of metal;

- carry out research and provide an conclusion on the reasons of damage to components and machine parts, determine its suitability for use.

6.8 With the production and technical department (PTD)

6.8.1 The staff of CCGT must:

- transmit to the PTD the materials for the analysis of the equipment,

-preparation the technical reports, organizational and technical measures to improve the efficiency and reliability of equipment during preparation for the autumn-winter period, applications for rationalization proposals for consideration and approval;

- coordinate with the PTD the draft repair plans of equipment, manufacturing and job descriptions;

- prepare acts of introduction and transfer organizational technical measures and transfer them to PTD;

- transfer to PTD the reports on the implementation of plans and measures on environmental protection;

- coordinate with the PTD the equipment testing program, technical solutions;

- coordinate with PTD the requisition for equipment, spare parts, specification for material resources.

6.8.2 The staff of PTD must:

- provide the CCGT with technical documentation for equipment, information materials, technical literature, the initial data for drawing up equipment loading plans, power generation from heat release, equipment operation modes;

- communicate to the CCGT the fulfillment of technical-economic performance of the equipment;

- conduct evaluation of applications for rationalization proposals submitted to the unit and assist innovators in the design of documentation;

- bring to the attention of staff of unit the plans of research, project-design works, environmental protection, introduction of new technologies, modernization, technical assistance to review and update schemes, production and job descriptions, and to coordinate them.

- bring to the attention of staff of CCGT the circulated documents, guidelines of management bodies on technical issues.

6.9 With the Division for preparation and conduct of repairs (DPCR):

6.9.1 The staff of CCGT must:

- transmit to the DPCR the materials for drawing up of summary plans of repairs; information necessary for the analysis of damage rate of units, assemblies and parts of equipment;

- develop and transmit the technical programs on transferring of equipment to repair and acceptance from repair, inspection and testing;

- ensure that the transfer of equipment and repair within the deadline set by the schedule, control the timing and quality of repair;

- report any detected faults in the equipment and detected hidden defects of repair.

6.9.2 The staff of DPCR must:

- organize and participate in the definition of technical condition of the equipment subject to be repaired;

- approve the schedule and duration of repairs, formalize the program of transfer of equipment to repair and acceptance from repair;

- carry out design works at the unit’s request. Provide the unit with repair documentation (drawings, diagrams, statements, etc.).

- draw up and control the execution of requisitions for equipment and spare parts.

- conduct technical supervision over service and industrial premises, buildings and structures, to determine the volume and organize repairs.

6.10 With the logistics department (LD)

6.10.1 The staff of CCGT must:

- prepare and transmit to the LD the material requisitions monthly consumption and clothing;

- issue to LD the annual list of the minimum reserve of materials and tools;

- provide to LD the information on remaining materials taken from by the unit from warehouse of LD.

6.10.2 The staff of LD must:

- carry out the implementation of materials and equipment requisitions of CCGT according to the allocated funds in accordance with the approved terms of supply;

- ensure the storage of stocks of materials, equipment, instrument in accordance with the technical specifications of their storage;

- ensure minimum reserve of materials and tools at the warehouses of LD according to the list.

6.11 With the Planning and Economic Department (PED)

6.11.1 The staff of CCGT must:

- provide data for reporting on the fulfillment of plans for the months in terms of unit, as well as teams, transferred into self-supporting working methods on the received (provided) services;

- provide data for reports on the use of resources, within the limit set to the unit;

- submit reports on the fulfillment of plans;

- provide data on the use of working time, sheets for the payment of bonuses to the unit's staff;

- participate in the implementation of labor standards;

- participate in the development of an action plan on Scientific Labor Organization (SLO).

6.11.2 The staff of PED must:

- provide the CCGT with the action plan on SLO and the rationalization of workplaces, the approved staff schedule, provision on bonuses to workers and specialists, salary fund;

- monitor the application of tariff rates, salaries, bonuses, allowances, coefficients to wages, assignment of categories to workers, spending of salary fund in the unit;

- communicate the plans approved in the established order;

- provide the elements of cost estimates (limits), the expenditure of which depends on the staff of CCGT .

6.12 With the Accountancy Department

6.12.1 The staff of CCGT must:

- keep the work time sheet for staff of CCGT and provide documents on violations of the work schedules;
- write-off of fixed assets and low-grade materials in the prescribed manner;
- participate in the work of committees to verify the availability of essential funds and other inventory items in the unit;
- submit the primary documents on standard forms on the consumption of operating materials, spare parts, tools, work clothes.

6.12.2 The staff of Accountancy Department must:

- provide funding for the CCGT's production plan;
- if necessary, take part in the inventory and write-off of fixed assets and other goods and materials in the unit;
- monitor the effectiveness of the use of public resources and preservation of state property in the CCGT unit.

6.13 With the Department of strategic planning and control of capital construction (DSPCCC)

6.13.1 The staff of CCGT must:

- consider the technical documentation for objects of capital construction within Thermal Engineering, give an opinion;
- carry out, in conjunction with staff of DSPCCC, technical supervision over the quality of work performed during the construction and installation of objects of capital construction.

6.13.2 The staff of DSPCCC must:

- coordinate with the CCGT unit technical documentation of objects of capital construction for Thermal Engineering;
- - carry out, in conjunction with staff of CCGT, technical supervision over the quality of work performed during the construction and installation of objects of capital construction.

6.14 With the HR department;

6.14.1 The staff of CCGT must:

- transfer to the HR department the application for employment of personnel, proposals for employment, dismissal and transfer to another job of workers and engineering and technical personnel in accordance with applicable law;

- carry out works, together with the HR department, aimed at reducing the turnover of employees, strengthening the labor discipline, selection and sending of personnel to business trips, to training, identify reserve from among the experts for promotion;
- provide information to the HR department about violations of labor discipline and internal work rules, protocols of qualifying commissions, the materials for promotion of workers, and schedules of vacation, and applications for leave.

6.14.2 The staff of HR must:

- formalize employment of workers, as well as hold talks and transfer to another job within the unit in accordance with applicable law;
- check the correct use of experts, together with the management and public organizations, aimed at reducing the turnover of employees, strengthening the labor discipline, selection and sending of personnel to business trips, to training, identify reserve from among the experts for promotion;
- take part, together with the head of the CCGT in drafting orders both to prosecute violators of labor and production discipline, and the promotion of distinguished workers of the unit;
- issue a power of attorney documents for pensions, issue certificates, keep personal files of workers.

6.15 With the workshop for hydraulic structures (WHS)

6.15.1 The staff of WHS must:

- service the pumping station of additional water (PSAW), conduct regular technical service and repair of pumps, pipes and fittings to the pump station of water purification plant of CCGT;
- provides a sufficient amount of raw water to the CCGT.

6.15.2 The staff of CCGT must:

- warn WHS during transfer and acceptance from repair.

7 Liability

7.1 The staff of CCGT is liable for:

- fulfillment of tasks for the production and supply of electricity and thermal energy;
- implementation of load schedule;

- maintaining reliable and economical operation of the equipment of CCGT, its readiness to bear the nominal electric and thermal loads;
- safety of the equipment and property assigned to the unit, cleanliness of the territory, premises and equipment of the unit;
- efficient organization of labor in the unit;
- state of labor and production discipline in the unit.
- timely and effective implementation of the functions assigned to the CCGT unit and complete use of the rights granted to him.

7.2 The disciplinary, financial and criminal liability of the CCGT personnel is determined in accordance with the legislation of the Republic of Uzbekistan.

Information data

Developed by the Unit of Combined cycle gas turbine of "NTPP"

Head I.H. Abdulloev

Agreed with

Production-technical department
Head T.H. Soliev

Centralized repair unit
Head N.N. Husenov

Electric unit
Head M. M. Pulatov

Unit of thermal automatics
Head U. T. Khalilov

Unit of Hydraulic Structures
Head T. Saidov

Head of chemical unit
Head N.N. Babakandov

Unit Electric adjustment
Head H. Bekkulov

Metals Laboratory
Head MJ Toshov

Division for preparation and conduct of repairs
Head F.I. Ismailov

Accounting Department
Chief accountant O.B. Odilov

Department of Capital Construction
Deputy director for capital construction K.R. Hafizov

Department of Logistics
Head H. I. Juraev

Human Resources Department
Head I.O. Suvonov

Administrative - economic department Head	M.B. Ismoilova
Service for labor protection, HSE and IS Head	H. O. Muminov
Lawyer	T.A. Toyloqov
Responsible for Standardization	N.S. Nurullayeva

Appendix 4

Human Development - 01

Manual for Human Resource Development Planning

Involving Operator & Maintenance personnel

March, 2018

Chapter 1　General Provision

1.　Purpose

With growth in self-responsibility (personal development), proper leadership of the officials and OJT as a basis, the officials shall work to cultivate personnel, recognizing the Attachment-1 "Mental preparation in developing and coaching."

※The range of multi potentiality aimed at mutual support is shown in Attachment-4.

2.　Related Standards

Manual for Positioning Plan of Operation & Maintenance Personnel

3.　Applicable Range

This manual shall apply to human resource development of all CCPP Operator & Maintenance personnel.

Chapter 2　System of human resource development policy for CCPP engineering personnel

1.　Basic Policy

The Attachment-2 "Systematic of Development Policy of O&M Staff of CCPP" is aimed to establish a system where P(Plan), D(Do), C(Check) and A(Action) are adequately conducted, and by reviewing and revising it every year, it is designed to develop staff who meet the needs of the job site.

(1)　P(Plan):

Human Resource Development Department shows Annual Basic Staff Development Policy and Annual Training Plan. And, an Immediate Manager and each individual set targets for the year and work out Staff Development Plan and Personal Development Plan.

(2)　D(Do):

Human Resource Development Department conducts the training; An Immediate Manager conducts On-the-Job Training and the individual conducts Personal Development Plan.

(3)　C(Check):

Department assesses and analyzes the skill learning status and the results of participation in the training; Immediate Manager complements the assess and analysis of the work skill learning status and complements coaching of such work

skills. Each individual self-assesses his own skill learning status.

(4) A(Action):

An Unit Manager conducts job rotation to seek to train his personnel.

Chapter 3 Level of development of Operator & Maintenance personnel

1. Technical level to be achieved

(1) Technical level of the staff is basically classified 5 stages as shown in the table. In addition, Stage Ⅳ will be trained for Operator & Maintenance personnel.

Technical Level and Technical Level to be achieved

Level Stage	Technical level to be achieved
Stage Ⅰ: (Common basic)	Possible to carry out easy routine work by own and possible to carry out rather complex routine work under conducting of chief engineer
Stage Ⅱ: (Basic : Class C)	Possible to carry out easy routine work by own and possible to carry out routine work under occasional conducting of chief engineer
Stage Ⅲ: (Application Ⅰ: Class B)	Possible to carry out easy routine work by own and possible to conduct routine work to junior engineer
Stage Ⅳ: (Application Ⅱ: Class A)	By high specialty and possible to carry high level work by own and possible to conduct the work to junior engineer
Stage Ⅴ: (SA grade)	Possible to carry out whole out of routine work by own and possible to conduct every work to whole staff engineer and also possible to offer improvement the jobs.

2. Make all the thermal power personnel acquire the basics of "power generation jobs" and "maintenance jobs"

① In an effort to achieve early learning, make plans to train personnel in the common basics by setting a standard target of 3 years (1.5 years for operation and 1.5 years for maintenance).

--- (On the Job Training)

② After completion of the common basics, in an attempt to foster professional engineers in operation, maintenance and planning

(including environmental・chemicals) have the personnel acquire the basics for each function and foster personnel at the application stage.

③ At the application stage, conduct training management by categorizing the job into Application Ⅰ and Application Ⅱ. In the meantime, after finishing Application Ⅰ, promote diversification of (O&M) abilities by planning rotation with the other units

3. Human resource development program for Operator & Maintenance personnel

The following Step shows a flow of Human Resource Development Program for Operator & Maintenance personnel.

Step 1 ; Development of common basic(Operator & Maintenance) stage : Learning basic technology of thermal power

New employees shall acquire a minimum level of knowledge and skills by conducting "Basic education on thermal power (Common basics of Operation & Maintenance)" through OJT with a goal of 3 years.

- **Common basic(Operation)stage :**

  Within the goal period, for the training period and full-time experience period are set at each power plant according to the actual condition of each power plant.

  ・**Patrol personnel :**
  Standard goal 12 months (Training period : 4 months、Full-time period : 8 months)

  ・**Control personnel :** Standard goal 6 months (Training period: 6 months)

- **Common basic(Maintenance)stage :**

  After completing the common basic (Operation)stage, divide professionally into HRSG, turbines, electricity and I&C and acquire specialized skills of maintenance professionals at the goal1.5yeas in the maintenance department.

Comprehension of "Education of basic technologies" shall be confirmed by

oral test or written exam, and the successful candidates are given the following certifications of knowledge and skills.

- Certification of Operating skill basics
- Certification of Maintenance skill basics.

Step 2 ; Basic stage : Class C (Beginner level) technology acquisition

- **Training of operation basic stage ; Development goal period**

① University (Master) graduate

・Patrol personnel : Standard goal 9 months (Training period : 4 months, Full-time period : 3~5months)

・Control personnel : Standard goal 9 months (Training period : 4 months, Full-time period : 3~5months)

② High school college / High school graduate

・Patrol personnel : Standard goal 10 months (Training period : 4 months, Full-time period : 6months)

・Control personnel : Standard goal 10 months (Training period : 4 Months, Full-time period : 6 months)

- Training of maintenance basic stage : Development goal period

At the time of the placement to the maintenance department, to determine the base professional (HRSG, turbine, electrical, I&C). Comprehension of "Education of class C(Beginner level) technologies" shall be confirmed by oral test or written exam, and the successful candidates are given the following certifications of knowledge and skills.

- Certification of Operating skill class C.
- Certification of Maintenance skill class C.

Step 3; Application Ⅰ stage ; Class B (Intermediate class) technology acquisition

- Training at operation application Ⅰ stage :
  Development goal period : About 2 years (Development goal period shall be planned under the decision of a Shift Manager.)
- Training at maintenance application Ⅰ stage :
  Development goal period : About 1~3 years (To acquire the specialized

skills of maintenance professionals at the goal.)

- Comprehension of "Education of Class B (Intermediate class) technologies" shall be confirmed by oral test or written exam, and the successful candidates are given the following certifications of knowledge and skills.

  - Certification of Operation skill class B.
  - Certification of Maintenance skill class B.

Step 4; Application Ⅱ stage ; Class A(Senior class) technology acquisition

- Developing period: It shall be set by the judgment of Chief Engineer & Company president.
- Training at operation application Ⅱ stage: To acquire the specialized skills of Shift manager.
- Training of maintenance application Ⅱ stage: After completing the maintenance application Stage Ⅰ to acquire more advanced specialized skills.

Comprehension of "Education of class A technologies" shall be confirmed by oral test or written exam and the successful candidates are given the following certifications of knowledge and skills.

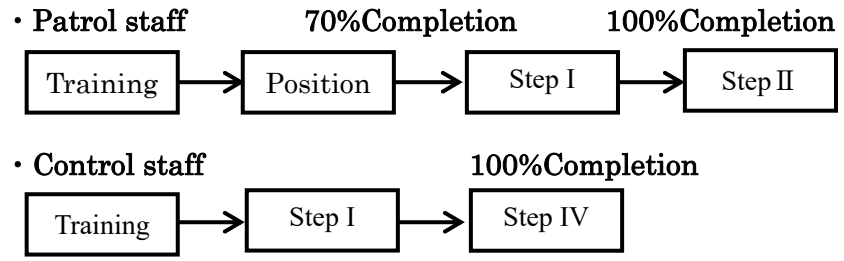
- Certification of Operation skill class A.
- Certification of Maintenance skill class A.

4. Flow of Basic operators' development

Flow of basic development of operating staff is shown in the following table. Classification of stages of target levels.

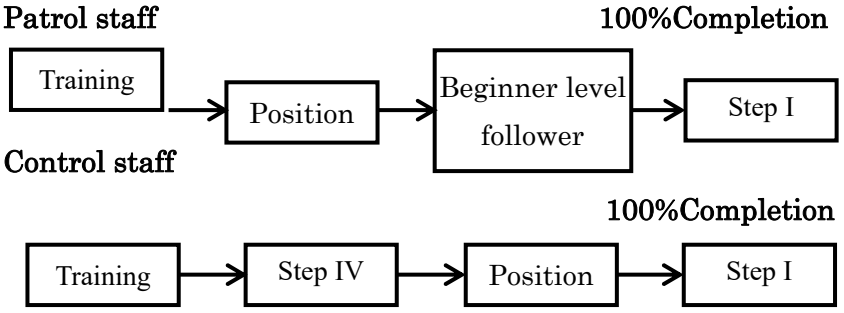
Ⅰ : Basic skills in operations as a whole.
Ⅱ : Minimum required skills to assume a post as patrol staff.
Ⅲ : Skills to be mastered as patrol staff.
Ⅳ : Minimum required skills to assume a post as control staff.
Ⅴ : Skills to be mastered at the basic stage of power generation

Step 1 :
Common basic (Operation)stage (Basic education)
Developing period : 1.5years
★Patrol completion certificate and operation skill base certificate



・Comprehension confirmation : Oral test or Written exam.

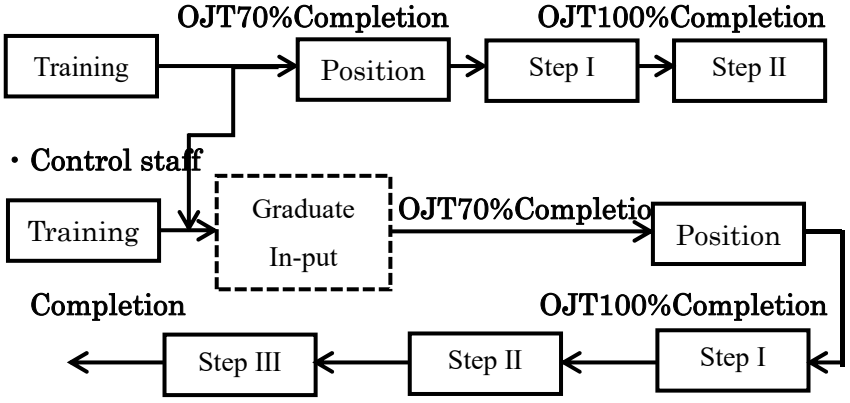
Step 2 :
Operation basic stage (Class C Education)
Developing period : 20months.
★Operation skill certification class C.



University (Master) graduate
Developing period : 18 months

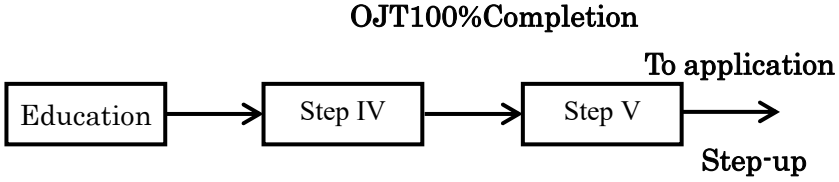
・Comprehension confirmation : Oral test or Written exam.

・Patrol staff



・Comprehension confirmation : Oral test or Written exam.

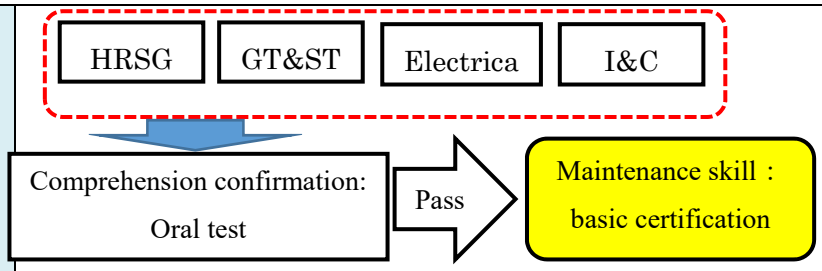
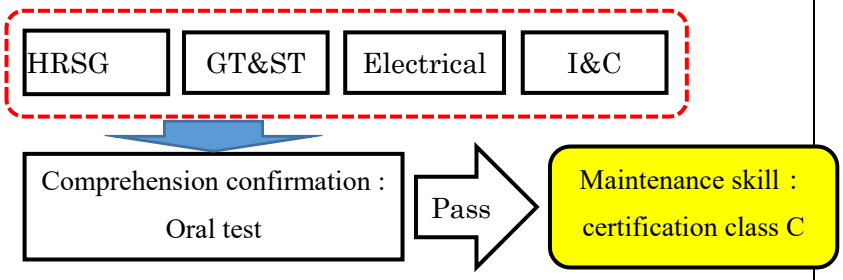
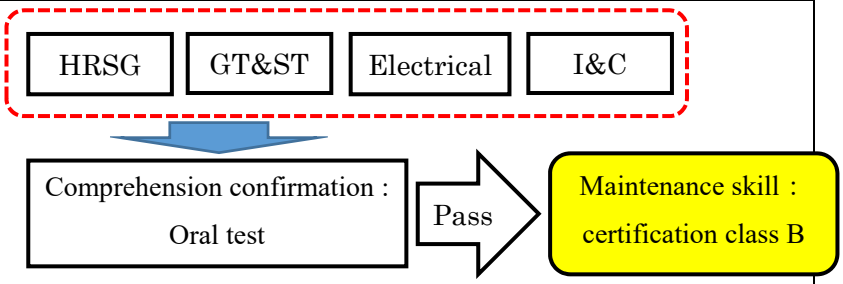
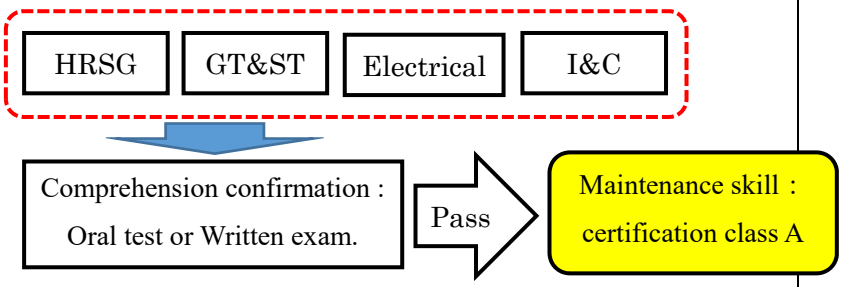
Step 3 :
Operation application I stage (Class B education)
Developing period : about 2years
★Operation skill certification class B



・ Comprehension confirmation : Oral test or Written exam.

Step 4： Operation application Ⅱ stage（Class A education） Developing period： It shall be set by the judgment of Chief Engineer & Company president. ★Operation skill certification class A	Utilizing development of patrol staff and control staff at the Application 1st stage of development, developing period and developing curriculum should be set tailored to the job experience of each individual staff. ・Comprehension confirmation：Oral test or Written exam.

5. Flow of basic development of maintenance staff

Step Ⅰ Common basic(Maintenance)stage (Basic education) Developing period : 1.5years	
Step 2 : Maintenance basic stage (Class C education) Developing period : about 2years	
Step 3 : Maintenance application Ⅰ stage(Class B education) Developing period : about1~3years	
Step 4 : Maintenance application Ⅱ stage(class A education) Developing period : Development shall be made by the judgment of Chief Engineer & Company president	

Chapter 4 Record system of professional skills (knowledge & skills)

This chapter provides manuals based on which personnel who have been newly assigned to any job function are to undergo a series of cultivation ranging from the common basic phase to the applied phase in the work-site.

Views on development management from common basic stage through

application stage II are shown in Attachment-3 “Professional Record System at CCPP (Basics through Application stage II).

1. Records of development status

(1) Record on developing plans (track records) and Chief Engineer’s view, and grasp of professional skill learning status, and records on understanding level at the time of grasping the status and follow-up status.

→ In daily management of development progress, such progress shall be recorded utilizing recording forms.

(2) “Chief "Engineer reviews the personnel training plan every year, P(Plan), D(Do), C(Check), A(Action) perform with PDCA.

(3) When professional skill acquisition by personnel eligible for development can be confirmed, it shall be recorded on “CCPP Personnel Development Records” based on “Records on Development Status.”

Point:

・“Chief Engineer” who is in charge of personnel development shall be the pivot and get involved in planning development to implementation to confirmation through to follow-up.

Trainees can receive support from a Senior such as a Shift Section Chief to be nominated by a Section Chief as needed (hereinafter called “Leader”).

2. Record of confirmation of professional skill acquisition)

Internal guidelines: “Professional Skill Record System” and “Records on Professional Skills,” records on confirmation of professional skill acquisition (grasp of acquisition) shall be kept in “Data Base(DB) of CCPP Personnel Development Records.”

Meanwhile, since each piece of information in the data base corresponds to “Confidential documents” and “Documents to be handled with care,” proper information management shall be conducted so that any detail of records does not leak out.

Also, as to technical personnel assigned to a thermal power plant construction site, items other than professional skill acquisition history shall be recorded.

3. Management of records

(1) Management of records

① Training Center of CCPP: Training Coordination Section Chief

② Training Center of CCPP: Personnel to whom Training Coordination Section Chief gives instructions

(2) Data Base Input Staff (Recording Staff)

① Records of a newcomer before he is assigned to the P/S shall be kept by Data Base Manager.

② Records of a Development Stage Manager after a newcomer is assigned to P/S, shall be kept by each workplace.

③ Records of managers shall be kept by senior managers and records of head of each work organization shall be kept by himself.

④ In the above ②and ③, history of participation in internal training and acquisition of external qualifications shall be recorded by Data Base Manager.

※Point:

- Initial registration shall be made by each individual.
- If an individual does not make out his own form, he cannot confirm his entry details on the screen and so it is necessary to pay attention to it.

4. Record items

(1) Basic information

① Date of joining the company, academic career

② Date of joining the company, academic career

③ Present function, Name of post, Job in charge

④ Date of assignment to the present position

(2) History of job assignment

① Date of assuming post

② Name of position, Name of post, Job in charge

③ History of acquiring professional skills (knowledge & skills)

<Operating function>

- Month of the year of starting development, month of the year of acquisition, and acquisition prior to SRS introduction at each developing

stage of conventional and combined plants, respectively.

- Month of the year of acquiring professional skills (knowledge & skills) which are common company-wide.
- Month of the year of professional skill (knowledge & skills) acquisition at each P/S.

<Maintenance function>

- Month of the year of starting development for each development stage, month of the year of mastering, acquisition prior to SRS introduction.
- Month of the year of acquisition for each company-wide professional skill and month of the year of confirming actual practice, and acquisition prior to SRS introduction.
- Month of the year of acquiring professional skills (knowledge & skills) at each P/S.
- Viewpoint of job execution; month of the year of acquisition.

The above judging standard for "acquisition prior to SRS introduction" for each function shall be as follows:

<Person in charge>

- Personnel for operational function shall be judged by a Section Chief based on the simulator training history of the personnel.
- Function of maintenance and planning/chemical/environment shall be comprehensively judged by Section Chief after confirming job execution perspective skills and job assignment history of the personnel.

※ Point:

The judgment on the degree of the personnel's skill acquisition of operating function shall be made only by their simulator training history because they experienced simulator training.

<Managers>

Senior manager shall comprehensively judge the manager from his job assignment history.

④ Job history

・The year in which job is executed.
・Job assignment (contents) history
・Personal development history

⑤ History of taking an assembled training course (professional training)
・Name of professional training
・Month of the year of taking the course

⑥ History of taking an assembled training course (general training, etc.)
・History of taking an educational course at the time of back up
・Name of general training, Month of the year of taking the course

⑦ History of acquiring external qualifications
・Name of the acquired external qualifications; Month of the year of acquisition

(3) Record browsing security

Scope of personal records which personnel are allowed to browse by job responsibility shall be decided by Uzbekenerugo HQ.

(4) Eligible personnel for Professional Skill (knowledge) (skill) Record System

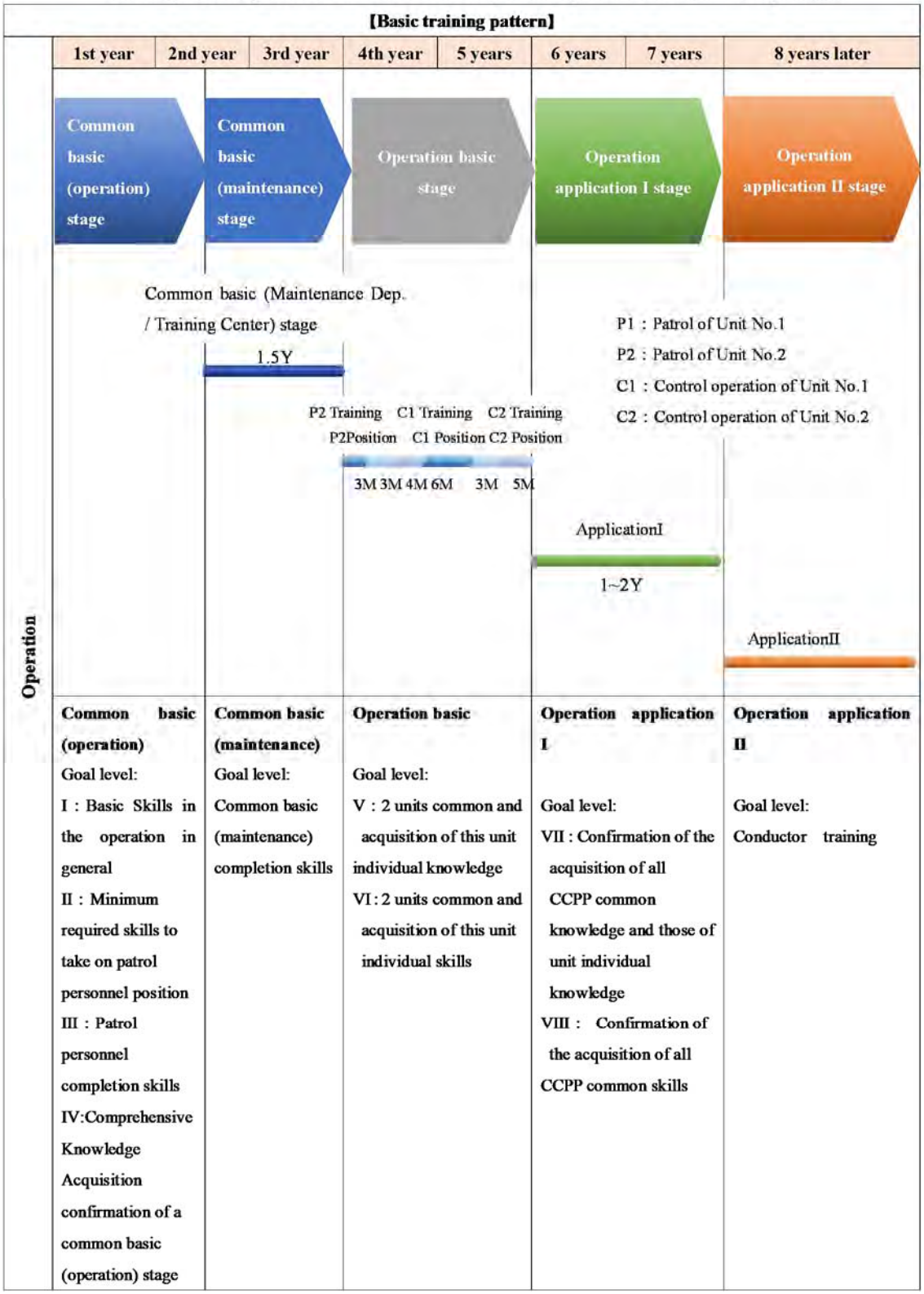
This system shall be applied to rank and file Operating & Maintenance staff who are assigned to individual function of planning, power generation and maintenance of the thermal P/S.

Meanwhile, professional skills (knowledge & skills) for unique equipment shall be developed after consultation at the relevant workplace.

Chapter 5 Specific method of personnel development (Roadmap for Human Resource Development)

Roadmap for Human resource development of Operator & Maintenance personnel is shown at the table below.

Roadmap according to the human resource development of operation and maintenance personnel



【Basic training pattern】

Maintenance Personnel	1st year	2nd year	3rd year	4th year	5 years	6～8 years	9 years later
	Common basic (operation) stage		Common basic (maintenance) stage	Maintenance basic stage		Maintenance application I stage	Maintenance application II stage
	1.5Y		1.5Y	2Y		1Y～3Y	
	Common basic (operation) Goal level: I : Basic Skills in the operation in general II : Minimum required skills to take on patrol personnel position III : Patrol personnel completion skills IV : Comprehensive knowledge acquisition confirmation of a common basic (operation) stage		**Common basic (maintenance)** Goal level: ・Acquisition of Maintenance technology in order to maintain the proper operating condition ・From the construction plan of the general maintenance work until the construction work carried out, it is the understanding of the entire maintenance business through a series of business conduct (Rules, such as in-house standard, budget execution, etc.)	**Maintenance basic** Goal level: ・Construction plan, such as a periodic inspection work and parts replacement, can be evaluated ・Business can be carried out on the basic of the existing way		**Application I** Goal level: ・Acquisition of maintenance technology in order to maintain the proper operating condition ・From the construction plan of the general maintenance work until the construction work carried out, it is the understanding of the entire maintenance business through a series of business conduct (Rules, such as in-house standard, budget execution, etc.)	**Application II** Goal level: ・Facilities can be one of the identify is healthy, can work plan and evaluation of the implementation in the period taken into consideration and how such an optimal QC balance to determine the need for renovation ・The accident occurred at the time of first aid, it is initial response of such mobilization system established

Chapter 6　Technical Training Supervisor Meeting

As a meeting system for sharing the results of patrol and coaching by Technical Training Supervisor (hereinafter called “Super-tech”), Technical Training Supervisor Committee (hereinafter called “Super-tech Meeting”) shall be set up.

1. **Frequency of the meeting**

   Once a month, in principle.

2. **Framework**

   ① Technical Super-tech
   ② Master of Training Center(doubling as Committee Chief)
   ③ Instructors of Training Center
   ④ Person to whom instruction is given by Deputy from Power Generation Division of Uzbekenerugo Head Office (twice a year or so)
   ⑤ Other personnel authorized by the Chief as necessary

3. Assignments of Meetings

① Discussions and preparation of plans for tasks and specific countermeasures related to human resource development.
② Issuance of certifications for personnel who have acquired professional skills.
③ Other matters which Chief Examiner considers to be necessary.
For instance, discussions and deliberation shall be held on the results of patrol and coaching by Super-tech; and tasks, etc. on human resource development.

4. Operation of the Committee

The secretariat shall be the Navoi Training Center

Attachment-1

Mental preparation in developing and coaching

1. Mental preparation of Managing Supervisor (their own position, recognition of their roles, attitude as Supervisor, etc.)

(1) Managing Supervisor, as a member of a corporate entity, is in a position to represent subordinates to the management level who are on a senior level, and so to his subordinates is in a position to link the two parties as a final transmitter of management decisions to subordinates.

(2) His basic role differs depending on how you put weight on the post he is assigned to.
His basic role can be summarized as instruction and supervision, 2) coaching and development of his subordinates and 3) assistance to his superior.
In order to play this role, it is necessary to recognize that there is an apparent difference between the job as a supervisor and the job as a subordinate during his working staff days (in other words, simply being an excellent working staff is not fitting at all).

(3) It is also necessary to understand your role well, muster your subordinates' "morale" to achieve targets and results, and cooperate with your colleagues and other workplace personnel and efficiently carry out your job. Not only that, it is also necessary to make an effort to improve knowledge and skills for yourself so that you can develop an ability for judgment depending on any situation.

2. How to give your subordinates jobs to motivate their "morale"

Personnel can carry out their jobs in the most effective and efficient manner only when their "morale" is aroused to be willing do their jobs. For this purpose, it is important to motivate your subordinates to perform their jobs.

To be specific,

① Try to develop their merits and develop their potential at all times.

② Show definite targets and have them enjoy a sense of accomplishment such as "can-do spirit."

③ Inform your subordinates of the results they have accomplished.

④ Give your subordinates psychological rewards such as "recognizing their capacity," "offering a compliment" and "giving encouragement."

⑤ Establish a trust relationship with them on a routine basis.

3. Understanding of work contents according to their work level, giving instructions and coaching

It is necessary to understand well progress steps of your subordinates' assignments and their work levels at the steps. It is also necessary to know their histories, personalities, etc. and give instructions and coach them so that each of your subordinates can demonstrate their characteristics and capabilities.

4. Direct instruction and supervision from a superior to his subordinates

It is necessary for Managing Supervisor to understand the status of assignments given to his subordinates, coach them himself and be careful enough not to entrust such assignments only to them and their colleagues.

5. Consciousness of OJT (from "teaching OJT to "developing OJT")

Education has a "teaching" aspect and "developing" aspect.

It is important for the supervisor to clarify his training vision, that is, in what way he wants to develop each of his subordinates. Recognizing that there is no other way of accomplishing their jobs than to enhance strength of the valuable workforce (subordinates) who are under the care of you as supervisor, it is necessary to play the role of conducting OJT without fail.

(1) OJT has the following advantages:

① It enables you to coach them tailored to the development of your subordinates' capacities.
② It enables you to have them learn practically and effectively.
③ It enables you to coach tailored to each of your subordinates' characteristics and propensity of their personality.

However, enthusiasm of the immediate manager shall become a major factor in achieving the effect of OJT. Also, it is also part of OJT to ask your subordinates questions when they have delivered documents to you.

(2) Personal development has the following advantages:

① It enables you to develop your capability in the way you want to do so.
② Because it is rooted in your morale, it is easier for you to develop.

It is necessary for the immediate manager to seek to create a workplace which would encourage his subordinates to pursue personal development and also encourage them to acquire external qualifications.

6. Observation and understanding of interpersonal environment at workplace and creation of ambience of open workplace

In order to understand what is happening interpersonally in workplace groups and organizations, it is necessary to create an atmosphere which would encourage exchange of candid opinions and simultaneously make an effort to communicate with your subordinates on a routine basis. It is also necessary to listen to your subordinates' opinions and casual comments.

7. Observation, understanding and effective communication of personal environment

Personal worries would not only prevent smooth execution of jobs, but also lead to accidents. Therefore, you need to provide consultation also on private worries as much as possible and pay attention to your subordinates' heath conditions including their complexions.

8. Concerning coaching associated with taking an Assembly Training

An Assembly Training is a training conducted by assembling many employees and it is important to have them fully understand that other than direct costs such as travel expenses associated with training, daily allowances and cost of external instructors when conducting training, there is a necessity of an indirect cost of decline in productivity due to their leaving away from routine jobs.

On the above basis, an Assembly Training has the following advantages:

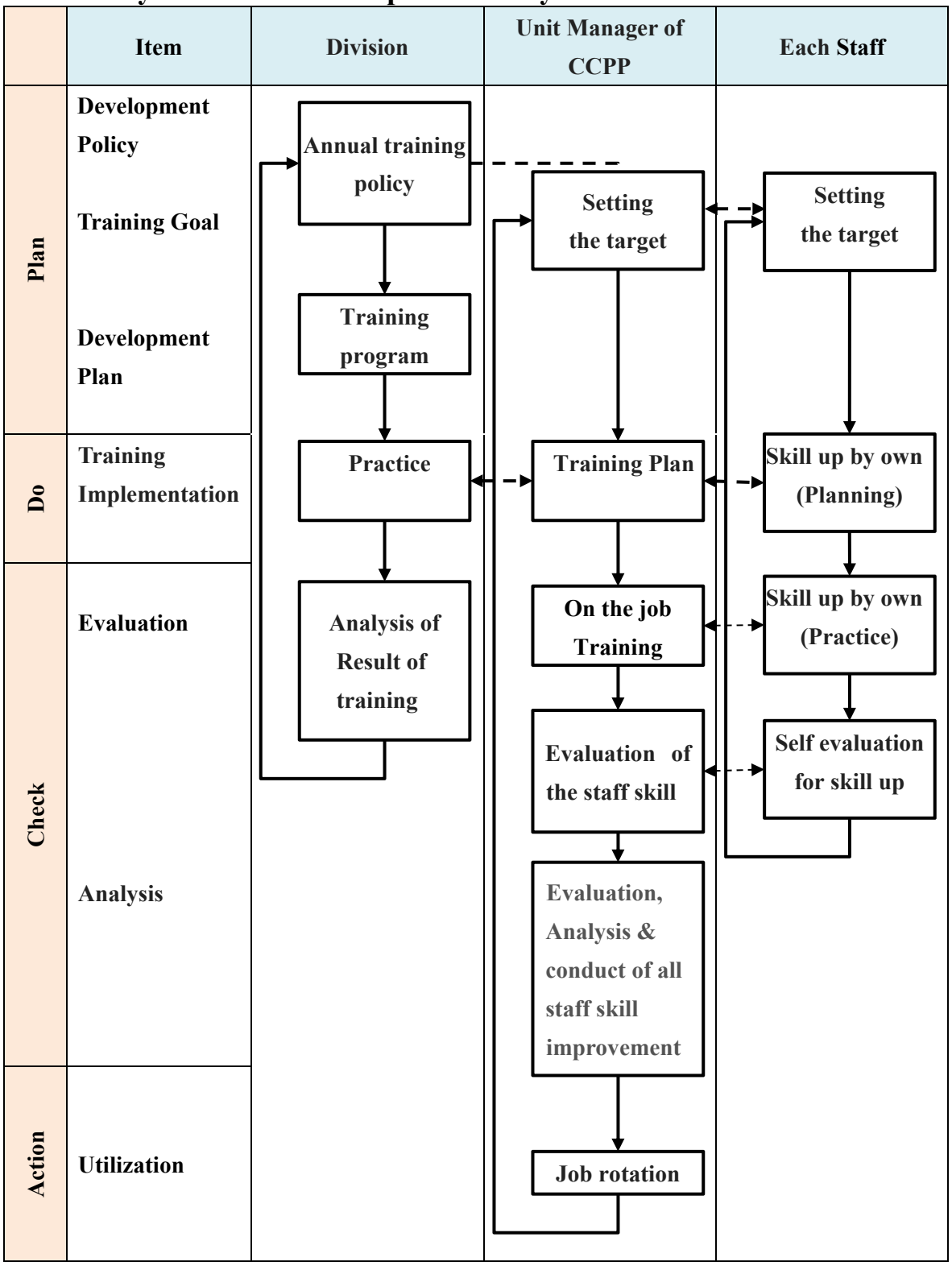
・It enables them to acquire knowledge and skills which cannot be gained only by carrying out routine jobs. (It complements their efforts to acquire professional skills.)

・It enables necessary personnel to take required training.

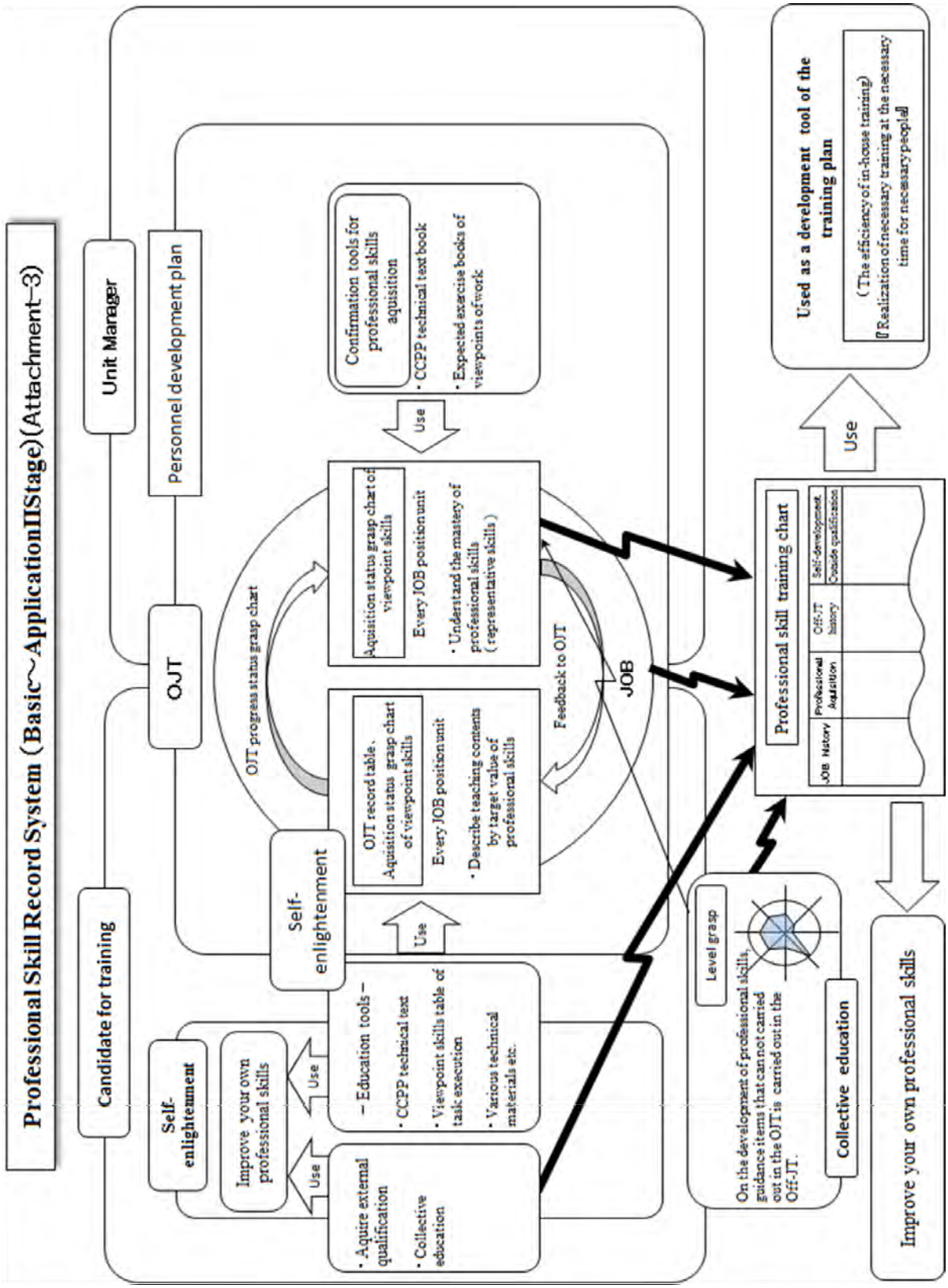
However, if they take the training without any definite goal, they won't be able to reflect it in their jobs so that any knowledge to be gained would not be their own in real terms. Therefore, it is important for you, as their immediate manager, to say a word without fail before dispatching your subordinates, asking them "what are you going to learn?" and also after they have finished the training, just to ask "what did you understand well?", "How do you want us to utilize knowledge you have gained?" and so on. In addition, you should have such trainees conduct communicating training in their workplace to establish their knowledge and increase the level of the personnel in charge.

Attachiment-2

Systematic of Development Policy of O&M Staff of CCPP



Attachment-3



Signification of Multiprocessing

Tackle the goal of "enrich basic education to promote functional multiplicity."- - - -

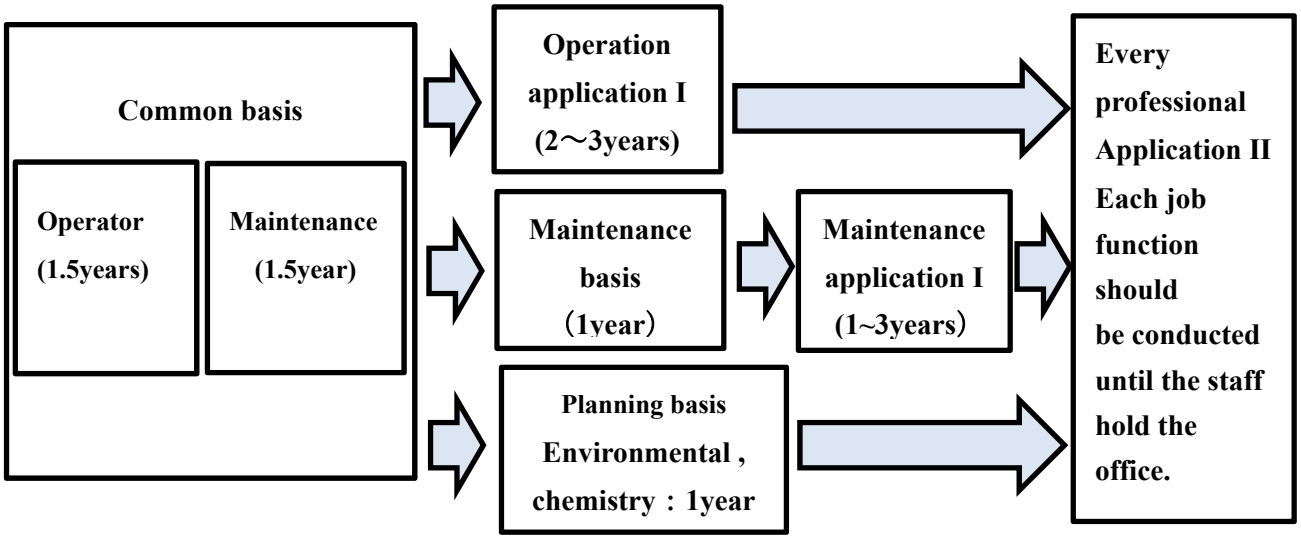
① The field of activity of CCPP personnel can be expanded.

② In case unexpected work comes up in the workplace of CCPP, Uzbekenerugo can secure backup systems.

③ Also, replacement of old jobs with new ones can be achieved by changing assigned Jobs and conducting personnel exchanges between old departments.

Conducting job rotation through creation of multiple functions may temporarily slow down work performing speed but it is meaningful for future "self" and "workplace."

● **Multipotent of training time**



● **Multiple function range targeting to perform mutual assistance among the existing personnel.**

	Work to be assisted in case risks occur	Skills required for assistance.	Newly required skills (within multiple function range).
Planning : Environmental chemical :	Fuel analysis	—	Fuel analysis —
Electrical : I&C :	Minor repair work that does not output	Limit switch, Solenoid valve, Board, Cable, etc.	Pressure gauge, Pressure switch, Pressure transmitter Small electric motor
HRSG : Turbine (ST/GT) :	Minor repair work that does not output	Piping ,Valve, Compressor, etc.	General pump （Water pump） Fan(compact)

Appendix 5

Human Development - 02

Manual for Positioning Plan of

Operator & Maintenance Personnel

May 2018

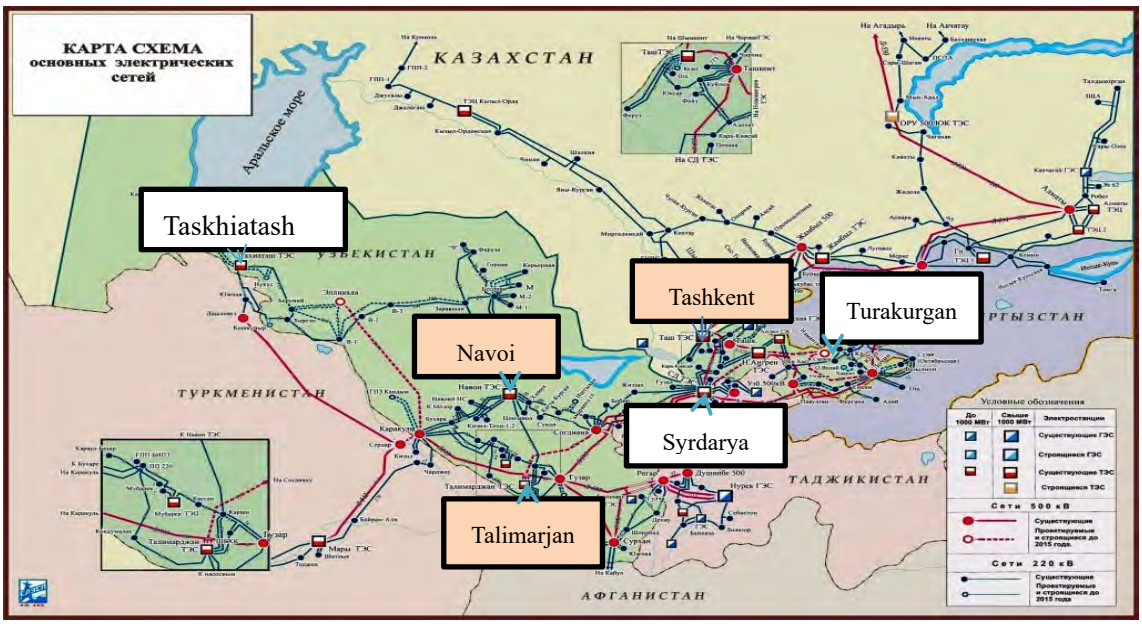
Chapter1 General Provision

1. Purpose

In the near future, Uzbekenerugo has plans to introduce 19 units of Gas turbines for CCPP in the 6-year period from 2016 to 2021.

Under such circumstances, this manual shall specify to achieve optimum balance of Operator & Maintenance personnel, put the right human resources in the right place and shall aim to facilitate operators and improve educational effects.

Location map of CCPPs implementation plan site



2. Definition of Terms

Optimum balance of Operator & Maintenance personnel means securing necessary operator and maintenance with necessary knowledge and skills

※ Optimum balance of Operator and Maintenance personnel shall be achieved by selecting competent personnel from who has operation experiences in the existing CCPP, and dispersedly positioning them to new power plants.

3. Related Standards

(1) System for Operation & Maintenance and Manual for consolidating and improving future Regulations

(2) Manual for Human Resource Development Planning involving Operator & Maintenance Personnel

4. Applicable Range

This manual shall apply to all Operator & Maintenance personnel who have been positioned to new CCPPs.

Chapter 2 Optimum balance of Operator & Maintenance personnel

1. Implementation Procedure

The CCPPs shall work to have the personnel who acquires the following professional skill (knowledge and skills) to achieve optimum balance of Operator & Maintenance of CCPPs.

(1) At the start-up of the construction office of CCPP, select key persons (senior level class: 2 persons at a minimum) in each function (Operation, HRSG, ST, GT, I&C, Electricity, and BOP) from Operator & Maintenance personnel who have work experience in the existing Gas Turbine plants and placing them to PIU of Construction Department.

Knowledge/Skill Level	Technical level to be achieved
Beginner level	Possible to carry out easy routine work by own and possible to carry out rather complex routine work under conducting of chief engineer
	Possible to carry out easy routine work by own and possible to carry out routine work under occasional conducting of chief engineer
Middle level	Possible to carry out easy routine work by own and possible to conduct routine work to junior engineer
	By high specialty and possible to carry high level work by own and possible to conduct the work to junior engineer
Senior level	Possible to carry out whole out of routine work by own and possible to conduct every work to whole staff engineer and also possible to offer improvement the jobs.

- O-JT Implementation Place：Exiting CCPP
- OFF-JT Implementation Place：Navoi Training Center

(2) And, persons shall establish educational system (including O-JT&OFF-JT implementing schedule) and be assigned to PIU, and , conduct O-JT ＆OFF-JT education as needed for Operator & Maintenance personnel who will become CCPP personnel in the future until the CCPP is put into commercial operation.

(3) In principle, the key persons shall be involved in such education until the staff are developed from beginner level to middle level and then become their successors (personnel who hold senior-level knowledge and technology).

(4) Holders of middle-level knowledge and technology shall conduct O-JT＆OFF -JT education for beginner-level staff.

(5) Holders of senior-level knowledge and technology shall conduct O-JT &OFF -JT education for middle-level staff.

※１） Professional skill (knowledge & skills) which Operator & Maintenance personnel are to acquire On the Job Training are as shown in the following table.

● **Item of professional skill (knowledge & skills) of operator**

Item	Professional skill of operator (knowledge & skills)
General Items & Common Items	●Precautions in operator in general： ・The operator understands basic rules of chain of command and operate based on reports, communications and directions they receive. ・The operator understands precautions on safe behavior and others.
	●Understanding general basic items： ・The operator understands the key control equipment numbers (Sequence numbers). ・The operator can use tools, jigs & safety protections properly.
Knowledge of disaster Prevention	●Understanding dangerous goods High pressure gas & chemicals ・The operator understands characteristics and handling of dangerous goods (NG, etc.), high pressure gas (ammonia, etc.) and industrial chemicals.
	● Understanding handling disaster prevention equipment including firefighting equipment ・The operator understands installation purpose, structure & operating methods of disaster prevention equipment including fireextinguishing system.
Handling of electricity	●Understanding operator of power sources： ・The operator operates switching-on/-off of power sources of auxiliaries (Metal-clad, Power Center and Control Center) keeping safety in mind. ・The operator can safely measure insulation resistance and decide on abnormality of measured values.
Various devices & equipment	●Understanding the main equipment & auxiliary system and installation purpose and structure of equipment： ・The operator understands the main equipment and auxiliary system. ・The operator understands the installation purpose and can decide that any equipment is in operator and shutdown by normal valve structure. ・The operator understands difference in type & structure and function, and characteristics of each equipment.
	●Early detection & prevention of expansion at times of abnormality : ・The operator understands purpose, focal points & condition monitoring of patrol inspection to achieve early detection and prevention of expansion at times of abnormality.

	●Understanding normal status and abnormal status of auxiliaries & main equipment : ・The operator understands purpose, focal points & condition monitoring of patrol inspection to achieve early detection and prevention of expansion at times of abnormality.
	●Understanding protective device of auxiliaries & main equipment : ・ The operator understands the limit values and warning values. ・The operator operates with the understanding of types & systems as well as warning values and activating values of protective devices.
	●Understanding and operator of starts, stops & switching operators of auxiliaries and main equipment : ・ The operator operates with the understanding of starts,& stops as well as switching operator of auxiliaries and main equipment, and function confirming tests.

● **Professional skill (knowledge & skills) items of Maintenance personnel**

Professional skill (knowledge & skills) items which Maintenance & Repair personnel are to acquire O-JT are as shown in the following table.

・Each job function shall work to improve skills for the work plan, work design, work implementation and responses to trouble for the machinery and equipment in the following table.

	Professional skill (knowledge& skills) of auxiliary equipment item	Professional skill (knowledge & skills) of the main equipment item
Turbine maintenance personnel	① General pump ② Compressor ③ Demineralizing equipment ④ Condenser ⑤ Feed-water heater ⑥ High-temperature and high-pressure piping ⑦ Feed-water pump ⑧ Crane(Overhead travelling crane, etc.) ⑨ General piping ⑩ Valve	① Steam turbine(ST) ② ST auxiliary equipment ③ ST main valve ④ ST speed governor and Safety equipment ⑤ Gas turbine(GT) ⑥ GT auxiliary equipment
HRSG maintenance personnel	① Gas duct(Duct, HRSG Outlet damper) ② NOx removal equipment ③ Feed-water pump	① HRSG
Electrical maintenance personnel	① High-pressure motor ② Low- pressure motor ③ Circuit breaker ④ Distribution panel・ ⑤ Switchgear(Metal-clad、Power center、Control center) ⑥ Distribution panel・Switchgear(local control panel) ⑦ Power cable (High pressure, Low pressure)	① Generator ② Generator ancillary device (sealing device, gas filling equipment, automatic voltage regulator board, neutral point grounding device, generator transformers, etc.) ③ Exciter ④ Transformer(Main transformer、House

	⑧ OF cable ⑨ Isolated phase bus ⑩ Protective relay ⑪ Power meter, indicating instrument, recorder, converter isolator	transformer、Accessory device)
C&I maintenance personnel	① Ignition device (including fire detector) ② Control Valve、Control Drive ③ SW、Pi、Ti ④ Electrical device ⑤ Pneumatic device ⑥ Control air dryer ⑦ Exhaust gas analyzer (NOx, O2, CO,NH3)calorie meter ⑧ Gas detector ⑨ Auxiliary machine vibration meter ⑩ Computer	① Gas turbine control device ② Steam turbine control device ③ Turbine bypass control device ④ EH governor control device ⑤ HRSG control device ⑥ Gas turbine and steam turbine monitoring instrument ⑦ System-wide (digital device, etc.)

※2) OJT track record of Operator & Maintenance personnel at Navoi CCPP-1

① Talimarjan- 1&2(450MW×2Units)：

On two occasions (March and April 2015): the following 34 staff participated before the CCPP was put into operation.

・Breakdown: 19 Operators and 15 Maintenance Staff

② Tashkent-1(370MW×1Unit) ：

May 2015：the following 25 staff participated before the CCPP was put into operation.

・Breakdown: 10 Operators , 8 Electric Staff , 3 C&I Staff and 4 Chemical Staff

③ Turakurgan-1(450MW×1Unit):

September 12, 2017 through May 2018：the following 4 staff participated before the CCPP was put into operation.

・Breakdown: 19 Mechanical Staff、1 Shift Manager and 1 Safety Management Staff

※3)「Knowledge and Practical Skill which Operation & Maintenance Staff should acquire at Navoi Training Center (Off-JT)」are as shown in the following table.

(Legend) **O**：Operator&Patrol、**T**：Steam & Gus Turbine Staff、**H&BOP**：HRSG &Balance of Plant Staff、**E**：Electric Staff、**I&C**：Instrument & Control Staff (including Programmer)、**JSC**：UE JSC ●：Knowledge &Practical Skill ○：Knowledge

No.	Training Course	O	T	H&BOP	E	I&C	JSC
❶	**Non-destructive testing**		●	●			●
❷	**Vibration analysis for rotating machine**		●	●			●
3	**Remaining life assessment**		○	○			
4	**Gas Turbine (GT) Combined Power Generation Equipment**	○	○	○	○	○	
5	**GT Hot Parts Maintenance**		○				
❻	**Details of Electrical Facilities for GT CCPP**				●		●
7	**Operation & Control Theory of GT CCPP**	○			○	○	
❽	**Details of Control & Instrument Devices for GT CCPP**					●	●
9	**Basic GT Operator & Maintenance**	○	○	○	○	○	
10	**GT Control System**	○	○			○	
11	**GT Electrical Control System**	○	○		○		
12	**GT Operation & Maintenance Lecture**	○	○	○	○	○	
⓭	**Simulator Maintenance Tool**	●				●	
⓮	**Simulator Training**	●					

※1)❶,❷ ,❻ ,❽ ,⓭,⓮ are Knowledge &Practical Skill training courses.

※4) Off-JT track record of Operator & Maintenance personnel at Navoi Training Center

① Operator & Maintenance personnel at Navoi CCPP-2 (Total of 37 staff including

5 chemical staff.

② Eligible staff are university graduates who have TPP operatoral experience of more than 3 years.) participated in the trial training from April 25, 2017 through May 25, 2017 in order to acquire basic knowledge of CCPP.

Chapter 3 Plans to put the right staff in the right places

1. Basic Policy

Thermal Power Department (Uzbekenerugo HQ) shall get the picture of track record and progress status of each CCPP, provide guidance and advice, and in doing so, make human resource development plans giving consideration to putting the right personnel in the right place and operate them.

2. Role of Thermal Power Department (Uzbekenerugo HQ))

Thermal Power Department (Uzbekenerugo HQ) shall make and operate educational plans for Operator & Maintenance personnel which may enable it to optimize personnel balance of the whole CCGP, and also review them at east once a year to contribute to safety and stable supply of power.

3. Role of each CCPP

(1) In order to operate the above Chapter 3. 2., each CCPP shall develop lifelong educational plans for the individuals and review and implement them as oftenas once a year.

→Specifically, JICA Expert Team recommends that the unit manager manage and operate the following “Individual career record table.”

Individual career record table

Career History	Professional Skills Acquisition History	Off the Job Training Career History	Self-Development History
			Outside Qualification
-	-	-	-

(2) Unit Manager shall make and monitor “Education plans for CCGP” to ensure personnel balance of the whole CCGP.

(3) Also, he shall develop lifelong educational plans for the individuals to manage and operate them as “the individual career record table.”

Appendix 6

Human Development - 03

Manual for preparation (draft) of development Policy and plan for Operation & Maintenance of the CCPP

May 2018

Chapter 1　General Provision

1. Purpose

This Manual specify manuals for the maintenance policy and plans for Operation & Maintenance of CCGP and aims to facilitate and improve operations.

2. Related Standards

(1) Manual for Human Resource Development Planning Involving Operator & Maintenance personnel

(2) Process Supporting Manual for Development of draft rules and rulemaking for the Operation & Maintenance policy and plans

(3) System for Operation & Maintenance and Manual for consolidating and improving future Regulations

(4) Manual for Safety and Quality Control for periodic inspection work and large-scale improvement work

3. Scope of Application

This manual shall apply to all CCPPs in Uzbekenerugo.

Chapter 3　Development Policy for Operation &Maintenance

1. Basic Policy

Development policy in accordance with the operation & maintenance of the CCPP is basically defined as shown in the figure below.

Development Policy for Operation &Maintenance

(Basic concept)

- ○ **Development and expansion of technical base for ensuring quality and safety**
- ○ **Promotion of information sharing**

(Specific policies)

- **To promote the regulation of guideline and manual for CCPP Operation**
- **To promote the development and DB(Data Base) of the manual**
- **Holding information exchange meeting on operation and maintenance management**

2. Preparation of development plan (draft)

(1) Preparation of guidelines and manuals for CCPP management jobs

CCPP management shall work to consolidate guidelines and manuals as shown below and also review them for improvements so that they can ensure security and quality of CCPP and facilitate CCPP operations.

1) Preparation of Guidelines for CCPP Management Jobs (Uzbekenergo HQ)

Items	Guidelines
Common Standards for Operation and Maintenance	- Guideline for Names CCPP equipment - Guideline for handling of accidents , etc. - Guideline for specifying CCPP equipment cods - Guideline for handling work slips - Guideline for the disposal of industrial wastes
Operation Standards (Including Plans and Environmental Chemical , etc .)	- Guideline for preparation and management of equipment operating slips - Guideline for safety device for CCPP - Guideline for thermal efficiency management - Guideline for management of lubricant oil , etc. - Guideline for statistical treatment of power generation records - Guideline for handling chemicals - Guideline for preparation of daily records of security - Guideline for procedure for operational power stoppage - Guideline for water quality control

2) Preparation of Guidelines for Quality Control Job of Scheduled Inspection (Uzbekenerugo HQ)

Items	Guidelines
Maintenance Standards	- Guideline for prior assessment of work safety - Guideline for maintenance standard for CCPP equipment - Guideline for handling spare parts for thermal power station - Guideline for management of instrument & control device - Guideline for preparation of specifications - Guideline for implementation of inspection of CCPP - Guideline for implementation of welding inspection - Guideline for identification of inert gas, etc. - Guideline for setup of protective relay system of CCPP - Guideline for management of radioactive isotopes - Guideline for management of skeleton drawings of pipelines of CCPP equipment - Guideline for operation management of environment and chemical

(2) Preparation of manuals (proposal) of technical standards

- Inspection methods, decision criteria, and maintenance criteria for CCPP equipment-

1) In order to carry out periodical inspection work smoothly and steadily, it is necessary to specify inspection methods, decision criteria, and maintenance criteria for CCPP equipment and establish them as the company rules.

2) Preparation of manuals (proposal) of technical standards

The technical standards for the following items A through C be prepared for the rule making.

A. Various inspection methods at the time of periodical inspections should be specified.
B. Decision criteria should be specified to carry out the following inspection work smoothly and steadily
   ・Decision criteria for boilers and boiler accessory equipment
   ・Decision criteria for steam turbines and steam turbine accessory equipment
   ・Decision criteria for gas turbines

・Decision criteria for electrical equipment
・Decision criteria for instrumentation equipment

C. Maintenance details should be specified in order to maintain proper soundness of the following installations and prevent incidents due to aged deterioration

・Maintenance criteria for Boiler equipment
・Maintenance criteria for Steam turbines
・Maintenance criteria for Gas turbines
・Maintenance criteria for Electrical equipment
・Maintenance criteria for Instrumentation equipment

(3) Preparation of Manuals for Operation Management of CCPP (Each CCPP)

Items	Manuals
Prepared by Operation Department	- Manual for operator training - Manual for operation jobs - Manual for operation ad maneuvering control - Manual for patrol inspection management - Manual for scheduled tests - Manual for measurements to be taken in case an alarm is issued - Manual for management of valve locking
Prepared by Engineering Department	- Manual for environmental security management - Manual for management of condenser tubes - Manual for high pressure gas security education plans - Manual for high pressure gas vessel management
Prepared by Maintenance Department	- Manual for patrol inspection standards for maintenance workers - Manual for maintenance standards for CCPP equipment - Manual for handling panel operation - Manual for scheduled inspection work of instrument and control device - Manual for operation management method attendant on the change of control circuit - Manual for budget plans and execution management

Chapter 3 Preparation of Manual for CCPP management jobs and promotion of DB(Data Base) development

1. Arrangement in order and development of the data base for " Manual for Measures to be taken in case ANN (Alarm) is issued "

It is important to routinely provide training so that in case of any abnormality in operation, operators can take prompt measures .Therefore, it is very important for us to enhance operators' knowledge and ability as well as to arrange in order and post the data base of " Manual for measures to be taken in case ANN(Alarm) is issued " drawing upon the equipment incidents and trouble cases which have occurred at each power station .

Meanwhile, JICA Expert Team would recommend to utilize oral test to confirm how much operators have learned required knowledge at each power station.

2. Preparation of new patrol inspection standards and development of the Data Base

It is important that in the routine patrol inspection, the patrol staff not only make a tour of inspection of the equipment using check sheets of the patrol inspection records specifying the operation standard figures of each equipment but also organize the damage mechanism of the equipment experiencing trouble.

It is, therefore , important that based on this the operators prepare " New patrol inspection standards " and register the data base specifying the inspection points for each unit.

It is also important for the patrol staff to prevent patrol inspection oversight and show the patrolling routes for reasonable inspection.

3. Preparation of the " Manual for repairs of equipment "," Work standard manual" , etc. and development of the Data Base

Great efforts have been made for the maintenance work at each power station.

However, it can well be considered that in the future there will be cases where non-delivery of spare parts and tools will cause problems because the relevant equipment cannot be

repaired .

Therefore, it is necessary to pay full attention to the following points and think of further enhancing reliability of each power station.

(1) While the maintenance work is performed by utilizing the Manual for handling each equipment submitted by a manufacturer, it is recommended that in the future, the " Manual for handling each equipment " and " Work standard manual " be prepared taking into consideration the experience of power stations.

(2) It is also recommended that the important " Repair records"," 2) Summary of changes with time, etc. such as measurement records "be kept or managed by computer.

4. **Preparation for Manual for basic design and development of the Data Base**

It is also very important to tackle reorganization of intra-office standards and design standards such as the design manual aiming at arranging and expanding the design technology base and have review meetings of knowledgeable people.

※ **Items to be reflected for the improvement and expansion of the manual for designing**

① When it comes to the preparation of manuals, they tend to take the textbook style of explaining the design method. However、the design manual should specify " conditions necessary at the time of designing " so that when such conditions are taken in, it should consequently lead to such and such design specifications.

② Since some items which require measures against troubles such as incidents at the existing power stations to reflect in " designing " , such items should be taken in positively.

③ Photos and image figures should be incorporated into the manual for designing so that it can become a visual manual for designing which even beginners can immediately understand.

Chapter 4 Information sharing

1. Holding of operation and maintenance management information exchanging meetings

It is recommended that operation and maintenance management information exchange meetings be held so that information sharing can be promoted.

(1) Purpose

① To mutually exchange information on challenges tackled by CCPP as well as know-how which are useful in continuing safe and stable operation of CCPP so that the spiraling of the entire CCPP can be conducted.

② To provide opportunity for company-wide exchanges of chief level personnel who are in charge of boilers, turbines, electricity, instrumentation & control and operation and help them to create environment in which routine information exchanges are made.

(2) Frequency of meetings

Information Exchange Meeting shall be held once a year.

※Time should be taken by each CCPP for mutual discussions.

(3) Tasks common to all functions

Information which is useful for safe and stable operation of power stations.

① Prevention of serious disaster

② Prevention of incidents causing supply disruption

(4) Cases of themes for specific information exchanges＞

① Operation management aspect

A. Information on efforts made to prevent human errors in operations.

B. Information on challenges tackled to achieve early detection of any sign of an accident and prevent expansion of such an accident.

C. Information on efforts to conduct educational and technical hand-down.

D. Information on soundness of other equipment.

② Maintenance management aspect

E. Quality enhancing information on the management status of pending issues.

F. Accurate information on implementation of horizontal development of incidents.

G. Information on improvement of facility management method (Condition Monitoring Technician)

H. Information on efforts to pass on education and technology

I. Information on the soundness of other equipment

Appendix 7

Human Development-04

System for Operation & Maintenance and Manual for consolidating and improving future Regulations

May 2018

Chapter 1 General Provision

1. Purpose

All CCPP of Uzbekenerugo shall work to consolidate and improve systems and rules for Operation & Maintenance to meet short and mid-term power demand from the whole Uzbekistan region and facilitate operations.

2. Related Standards

(1) Manual for Positioning Plan of Operator & Maintenance Personnel

(2) Manual for preparation (draft) of development Policy and plan for Operation & Maintenance of the CCPP

(3) Process Supporting Manual for Development of draft rules and rulemaking for the Operation＆Maintenance policy and plans

(4) Manual for Safety and Quality Control for periodic inspection work and large-scale improvement work

3. Applicable range

This manual is applicable to all CCPP of Uzbekenerugo.

Chapter 2 The system and regulations for the operation & maintenance management to cope with short and mid-term power demand in the entire Uzbekistan regions :

The manual shall be subject to meeting the following requirements.

1. Organization

(1) The system for the operation & maintenance management of the CCPP (hereinafter "Organization") shall have clear description of the responsibility , authority and mutual relationships of the following departments (including the employees) and shall be documented.

① Department which manages the jobs on the operation & maintenance and safety management.

② Department which implements the jobs on the operation & maintenance and safety management.

③ Department which verify the validity of the jobs on the operation & maintenance and safety management.

(Remarks)

"Safety management" means to make prior assessment of safety in the use of condition that such as for modifying the boiler , etc. and to utilize information on malfunctions and incidents inside and out of the company for the operation & maintenance management.

(2) Especially, the responsibility, authority and mutual relationships shall be defined, documented and implemented in the departments which require decision making and authority for the following jobs;

①Actions which prevent all nonconformity on the operation & maintenance and safety management

② Clarification and documentation of the all the problems on the operation & maintenance and safety management

③ Commencement, recommendation or provision of solutions through the specified routes

④ Verification of the implementation of solutions

⑤ Management until malfunctions or unsatisfactory conditions are corrected

2. Operation management and routine inspection criteria)

(1) Table-1 of Boiler &Turbine, etc. Proper standards specifying operation management items shall be established and the operation management shall be implemented based on the standards and the results shall be recorded and kept.

1) Operation management (the minimum required efforts)

Standards for operation management shall be specified to perform appropriate operation management.

Table-1 Items for Operation Management

Equipment	Items for Operation Management
Boilers	・Steam pressure & temperature at outlet of Super-heater & Re-super-heater
	・Boiler vaporization volume or feed-water flow rate
	・Drum water level
	・Drum pressure
	・Quality of boiler water and feed-water
	・Spray water quantity of super-heater re-heater or steam temperature before and after
	・Fuel used
	・Boiler efficiency
Steam turbines	・Out of the generators
	・Steam pressure and temperature up-steam of Main Stop Valve and up-steam of Re-heater Stop Valve
	・Steam turbine speed
	・Steam turbine exhaust pressure
	・Steam turbine extraction pressure and temperature
	・Oil pressure at inlet of steam turbine bearings
	・Temperature of steam turbine bearings & oil temperature at outlet of bearings
	・Characteristic of lubricating oil
	・Steam turbine control hydraulic pressure
	・Opening of steam regulating valve
	・Vibration of steam turbine
	・Steam turbine efficiency
	・Expansion and difference in expansion of shaft and casing (only for those with 2 or more casings
Gas turbines	・Outlet of generator
	・Gas turbine speed
	・Discharge pressure of Gas turbine air compressor
	・Gas temperature at gas turbine inlet
	・Oil pressure at gas turbine shaft inlet
	・Gas turbine shaft temperature or oil temperature at gas turbine shaft outlet
	・Characteristics of lubricant oil
	・Ga turbine control fluid temperature
	・Vibrations of gas turbine

	・Gas turbine air compressor inlet air temperature
	・Fuel used
	・Gas turbine efficiency

(2) Table-2 of Boiler &Turbine, etc. Proper standards routine inspection of equipment ,inspection points , inspection items , inspection method , standards for adequacy , etc. shall be established and the routine inspection shall be conducted based on the standards and the results shall be recorded and kept.

1) Routine inspection (the minimum required efforts)

The routine patrol inspection method shall be specified and the condition shall be confirmed.

In the meantime, the frequency of the patrol inspection shall be 1 time or more per day to achieve early detection of any abnormality.

Table-2. Routine Inspection Item

Equipment	Routine Inspection Item
Boiler safety valve	・Steam leaks from valves seats
Main pipeline	・Abnormal of hangers ・Leaks of steam and gas from pipeline ・Vibration of pipeline
Boiler or furnace	・Combustion status ・Abnormality inside the furnace
HRSG	・Damage to boiler body or tubes ・Drum two-tone water level , steam leaks , damage to glass
Steam turbines	・Vibration、abnormal noise ・Steam leaks from casing ・Loosing of bolts & nuts ・Vibration、abnormal noise、spies superheating and waste oil of bearings
Main heat exchanger, etc.	・Main leaks ・Water level
Gas turbines	・Vibration、abnormal noise, superheating and other abnormality ・Leaks of gas lubricant oil , etc. ・Abnormality of scaffolding , supporting metal

	fittings , and loosening of bolts & nuts ・Vibration、abnormal noise、superheating and waste oil condition of bearings
Gas turbine air compressor	・Vibration、abnormal noise and other abnormality ・Leaks of lubricant oil ・Abnormality of scaffolding , supporting metal fittings , and loosening of bolts & nuts ・Vibration、abnormal noise superheating and waste oil condition of bearings
Generators	・Vibration、abnormal noise, offensive smell ・Leakage of hydrogen gas ・Quantity and temperature of waste oil from bearings , budding condition ・Vibration of GT bushing and phase separating bus bar , leak from water leakage alarm ・Wear condition ,vibration of the superheating and connecting condition of lead lines
Main revolver (excluding Steam turbine , Gas turbine and Gas turbine air compressors)	・Vibration、abnormal noise and temperature increase of the body ・Steam and gas leaks from glands ・Oil temperature , oil surface and oil leaks from bearings
Main valves	・Vibration、abnormal noise of valves ・Leaks of steam , gas ,etc. from valve glands , valve seats ・Abnormality of activating source
Main transformer	・Superheating , offensive smell , buzzing and discoloring condition ・Conservator oil surface , discoloring condition of breather silica gel
Electric equipment	・Abnormality of display lights on operation panels , monitoring panels , distribution panel switching device , Switch-on condition of alarm display ・Superheating , offensive odor and discoloring and terminal tightening condition ・Vibration、abnormal noise , offensive smell of motor

	transformer , illumination transformer
Instruments	・Damage condition of indicators and recorders , etc. ・Damage condition and any difference by comparison between indicated values and standard values on instruments such as indicators and recorders ・Condition of ink loss from recorders and of chart processing ・Indicated values on , leaks from detector

2) Periodic inspection (the minimum required efforts)

① Inspection of equipment by overhaul or dismantling

② Activation and adjustment test of equipment

③ Checking of records

Periodic inspection should be conducted by appropriately combining the above three Items.

3. Responses in case of emergencies

（1) Standards for measures to be taken to cope with abnormality and incidents of boilers / turbines, etc. shall be established.

（2) Contact system in case of an emergency shall be established.

4. Maintenance standards

(1) Standards shall be established for making a decision on maintenance and repair, etc.

(2) Records including the details of maintenance and repair, etc. shall be managed and kept.

5. Management of documents

(1) Procedure for managing documents on the operation, maintenance and safety management shall be documented and maintained.

(Remarks)

The documents may be hard copies, electronic media or any other media.

(2) The authorized department shall examine and approve the adequacy of the documents.

(3) In order to clarify the updated versions, the procedure for managing ledgers and the like shall be specified.

(4) This procedure shall be available at all times to prevent any use of invalid documents or abolished documents.

(5) Management of the following shall be ensured.

① Appropriate versions of documents shall be available at all the departments that conduct operation, maintenance and safety management .

② Invalid or abolished documents shall be promptly removed from all the issuing departments and using departments , or measures shall be taken to prevent use of documents for unintended purpose .

③ Appropriate identification shall be made for abolished documents which are kept for the purpose of preserving knowledge .

(6) Unless expressly instructed, confirmation or approval of any modification shall be made by the same organization that first prepared the documents.

(7) If expressly instructed, the procedure for giving instructions shall be clarified.

(8) Expressly instructed organization or department shall be able to use any supporting information constituting the basis for the confirmation and alteration.

(9) Parties other than the organization or department which confirmed and approved the supporting information constituting the basis for confirmation and alteration shall be able to use such information.

(10) Contents of alteration shall be specified in the documents or in appropriate attached documents.

6. **Education and training**

(1) Contents of education and training required for all the personnel who are engaged in jobs related to the operation, maintenance and safety management shall be specified, documented , and implemented and such records shall be kept.

(2) For personnel who are engaged in specified jobs, the followings standards for acknowledge qualification shall be documented, maintained and implemented.

① Acknowledgement of qualification based on appropriate education and training as necessary.

② Acknowledgement of qualification based on experience.

7. Management of records

(1) The following procedures for operation, and safety management shall be documented and maintained.

① Identification of records
② Collection of records
③ Indexing of records
④ Utilization of records
⑤ Filing of the records
⑥ Keeping and Maintaining of the records
⑦ Abolition of records

(2) Records shall be maintained to verify the records are adequate for the specified requirements and the management is effectively conducted.

(3) Records shall be easy to read.

(4) Records shall be kept under the environment which is suitable for preventing deterioration, damage and missing .

(5) Records shall be kept and maintained so that they can be easily referred to.

(6) The duration of keeping records shall be specified and recorded.

(Remarks)

Records may be hard copies, electronic media or any other media.

8. Supervision of inspection and measuring devices

(1) General matters

1) Procedures for managing, rectifying and maintaining the devices used for inspection, measurement and testing (including software for tests) shall be documented and maintained .

2) Errors in measurement when the devices are used for inspection, measurement and testing shall be perceived and such devices shall meet the required measuring capability.

3) In case standard measurement devices such as testing software or testing hardware is used as a system suitable for the inspection, the following verification capabilities shall be documented .

① Such measurement devices shall be inspected in advance.
② Such measurement devices shall be inspected against at specified intervals.
③ The frequency and scope of the inspection shall be specified.
④ Records of the management of such instruments shall be kept.

9. Procedure for management

(1) Appropriate inspection, measurement and testing device shall be selected and the measuring items and required accuracy shall be specified .

(2) All the inspection, measurement and testing devices including measurement device which may affect the quality shall be identified , and traceability with the national standards for calibration shall be verified . The standards for correction in case there are no national standards shall be documented, or calibrated before using and adjusted.

(3) The calibration process of the device for inspection, measurement and testing shall specify the following items:

① Type of the device
② Peculiar identification number
③ Setup location
④ Inspection frequency
⑤ Inspection method
⑥ Standards for judgement
⑦ Measures to be taken in case the results are unsatisfactory

(4) The calibration status shall be displayed by appropriate signs or approved identification records and the inspection, measurement and testing device shall be identified.

(5) The records of calibration of the inspection, measurement and testing device shall be kept.

(6) In case of the results of the calibration turn to be unsatisfactory, the validity of the past inspection and testing results shall be evaluated and documented .

(7) Appropriate environment conditions shall be ensured to conduct calibration, inspection, measurement and testing.

(8) In handling, preservation and keeping of the device for inspection, measurement and testing, the maintenance of the accuracy and applicability for the use shall be ensured .

(9) Protective measures shall be taken for the inspection, measurement and testing device including testing software and hardware to prevent adjustments which would invalidate the setting of calibration .

10. **Corrective measures**

(1) General items

1) Procedure for taking corrective measures shall be documented and maintained.

2) The corrective measures taken to eliminate the cause of inconformity or potential inconformity shall satisfy the following items .

① The corrective measures are appropriate for the magnitude of the problems.

② The corrective measures are appropriate in proportion to the risks.

③ Attendant on the corrective measures and preventive measures, changes of the related procedural manual are made and recorded.

11. Procedure for corrections

The procedure for corrective measures shall include the following :

① Effective treatment of reports on failed parts .

② Investigation shall be conducted of the cause of the failure about the equipment, process and management and the results are recorded .

③ Decisions on corrective measures required for the elimination of the cause of the failure .

④ Management which ensures the effectiveness of the corrective measures .experience in works, maintenance and operation which are included in the contents of inspection.

Appendix 8

Human Development-05

Process Supporting Manual for Development of draft rules and rulemaking for the Operation& Maintenance policy and plans

May 2018

Chapter 1　General Provision

1. Purpose

This manual provides specific operating methods to provide process support for developing draft rules and rulemaking for the Operation&Maintenance policy and plans, and also facilitates their smooth operations.

2. Related Standards)

(1) Manual for preparation (draft) of development Policy and plan for Operation & Maintenance of the CCPP

(2) System for Operation & Maintenance and Manual for consolidating and improving future Regulations

(3) Manual for Safety and Quality Control for periodic inspection work and large-scale improvement work

3. Applicable range

This manual shall apply to all CCPP Operation & Maintenance personnel in Uzbekenerugo.

Chapter 2　Preparation of Operation & Maintenance Policy of CCPP

1. Basic Policy

CCPP Operation & Maintenance policy is as shown in the following table.

Operation and Maintenance Policy of CCPP

(Basic concept)

○ In order to secure safety of CCPP installation and personnel and perform optimum operation of CCPP, we aim to improve knowledge and capability of Operation & Maintenance personnel.

(Specific policies)

- We will emphasize the basics and have them improve knowledge and skills.
- We will fully enforce efforts to have them tackle jobs with confidence and pride.
- We will enhance teamwork and communication to exert their comprehensive strength.
- We will create an environment where we always look back on their work results and conduct self-training

Thoughts of the top management

2. Preparation of Operation and Maintenance (draft) Plan of CCPP:

(1) We will specify in the prescription (annual policy establishing prescription) specific "CCPP operation and maintenance policy" to annually review and improve it

(2) We will create a system in which P(Plan), D(Do), C(Check) and A(Action) are always conducted with an aim to contribute to a smooth operation of the system.

As for specific annual program, we will select important items based on troubles in the previous year to make out specific measures to be taken.

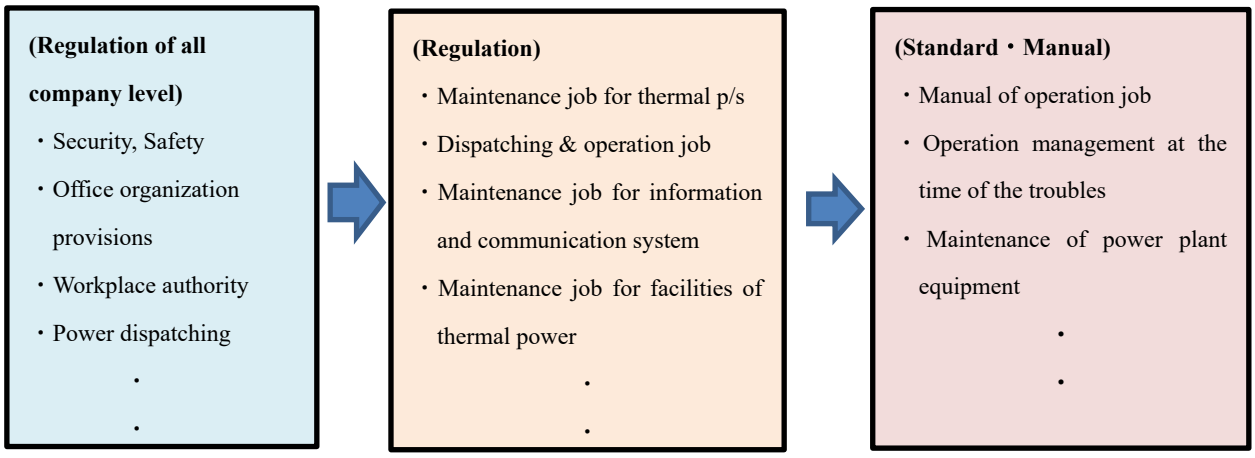
Chapter 3 The enactment process of operation and maintenance and safety management regulations shown below. (Reference case for formulating rules and the like on Operation, Maintenance and Safety Control)

In the Japanese power companies, rules concerning the operation, maintenance and safety are stipulated as the regulation of operation and maintenance under the all company level regulations which are stated basic rule.

And detail operation and maintenance standards and manuals are prepared individually each power station .

These system are shown in the table below.

System of regulations, Guidelines, Manuals for Operation, Maintenance and Safety



2. Stipulation of the regulation

Above table's regulation is stipulated as common apply for division and the contents of regulation concerning the thermal power is mentioned bellow.

(1) The regulation of maintenance job for thermal power

- General
- Observation, inspection, modification work
- Action of work
- Countermeasure of troubles
- Treatment of safety work and health
- Management of maintenance data
- Activity of cooperation with community

- Management of spare parts
- Prevention of any incident caused by human factor

(2) The regulation of dispatching and operation job

The rule related to thermal power operation stipulated in the regulation is as follows.

- General
- General control and operation job
- Control and operation during normal condition
- Control and operation in case of trouble
- Control and operation during abnormal whether condition

3. Regulations of Japan's power utilities companies relating to the Operation and Maintenance (For reference))

(1) Regulations related to Japan's electricity utilities industry law

Power utilities companies in Japan run their business in accordance with the following regulations and rules set by METI(Ministry of Economy, Trade and Industry)

1) Electricity Utilities Industry Law(National Law : enacted in1964)
2) Enforcement Order for Electricity Utilities Industry Law (Ministerial Decree : in 1965)
3) Rules for Enforcement of Electricity Utilities Industry Law(Ministerial Decree : in 1965)
4) Ministerial Decree for Technical Standards on
   a. Electrical Facilities (enacted in1965)
   b. Thermal power Facilities (enacted in1965)
   c. Hydropower Facilities (enacted in1965)
5) Regulations on Electricity Related Accident Report (Ministerial Decree : in 1965)

The outline of the above regulations and rules relating to power generation facilities, and operation and maintenance in Japan are as follows.

(2) Electricity Utilities Industry Law

The national law aiming at protecting the benefit of power consumers and

developing the electricity utilities industry soundly by the appropriate and reasonable management of electricity utilities industry, and also aiming at secure the public safety and environmental conservation by regulating the engineering work, operation and maintenance of electric power facilities.

1) Conformance to Technical Standard (Clause39&40)

① The installation personnel of power utilities, shall keep their facilities conformance to technical standards set by the METI (Clause 39)

② If the power utility facilities are judge to be not matched with the relevant technical
standard, the Minister of METI has the power to order the installation personnel to repair and modify, and/or to move those facilities, or to stop the operation for the machine, or to restrict the operation. (Clause 40)

2) Establishment of independent safety rule (Clause42)

① The installation personnel of power utility facilities shall establish the safety rule on engineering works, operation and maintenance relating to power utility facilities by each organization in compliance with the relevant Ministerial Decrees and submit the notification to the Minister of METI prior to the commencement of service. (Clause 42-1)

② If safety rule is modified, the installation personnel shall submit the notification to the Minister of METI on modified issues without delay. (Clause 42-2)

③ The Minister of METI can order to modify the safety rule from the viewpoint of assurance of safety of power utility facilities, if necessary.(Clause 42-3)

④ The installation personnel and his employees shall follow the safety rule. (Clause 42-4)
The Safety rule should be in compliance with the relevant Ministerial decrees.

3) Chief Engineer (Clause 43)

① The installation personnel of power utility facilities shall select the chief

engineer among chief engineers certified by METI in order to supervise engineering work, operation and maintenance of power facilities. (Clause 43-1)

② The installation personnel of power utility facilities shall submit the notification to the Minister of METI without delay, when the chief engineer is selected and discharged. (Clause 43-2)

③ The chief engineer shall carry the supervision in good faith for engineering work, operation and maintenance relating to security. (Clause 43-3)

④ The personnel involved in engineering work, operation and maintenance shall followthe instruction of the chief engineer to keep the security. (Clause 43-4)

(3) **Enforcement Order for Electricity Utilities Industry Law**

1) Collection of Report (Clause 8)

① The minister of METI can let the Electric Power Supplier report the following issues :

- Issues relating to management of electric power supply business
- Issues relating to engineering work, operation and maintenance in connection with security of power utility facilities
- Issues relating to financial status
- Issues relating to management of research services
- The control authority can get any information or data relating to electric power supply business according to need.

(4) **Rules for Environment of Electricity Utilities Industry Law**

The ministerial decree of " Rules for Enforcement of Electricity Utilities Industry Law "gives the more detailed clauses to practice the "Electricity Utilities Industry Law ".

＜For example relating to Voluntarily Periodic Safety Control Inspection ＞

● Voluntarily periodic inspection shall conduct for the following items ;

- Release or overhaul inspection for partial damage, deformation and occurrence of abnormal condition
- Operational test inspection for function and actuation condition

●The record of the voluntarily periodical inspection shall include the following items ;

- Date of inspection
- Inspection facilities and equipment
- Method of inspection
- Name of the person conducting the inspection
- Contents of the countermeasures and/or repairs, if any

● The voluntarily periodical inspection record shall be stored for five(5) years.

(5) **Regulation on Electricity related Accident Report**

The regulation define the accidents to be reported to the head of Regional Bureaus of Economy, Trade and Industry or the Minister of METI including the definition of accidents.

1) Definition of accidents (Clause1-3、4、5)

① **" Accident of damage "** means the Power facilities / equipment have stopped the operation immediately or are forced to stop the operation, or become un-operational condition, or to suspend their usage due to the decrease in function and/or loss of function caused by deformation, damage, breakdown, fire disaster, and /or insulation deterioration / breakdown.

② **" Accident of damage** for main power facilities " means the main power facilities / equipment , which are given notice separately, have stopped the operation

immediately or are forced to stop the operation, or become un-operational condition, or to suspend their usage due to the decrease in function and/or loss of function caused by deformation, damage, breakdown, fire disaster, and/or insulation deterioration / breakdown.

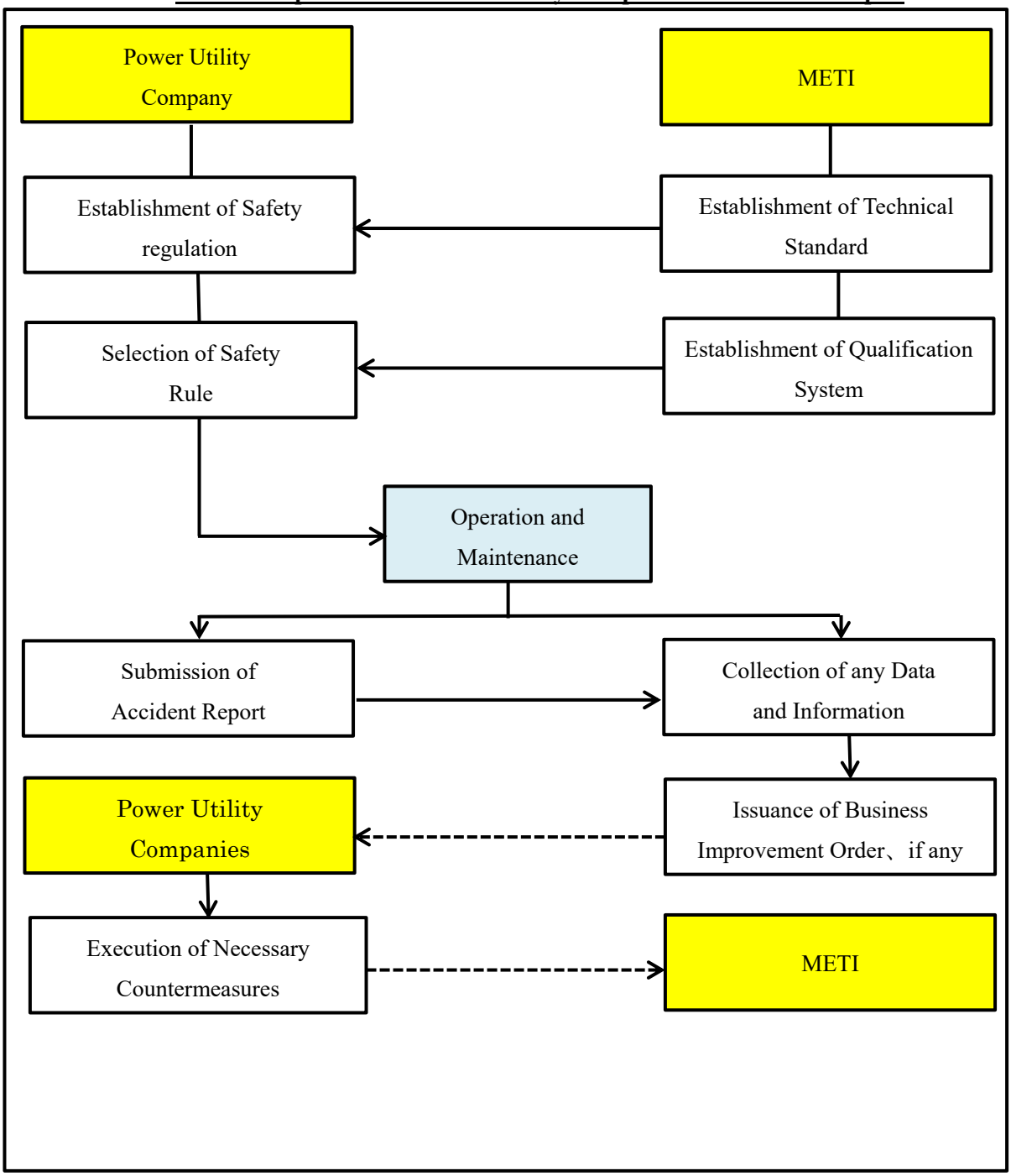
2) Accident Report (Clause 3-3)

Prompt report of electric accidents stipulated in the preceding clause shall be made within forty-eight(48) hours from when the accident was found and informed in manner of telephone etc. concerning the date & time of accident, power facilities which occurred the accident, and brief of accident without delay, and detailed report of electric accidents shall be submitted

by the reporting from 11th within thirty(30) days from when the accident was recognized.

Based on the above introduction of current regulations and rules in Japan, the following relationship between power utility companies and controlling authority (METI) is able to be draw

Relationship between Power Utility Companies and METI in Japan



Reporting form 11th (Clause 3 related)

Electricity Related Accident Report

1. Title :

2. Reporting enterprise
   1) Name of enterprise (Name of the installation personal of power utility facilities)
   2) Address

3. Date and time accident occurrence

4. Power facilities of accident occurrence (installed location, working voltage)

5. Status of accident

6. Cause of accident

7. Status of damage
   1) Death or injured : yes / no
      Status : yes / no
   2) Firing
      Status : yes / no
   3) Delivery failure :
      Status : yes (Delivery failure output and time) / no
   4) Others : Affection to others, if any
      Status :

8. Date and time of recovery

9. Preventive countermeasures

10. Name and affiliation of the chief engineer

11. Confirmation by the installation personnel : yes or no

(6) Other Related Regulation and Qualified Personnel in Japan

In the practical operation of a power plant, many related regulations not limited to the regulations in Section 5.4.1 shall be followed. The following table shows the regulations and personnel assignment related to operation of a thermal power plant including the regulations in Section 5.4.1.

Related Regulations	Required Personnel
Electricity Utilities Law ; Clause 43.1	1st/ 2nd Class Electrical Chief Engineer
Electricity Utilities Law ; Clause 43.1	1st Class Boiler turbine Chief Engineer
Law of Rationalization for the Use of Energy ; Clause 7.1	Qualified Person for Energy Management (Heat)
Law of Rationalization for the Use of Energy ; Clause 7.1	Qualified Person for Energy Management (Electricity)
Law of Development for Pollution Control Organization for Specific Factory; Clause 3 & 6	Qualified Manager in charge of Pollution Control
Waste Disposal and Public Cleaning Law ; Clause 12.26	Qualified Chief Administrator for Industrial Waste (subject to) Special Control
Industrial Safety Health Law ; Clause 12.1	1st / 2nd Class Health Administer
Fire Service Law ; Clause 8.1	Fire Marshal
Fire Service Law ; Clause 13.1	1st / 2nd Class Operator for Dangerous Article
High Pressure Gas Safety Law Clause 27.2 & 27.3 &33	Qualified Manager for High Pressure Fabrication Security
Water Works Law ; Clause 19	Person participating in Water-Works Engineer Lecture

Appendix 9

Human Development - 06

Manual for Safety and Quality Control for periodic inspection work and large-scale improvement work

May　2018

Chapter 1　General Provision

1. Purpose

This manual is aimed at maintaining and improving quality in periodic inspection work and large-scale improvement work of CCPP as well as ensuring security of equipment.

2. Related Standards

(1) Manual for Human Resource Development Planning Involving Operator & Maintenance personnel

(2) Manual for preparation (draft) of development Policy and plan for Operation & Maintenance of the CCPP

(3) Process Supporting Manual for Development of draft rules and rulemaking for the Operation&Maintenance policy and plans

3. Applicable range

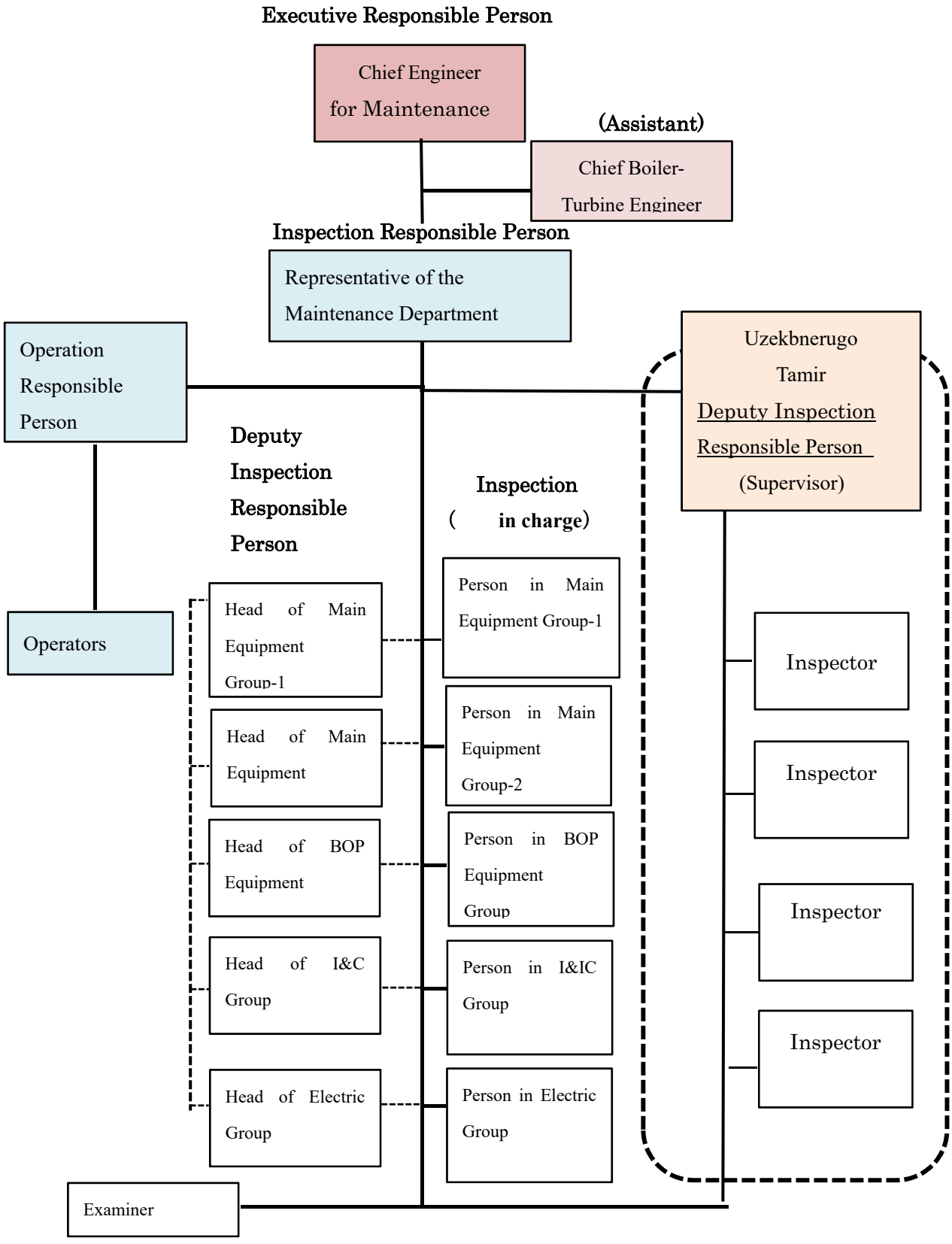
This manual shall apply to periodic inspection work and large-scale improvement work of CCPP.

Chapter 2　Safety and Quality Control System and Participant's Roles

1. Safety and Quality Control System (Inspection System)

The Safety and Quality Control System**(Inspection System)** shall basically be as shown in the following figure。

Figure-1　Safety and Quality Control System (Inspection System)



2. Participant's Role

The roles of the participants are shown below.

(1) Executive Responsible Person

Executive Responsible Person shall be Chief Engineer for Maintenance.

1) He shall exercise control over jobs on Quality and safety of CCPP facilities.

(2) Chief Boiler-Turbine Engineer

The Chief Boiler-Turbine Engineer performs the following as assistance of Chief Engineer for Maintenance

1) He shall give guidance and advice on the plans and implementation of concerning safety and quality of periodic inspection work and large-scale improvement work
2) He shall confirm and approve various kinds of documents such as inspection results, inspection records related to safety and quality control.

(3) Inspection Responsible Person

Inspection Responsible Person shall be Chief Boiler-Turbine Engineer.

1) He shall be responsible for appropriate implementation of periodic inspection work and large-scale improvement work.
2) He shall be prepare Inspection Manual and establish inspection system.
3) He shall be responsible for planning and implementation of safety and quality control.
4) He shall appoint inspectors and give them educational training.
5) He shall confirm and approve safety and quality control records.
6) He shall manage safety and quality control records.
7) If there is any failure, he shall take measures in accordance with the guideline.
8) He shall confirm that there is no imperfection in the inspection records and attachment and if he finds any imperfection, he shall correct it.
9) He shall be authorized to give permission to the delivery to next process.
10) He shall conduct process management of periodic inspection work and large-scale improvement work.

(4) Deputy Inspection Responsible Person)

1) When Inspection Responsible Person is absent, he shall perform superior's duty on his behalf.
2) If it is difficult for him to abide by the procedure necessary for the inspection

in performing his duty, he shall seek Inspection Responsible Person's judgment and take necessary measures

3) He shall confirm that there is no imperfection in the inspection records and attachment, and if finds any imperfection, he shall correct it.

4) He is authorized to give permission to the assembly or restoration.

5) He shall grasp the inspection status and periodically report to Inspection Responsible Person

(5) Inspectors

● Inspectors :UE/ Uzbekenerugo -Tamir(Assistant Inspector)

1) On the basis of compliance with the procedure necessary for inspection, they shall conduct periodic inspection work and inspection of large-scale mprovement work

2) If they finds it difficult to abide by the procedure necessary for inspection, they shall seek Inspection Responsible Person's judgement and take necessary measures.

3) They shall decide to pass or fail in light of the judgement standards.

4) If finds it difficult to decide to pass or fail, they shall seek guidance or advice from Deputy Inspection Responsible Person, Inspection Responsible Person or Chief Boiler-Turbine Engineer.

5) If any decision goes beyond the decision standards, they shall review the contents of measures to be taken in case of failure and after obtaining approval from Inspection Responsible Person, he shall take measures against failure.

● Inspectors : CCPP side

1) They shall conduct and verify safety and quality control (including confirmation, review and judgment of inspection records).

2) They shall prepare safety and Quality Control Process Table in line with open-up & overhaul inspection process.

3) They shall supervise Uzbekenerugo –Tamir(Assistant Inspectors) who are involved in safety and quality control.

① They shall authorize inspection personnel who are involved in safety and quality control.

② They shall supervise safety and quality control records.

● Inspectors : Uzbekenerugo –Tamir (Assistant Inspectors)

1) They shall conduct open-up and overhaul inspections and maintenance of the equipment which is subject to safety and quality control, and keep records of the results.
2) They shall conduct visual inspection, take measurements of the equipment which is subject to Safety and quality control and keep records of the results.
3) They shall conduct non-destructive tests of the equipment which is subject to safety and quality control and keep records of the results. respect to the above 1) through 3), the Inspector and Inspection Responsible Person of the relevant CCPP shall confirm and approve it.

※ Authorization of Inspectors

The Inspection Responsible Person shall appoint and approve adequate number of Inspectors to conduct inspection in accordance with the following authorizing requirements.

A. Authorizing requirements Inspector: CCPP side

He shall have work experience in works, maintenance and operation related to contents of the inspection for more than one year.

B. Authorizing requirements of Inspector ;Uzbekenerugo-Tamir side

① Personnel who are engaged in non-destructive tests shall have the relative certification of completion of the studies.
② Supervisor who is to oversee boiler overhaul work in general shall have certification of completing studies on boiler maintenance engineer.
③ Personnel who are engaged in overhaul inspection of rotors and valves shall have work experience in the relevant work for more than one year.
④ Inspectors shall be authorized as the relevant inspection personnel after they are confirmed to satisfy either one of the above ① through ③ from a list of workers submitted by Uzbekenerugo-Tamir .

This result of authorization shall be approved by the Inspection Responsible Person.

(6) **Operation Responsible Person**

1) He shall select Operators necessary for inspection and give instructions on operations.
2) He shall finds any malfunction, he shall report to Inspection Responsible Person.

(7) Operators

1) They shall perform operations under the instructions given by Operation Responsible Person.

2) If they finds any malfunction, they shall report to Inspection Responsible Person

Chapter 3 Securing of personnel in charge of Periodic inspection work and Inspection of large-scale improvement work

The inspection responsible person shall make necessary documents confirmation for inspection before the inspection in is started, and prepare an inspection system and after gaining approval from executive the post it in the inspection record data base.

Meanwhile, as for the person in charge of operation and operators, the Inspection Responsible Person shall individually establish the system before performing the activation tests and trial operation inspections.

Chapter 4 Implementation Procedure of Inspection

The jobs from the start of inspection through its completion and the implementation procedure for each job are as follows.

1. Preparation for test and inspection

(1) Inspector shall confirm the following prior to the test

1) Confirmation of inspection and measurement.

Inspection and measurement device and testing shall be calibrated and inspected at intervals specified by the “Guideline for measurement control device management” or before they are used and confirmation shall be made of required accuracy.

2) Confirmation of qualification

The inspector shall make prior confirmation by a copy Requirement Certificate or Work Engagement Career that testing personnel have required qualification for the implementation of tests, and report to the inspector in charge.

(2) Inspector in charge shall confirm the following before inspection.

1) Establishment of system for operating inspection and test operating inspection

Operator in charge shall describe the names of Operator in charge and Operator

and the day when he confirmed the operator's qualification in Operating Inspection and Test Operating Inspection System Table (in arbitrary format) Inspector in charge shall confirm that the required items are described before the operating inspection and test operating inspection.

2. Implementation of Test

(1) Implementation procedure of tests

Inspector shall confirm that tests are conducted by Test Staff in accordance with Inspection Manual by witnessing the tests each time of the tests. The items to be confirmed shall be as follows:

1) Test method
2) Qualified person is conducting the tests
3) Parts where the tests are conducted
4) Inspection device used

(2) Handling of inspection device

Inspector and Test Staff shall handle the inspection device in accordance with the manufacture's handling instruction book.

3. Test Records

(1) Record of test results prepared by Test Staff

1) Inspector shall instruct Test Staff to prepare test records and request him to promptly submit them.
2) Inspector shall confirm the test records submitted by Test Staff and confirm that there is no problem with the test results.

(2) Operating inspection and test records of test operating inspection.

Inspector shall output and print necessary data for inspection. If the data cannot be output or printed, the data shall be collected. In the case, the data collection may be entrusted with Assistant inspector.

4. Conducting of Tests

(1) Scope of inspection

In accordance with each Inspection Manual.

(2) Inspection method employed by Inspector

1) Inspector shall make a decision to pass or fail of the test results in light of the grading standards by witnessing on site or examining the test records. The date of inspection shall be the date when Inspector make the decision to pass or fail.

A. The kinds of inspection in which the acceptability is decided by witnessing on site shall be visual inspection, appearance inspection, penetration test inspection, condenser leak inspection, operating inspection, and test operating inspection. However, as for the operating inspection of Gas Detector, the decision to pass or fail can be made by examining the test records.

B. Regarding inspection other than those referred to in above A, the decision to pass or fail can be made by examining the test records.

C. In case inspection is made in factory, the decision to pass or fail can be made by examining the test records after obtaining confirmation by Inspection Responsible Person of the inspection manual prepared by the delivering maker meeting our requirements. (The inspection manual shall be limited to the one specified in advance.)

2) In case it is difficult to make a decision to pass or fail by visual inspection, etc, additional Inspection such as PT inspection or technical evaluation confirming the soundness shall be conducted to make the decision to pass or fail.
Meanwhile, in case the decision is made to pass or fail by technical evaluation , the approval bate of such technical evaluation results shall be the date of inspection.

3) In case repairs are made based on the inspection results, re-inspection shall be conducted and an additional inspection conducted as necessary.

4) In case Inspection other than those specified in the Inspection Manual is conducted, inspection manual shall be prepared and approval of Executive Responsible Person shall be obtained.

(3) Witness by Inspection Responsible Person and Deputy Inspection Responsible Person

Deputy Inspection Responsible Person shall, in principle, witness on site the decision making on acceptance by Inspector and give appropriate instructions to Inspector and manage him.

5. Inspection Records

(1) Recording of Inspection results

1) Inspector shall use “Inspection Records” to describe necessary matters and prepare inspection records.
Nothing shall be transcribed from the test records into the inspection records except minimum requirements.

In case re-inspection is conducted or blank space of the inspection record format is insufficient due to additional inspection, inspection records shall be newly prepared. Each time inspection is conducted, the inspection results shall be confirmed by Deputy Inspection Responsible Person.

2) Deputy Inspection Responsible Person shall confirm that Inspector prepares appropriate records each time inspection is conducted and sigh the inspection records. He shall also confirm completion of the inspection of all the facility items (name of inspection in the inspection records) and obtain approval of Inspection Responsible Person.

3) Inspection Responsible Person. Shall approve of inspection records and conduct document registration ad post in the periodic inspection record data base inspection cover sheet, test records of operating inspection and test run inspection as well as inspection system tble for operating inspection and test runs.

(2) Attachment to Inspection records

1) Materials used to make a decision to pass or fail shall be attached to the inspection records. The original test records prepared by the Test Staff shall be attached.

2) Description or supplement of the inspection results shall be attached.

3) As for operating inspection and test run inspection, the original of the test records and the actual records of inspection system including Operation Responsible Person. and Operator shall be attached.

In case it is difficult to make a decision to pass or fail in light of the judgement standards, a list of the test records may be prepared. In that case, the original of the test records shall always be attached.

6. Measures against Failure

If Inspector decides that any item does not meet the requirement, the most appropriate measures shall be studied and described in the intra-office prompt report and confirmation of Inspection Responsible Person. shall be obtained.

(1) In case repair is made

After gaining approval from Inspection Responsible Person.、retest shall be conducted after the repair or replacement and the series of actions taken shall be recorded in the inspection records.

(2) In case repair is not made

1) Technical evaluation

A. If technical evaluation method is specified in the intra-office standards,

technical evaluation shall be conducted in accordance with such standards.

B. If there is no prescription in the intra-office standards, Inspection Responsible Person. shall coordinate with the maker's recommendations, operation records, etc., and if necessary, coordinate with the related parts and report to Executive Responsible Person on the result of the technical evaluation.

1) Special Employment

If, as a result of the technical evaluation, Inspector decides that safe and stable operations can be continued until the next inspection, and Inspection Responsible Person approves of it then it can be treated as Special Employment. The date when the special employment is approved shall be the date of inspection.

※1) In case malfunction (including that of inspecting equipment) occurs, it should be immediately reported based on "Communication System in case of malfunction" and at the same time, the causes shall be investigated and appropriate measures be taken after having discussions with the parties concerned.

Also, such process shall be recorded in "Measures to be taken in case the decision criteria are not satisfactory."

※2) In case the malfunction is decided to be so minor as not to cause trouble to ensuring security and operation of the CCPP, progress monitoring etc. shall be available. In addition, the contents shall be recorded in "Measures to be taken in case the decision criteria are not satisfactory."

7. Delivery to Next Process

If Inspection Responsible Person approves as " Pass " or as " Special Employment" in making a decision to pass or fail, the delivery to the next process is permissible. If Deputy Inspection Responsible Person approves any item as " Pass," he is allowed to give permission to the assembly or restoration.

8. Inspection Process Management

Inspection Responsible Person shall prepare " Inspection Process Management Table " after receiving reports from Deputy Inspection Responsible Person and grasp each inspection process.

After completion of the inspection, he shall make a an interim report to Executive Responsible Person in general interlocking timing. （Such report can be

eliminated if the periodic inspection does not include the general interlocking)
After making reports upon completion of the inspection, he shall post it on "Inspection Process Management Table " in Periodic Inspection Record Base.

9. Completion of Periodic Inspection

When Inspection Responsible Person confirms the completion of all the periodic inspection, the inspections shall be completed.

10. Supervision of Inspection records

(1) Inspection records shall cover the following ① through ⑪.
Also, the inspection records shall be stored until the relevant CCPP is abolished and the depository shall be Maintenance Division of CCPP.

① Date of inspection
② Object of inspection
③ Inspection methods
④ Inspection results
⑤ Name of person who conducted inspection
⑥ Contents of measures taken such as repairs if measures are taken based on inspection results
⑦ Organization for conducting inspections
⑧ Process management for conducting inspections
⑨ Items related to management of the relevant CCPP if there is another operator who provided cooperation in inspections
⑩ Items related to management of inspection records
⑪ Items of education and training related to inspections

11. Education & Training

(1) Person in charge of inspection shall provide Inspectors with education to have them acquire competence required for the inspection and record the results.
(2) Education and training shall be scheduled by the start of the inspection and be conducted.
(3) Competence which is necessary for Inspectors shall cover the following:

① Scope of inspection, inspection method and decision criteria
② Measures to be taken in case of malfunction
③ Expertise on how to conduct inspections

(Attachments)

※ The following materials need to be prepared and put in place:

1. “Inspection methods and decision criteria”
2.” Requirements for Inspections & Tests and inspecting equipment
3. “Measures to be taken in case decision criteria are not satisfactory”
4. “Inspection System Table”
5. “Inspection/ Inspectors’ career table”
6. “Inspection/ Inspection personnel certification table”
7. “Inspection/Certification Table of Inspection Personnel”
8. “Records of Group Education”
9. “Track Records of Turbine operation” or “Track Records of HRSG Operation”
10. “Various Test Records”

Attachment-1

1. Chief Boiler・Turbine Engineers be trained to improve maintenance of power generation facilities.

(1) In order to supervise security on the works, maintenance or operation of power generation facilities, it is necessary to create the jobs of Chief Boiler・Turbine Engineers and Inspectors in charge of periodical inspection and large-scale improvement work of CCPP to improve maintenance of power generation facilities.

● Required number of qualified Boiler・Turbine Chief Engineers and method of acquiring qualifications

Kind of qualification	**Intended place of selection** / **Construction site/ Power Plant site**	**Required number of qualifiers**			**Method of acquiring qualifications**
Boiler・Turbine Chief Engineer	○	Selected staff : 1 (per site)	+	Reserve : 1 (per site)	Authorization of Practical work

● Academic records or qualifications of Boiler・Turbine Chief Engineer and contents of work experience

Academic records or qualifications	**Work experience**	
	Work experience	**Years of experience**
1. Personnel who completed subjects on machinery engineering and graduated from university or any educational institution which is equivalent to or higher than university.	Works, maintenance, or operation of boilers or turbines for power generation.	More than 6 years after graduation (including more than 3-year experience in works, maintenance or operation of boilers or turbines for power generation).
2. Personnel who graduated from university or any educational institution which is equivalent to or higher than university (excluding	Works, maintenance or operation of HRSG or turbines (ST, GT) for power generation	More than 10 years after graduation (including more than 6-year experience in works,

those set forth in the preceding I tem 1.)		maintenance or operation of boilers or turbines for power plants)

● Responsibility and authority of Chief Boiler・Turbine Engineer
Refer to 「Manual for Safety and Q uality Control for periodic inspection work and large-scale improvement work」 Chapter 2. 2. (2).

2. Inspector be developed to improve inspection and verification of CCPP.

(1) Authorization of Inspector
Person in charge of Inspection shall appoint or approve adequate number of Inspectors in accordance with the following authorizing requirements.

1) Authorizing requirements of Inspector(CCPP side)
Personnel who have more than one year of work experience in works, maintenance and operation which are included in the contents of inspection.

2) Authorizing requirements of Inspector(Uzbekenerugo-Tamir side)
① Personnel who are engaged in non-destructive test shall have relevant certification of completion.
② Supervisors of overall boiler overhaul shall have certification of completion of training for Boiler Maintenance Engineer.
※1) Authorization Table of Inspection Personnel
1. Name:
2. Company Name:
3. Authorization Table of Inspection Personnel
③ Fill out the blank space with years of work experience in the relevant items of the following table.

Items				
HRSG overhaul	**Gas Turbine overhaul**	**Steam Turbine overhaul**	**Valve overhaul**	**Rotor overhaul**
-	-	-	-	-

④ Fill out the blank space with years of work experience in the relevant qualifications in

the following table.

Qualifications				
Dye Penetrant Test（PT）	**Magnetic Particle Test（MT）**	**Ultrasonic Thickness Test(UT)**	**Radiation Transmission Test（RT）**	**Boiler Maintenance Engineer**
-	-	-	-	-

⑤ Personnel who are engaged in the overhaul of rotors, valves, etc. shall have more than one-year work experience in the relevant work.

⑥ Inspectors shall be authorized as Inspection Officers after it is confirmed that they satisfy either one of the above ① through ④ from the list of workers submitted by Supporting Operator.
Also, the authorization results shall be approved by Person in charge of Inspection (Chief Boiler・Turbine Engineer).

In the meantime, each CCPP is requested to study the number of personnel required at each CCPP because of difference in operation from each other at each CCPP.

Appendix 10

"APPROVED" by
"Navoi TPP" JSC
Production director
_____T. G. Nazarov
«___»_____ 2015 year.

Economical and production training program of engineer-technicians

for CCPP Unit for 2015-2016 study year

№	Topics	hours
1.	Study of the "Labor protection" law of Republic of Uzbekistan.	1
2.	Study of "Internal labor orders of Navoi TPP"; "Rules of organizing work with personnel"	2
3.	Technical-economical indicators of the station.	2
4.	Technical features of the main and auxiliary equipment of CCPP Unit.	1
5.	Maintenance of turbines and HRSG of CCPP Unit.	1
6.	Work order system. Organizational and technical measurements during repair of the equipment.	2
7.	Safety technique rules in exploitation of heat-mechanical facilities.	2
8.	Operation of CCGT Unit equipment on economical mode.	2
9.	Study of all violations of the production instructions, accidents and orders which took place in State JSC "Uzbekenergo" during 2014-2015 years.	1
10.	Electric and heat energy for our own needs. Production and transfer of the electric and heat energy.	2
11.	Rules of using electric and heat energy. Number 245 decree of the cabinet of ministers dated on 07.04.2010	2
12.	Repeating study of PP-56 and RH-34-114.	2
13.	Regulations for registration and verification of the accidents.	2
14.	Basic fire safety requirements in the energy industry	1
15.	Storage and use of primary fire extinguishing equipment in energy facilities	1
	Total:	24 hours

CCPP Unit head I.H. Abdullaev

Head of service for labor protection Safety technique and Fire Safety H.O. Muminov

Head of the production and technical department T.S.Solieva

Head of the economical-planning department E.E.Davova

Personnel training engineer I.S.Ahmedova

Appendix 11

"APPROVED" by
"Navoi TPP" JSC
Production director
_____T.G.Nazarov
«___»_____2015y.

Production - economical and continuing training program of the operational personnel of

CCPP Unit for 2015-2016 study year

Plan

1. A theoretical course of technical skills. - 30 hours
2. Labor protection and Safety Technique - 10 hours
3. Study of economical matters -10 hours
4. Fire-technical qualifications - 10 hours

№	Training names	Study hours	Teacher
1	2	3	4
	A theoretical course of technical skills.	**30 hours**	
1.1.	Features and operation of Steam Turbine TC-2F-40.5.	2	Badriddinov J.S. Musaev A.B.
1.2.	Auxiliary equipment of the steam turbine.	2	Badriddinov J.S. Musaev A.B.
1.3.	Features and operation of gas turbine M701F4	2	Badriddinov J.S. Musaev A.B.
1.4.	Auxiliary equipment of the gas turbine.	1	Badriddinov J.S. Musaev A.B.
1.5	Features and auxiliary equipment of HRSG.	2	Badriddinov J.S. Musaev A.B.
1.6	Exploitation of the HRSG.	2	Badriddinov J.S. Musaev A.B.
1.7	Exploitation of the CCPP's saturating pumps.	1	Badriddinov J.S. Musaev A.B.
1.8	Exploitation of the CCPP pumps.	2	Badriddinov J.S. Musaev A.B.
1.9	Exploitation of the pressure vessels.	2	Мавлянов У.
1.10	Exploitation of the CCPP drums.	1	Badriddinov J.S. Musaev A.B.
1.11	Exploitation of the central thermal systems of the CCPP.	2	Badriddinov J.S. Musaev A.B.
1.12	Requirements of the state inspection "Sanoatgeokontehnazorat" to the pipe-lines and vessels.	1	Mavlyanov U.
1.13	CCPP gas facilities exploitation.	2	Sharipov A.B.
1.14	Exploitation of the auxiliary equipment of CCPP.	2	Badriddinov J.S.

			Musaev A.B.
1.15	Starting and stopping features of CCPP.	2	Badriddinov J.S. Musaev A.B.
1.16	Heat scheme, working principle and construction of CCPP	2	Badriddinov J.S. Musaev A.B.
1.17	Study of the orders about violating the requirements to the main constructions of the station and requirements regarding exploitation.	2	Muhidinov N.A.
2	**Labor protection and Safety technique**	**10hours**	
2.1	Study of the law of "Labor Protection" of Republic of Uzbekistan. Rules of using electric and heat energy. Number 245 decree of the cabinet of ministers dated on 07.04.2010	2	Muhidinov N.A.
2.2	Requirements of LP and ST to the working places and buildings.	1	Jumanazarov T.
2.3	Safety technique while working in the volume, gas lines and kindling a fire.	1	Jumanazarov T.
2.4	Work order system. Technical and organizational measurements for preparing the working place.	1	Jumanazarov T.
2.5	Performing the first aid to the staff, who has injured in result of an accident.	1	Jumanazarov T. Dumanov J.
2.6	Rules of organizing the work with the staff of the energy producing companies. Number 433 order which was confirmed by the "Uzenergonadzor" agency dated on 10.09.2002y. Regulations for registration and verification of the accidents.	2	Muminov H.O.
2.7	Study and analysis of the orders regarding accidents within SJSC "Uzbekenergo" system in 2014- 2015 season.	1	Muminov H.O.
2.8	Repeating study of PP-56 and RH-34-114, PP-36.	1	Jumanazarov T.
3	**Study of economical matters**	**10 hours**	
3.1	The main technical-economic indicators of the station. Making a business plan and compliance indicators of the business plan for 2015.	2	Soliev T.S. Davova E.E.
3.2	Salary fund, remuneration of labor and its calculation, income tax assessment from physical bodies.	2	Davova E.E.
3.3	Distribution of income and calculation of dividends in joint-stock company. Cost price, formation of the cost price, variable and fixed expenses.	1	Davova E.E.
3.4	Labor vocation and calculations of payments for labor vocation, payments as compensation and promotion.	2	Davova E.E.
3.5	Measures of solving the matters regarding production planned in 2015.	1	Soliev T.S.
4	**Fire technical qualifications**	**10hours**	
4.1.	Organizational measurements regarding fire safety.	1	Karaev I.
4.2.	The basic documents regarding fire safety.	1	Musaev A.B.
4.3.	Fire extinguishing features of 0,4 KW powered constructions in energy producing factories.	2	Badriddinov J.
4.4.	Fire fighting tools and supply of fire-prevention constructions.	2	Karaev I.
4.5.	Fire safety requirements in energy producing factories.	1	Karaev I.

4.6.	Fire safety of the gas turbine.	1	
4.7.	Usage and maintenance of the first fire fighting tools.	1	Karaev I.
4.8.	Knowledge check	1	Commission
	Total	60 hours	

Produced by:

CCPP Unit Head I.H.Abdullaev

Agreed by:

Head of new constructions service A.N.Yakubov

Head of labor protection Safety Technique and FS services H.O.Muminov

Head of the production technical department T.S.Soliev

Head of the economical planning
department T.S.Davova

Senior inspector of exploitation of LP,
ST and FS service N.A.Muhiddinov

Safety technique inspector of LP,
ST and FS service T. Jumanazarov

Fire safety inspector of LP,
ST and FS service I. Karaev

Senior inspector for industrial safety and dangerous
production facilities U.Mavlyanov

Personnel training
engineer I.S.Ahmedova

Appendix 12

Attachment No1

to JSC “Uzbekenergo” order

No324 dated 24/07/2018.

The number of staff required for training during the development of CCGT Turakrgan

	Name	Number	Tariff level (wage category)	Level of education
	Operational personnel (Total)	56		Higher Education
1	CCPP Unit manager	1	11	Higher Education
2	Deputy unit manager on operation	1	11(-10%)	Higher Education
3	Leading chemical engineer	1	9	Higher Education
4	Chemical engineer	1	8	Higher Education
5	Leading I&C engineer	1	9	Higher Education
6	Leading engineer for Relay protection and Automation	1	9	Higher Education
7	Plant shift head	5	10	Secondary Special Education
8	CCPP unit operator	5	7	Secondary Special Education
9	Unit patrol operator	10	6	Secondary Special Education
10	Laboratory assistant of express laboratory	5	4	Secondary Special Education
11	Senior duty electrician for automated process control systems	5	6	Secondary Special Education
12	Senior duty electrician of electrical equipment	10	4	Secondary Special Education
13	Duty electrician of electrical equipment	10	4	Secondary Special Education
14	Patrol operator of GTS	5	2	Not required
	Maintenance personnel (total)	6		
15	Maintenance fitter of electrical equipment	4	4	Secondary Special Education
16	Maintenance fitter of I&C	2	4	Secondary Special Education
	Total	62		

Appendix 13

The Project for Establishment of the Combined Cycle Gas Turbine (CCGT) Operation and Maintenance Training Center In Uzbekistan

Date: 19th November 2018

To: Mr. Djamshid Abdusalamov/ Deputy Chairman of the Board JSC «Uzbekenergo»
Mr. Kahramon H. GANIEV / Project Director, General Director of «Novoi IES»
Ms. Ayzada Seitniyazova/ Acting Project Manager, Head of Department of Foreign Economic Relation and Investment of «Uzbekenergo»
Mr. Tashpulatov Botir/ Head of Department of Work with Personnel
Cc: Mr. Suvanov ISTAM/ Director of Navoi Training Center at «Novoi IES»
Mr. Alibek KHAITOV/ Head of Human Resource Department of «Novoi IES»
Ms. Giazova Munisa/ Senior Specialist of Department of Work with Personnel

Request to confirm the progress of the Project.

JICA Expert Team (herein after referred to as JET) for "The Project for Establishment of the Combined Cycle Gas Turbine Operation and Maintenance Training Center in Uzbekistan" (herein after referred to as "The Project") have visited Uzbekistan from September to October 2018, as the 13th mission of The Project. Through the mission, JET and Uzbekenergo including Navoi Training Center (NTC), discussed many issue to solve in the Project. Finally, checklist (as attached "Signed Check List.pdf") were recognized and signed between the attendees, after the discussion.

For drawing success of the Project, We, JET request Headquarter Uzbekenergo and NTC to confirm the solution of following issue.

~~~~~~~~~~~~~~~~~~~~~~~~~~~~ **Issue to clarify** ~~~~~~~~~~~~~~~~~~~~~~~~~~~~

(1) Department of Foreign Economic Relation and Investment/ «Uzbekenergo Headquarter»

1) Monitoring Sheet Version 7 (for whole progress of The Project)
"Actual Project Manager", i.e. Ms. Ayzada, should prepare the "Monitoring Sheet Version 7" till the end of 2018, and report to JICA Uzbekistan office.

(2) Department of Work with Personnel/ «Uzbekenergo Headquarter»

1) Accredited Staff /demand for O&M CCPP (for overall goal of The Project)
Staff demand from 2018 to 2024 are informed by Department of Work with Personnel. (refer attached "O&M_CCPP_staff_Demand.pdf")
(a) Please separate the trainee's number of Navoi-2 and -3 from Navoi TPP on table.
(b) Please separate the trainee's number of Talimarjan1/2 and 3/4 from Talimarjan TPP on table.
(c) Please separate the trainee's number of Turakurgan1/2 and 3/4 from Turakurgan TPP on table.
(d) Please clarify the commissioning / commercial schedule and trainee's number for new 2 unit of Tashkent CHPs.

2) Assigned/ necessary number of trainer (for overall goal of The Project)
Reported data are not enough to estimate necessary number of trainer, because it include no kind of JOB of target trainees. And also the belonged CCPP UNIT of trainee are not clear. JET estimated necessary number of trainer, maximum 20 trainers as attached Excel -sheet «Training group», from these limited information, but not accurate.
So, please clarify the following condition to correct.
(a) Please clarify the number of staff by each quarter, by kind of JOB by each CCPP UNIT, i.e. Navoi 2/3, Tarimarjan 1/2/3/4, Tahiatash 1/2, Turakurgan 1/2/3/4 and new 2 unit of Tashkent CHP.
(b) Kind of JOB for each column on table of "O&M_CCPP_staff_Demand.pdf".
(c) Please estimate trainer's number to allocate with using these corrected data, to manage run of Training Center continuously for future.

(3) NTC and Human Resource Department (HRM)/ «Novoi IES», and Department of Work with Personnel/ «Uzbekenergo Headquarter»

1) Annual Training Plan 2019 for CCPP O&M staff (for Training plan/ output 2 of The Project)
Now, there are only information of trainee's number by Department of Work with Personnel/ UE-HQ. No official schedule of UE for each training course are existing, because NTC have not announced the collection of trainees for O&M staff CCPP.
~~~~~~~~~~~~~~~~~~~~~~~~~~~~

For annual training plan 2019, NTC have to announce their draft of training plan 2019 to each TPP through Department of Work with Personnel/ UE-HQ, and NTC have to finalize the plan including training details, i.e. specific date and time, trainer, number of trainee and etc. (refer attached "TTC Annual Training Plan.pdf")

(a) Please finalize the annual training plan 2019 including training details, soon.

(b) Annual Training Plan 2019 should be authorized by Department work with personnel/ UE-HQ.

(4) NTC and HRM/ «Novoi IES»,

1) Lecture Plan for 12 Training course (for Training plan/ output 2 of The Project)

Draft of "Lecture Plan" for 12 courses were already prepared by Trainer NTC. They must be officialize in NTC, but NTC itself is not authorized official yet.

(a) Lecture Plan should be finalized and registered as a document of NTPP.

(b) Registered document are required by the Project as evidence of deliverables, till the end of December 2018.

2) Individual Training Program (for O&M Staff Accreditation/ output 2 of The Project)

O&M Staff should complete the several training course by each JOB. JET proposed and recommended prepare the "Individual training program for each JOB", and Trainer already prepared the draft of the same. (refer "Request Individual Training Program.pdf")

(a) 11 Individual Training Program should be finalized by NTC, recognized and registered by Management and by HRM of «Novoi IES».

11 documents refer as attached <Request Individual Training Program; (A)>

(b) 7 Individual Training Program should be finalized by NTC, recognized and registered by Management and by HRM of «Novoi IES».

7 documents refer as attached <Request Individual Training Program; (B) 12)～18)>

3) Monitoring and record of Training (for O&M Staff Accreditation/ Project Purpose)

Training for Navoi-2 and for Turakurgan are implementing now. For 25 machinists were completed and other 20 are implementing now. 40 staff should be accredited as a project purpose.

Record and evaluation of training, as evidence, are required for monitoring. The form of the training record might be better as according to the attached record of Tashkent training center. ("Journal sample masked.pdf/ Journal Format En.docx")

(a) Training Record/Journal of 25 Machinist/ Novoi-2 should be reported till the end of 2018.

(b) Training Record/Journal of 20 personnel/ Turakurgan should be reported soon after completion of training, till the end of January 2019.

(c) Training Record/Journal of 5 Machinist, 5 Electrician and 5 &I person/ Novoi-2 should be reported, till the end of January 2019.

4) Accredit Trainer for the course No/9 (for Trainer Accreditation/ output 4 of The Project)

JET trained 14 trainer candidates and accredited for 11 subject/courses of training. Only 1 subject/ course, i.e. course No.9 "Gas Turbine Operation and Maintenance" are remained, and will be complete 27th December 2018.

(a) Preparing Table and cover for "3D model"

3D Model will be using in the lecture of the course No9. They should be displayed for easier using before 27th December 2018.

(b) Three trainer candidates for course No. 9 should participate training on 27th December, and success the final evaluation to become trainer. Three Trainer are Mr. Bazarov, Mr. Alisher and Mr. Khudoykulov. Also, other trainers, to get more knowledge, well come to participate training.

5) Russian Textbook (for Training Materials/ output 3 of The Project)

5 sets of English Textbook for 12 courses have been already delivered to NTC from JET. Russian Textbook should be prepared by NTC, according to the number of trainee of the course. Also Japanese side need the 2 sets of the same for JICA and JET, as a deliverable of the project. Please inform us the following condition.

(a) Completion day of manuscript of Russian textbook
(b) Printing Plan Schedule of Russian textbooks
(c) Information the delivery schedule of 2 sets of Russian textbook for JICA and JET.

6) Navoi-2 schedule (related for training plan as clause (4) 3) (c))
Gas Turbine of Navoi-2 will be start commissioning from December 2018, and start simple cycle. These schedule will influence training schedule for new employee.
(a) Please inform the schedule of Nasvoi-2, commissioning and commercial of GT and also about ST.

7) NTC Building schedule (related information for NTC opening and training plan)
Scheduler of NTC new building will influence the training.
(a) Completion days of Building of NTC
(b) Transport schedule of JICA training equipment from CCPP-1 to new building
(c) Schedule of furniture delivery and setting in building

8) Shutdown record of 2015-2018 (related information)
JET already get shutdown record of Navoi CCPP-1 from 2013 to 2015. There are no data of the same from 2015 to 2018.

Official solution or response will be expected through the Acting Project manager/ Ms. Ayzada.
Solution or response for these issues within three weeks, are highly appreciated.
All of your cooperation leads the success of the project.

Yours truly,

村田幸裕

Yukihiro MURATA/ Chief Advisor
JICA Expert Team of the Project

Checklist for consensus / Перечень тем для согласования on 17th Oct. 2018 / 17 октября 2018 года

№	Subject / Предмет	Objectives / Цели	Deadline / Крайний срок	Current status / Текущее состояние	Consensus /Консенсус	Person in charge ответственное ли цо	Co-person in charge сотрудничество человек
1	Training Plan till 2022-1st quarter План обучения до 1 квартала 2022	Accredited O&M staff Аккредитованный персонал по ЭиТО	19-Oct/2018	Cooperation between NTC and UE-HQ HRM Сотрудничество между NTC и UE-HQ HRM	will be reported in Meeting on 19 October будет сообщено на совещании 19 октября	Mr. Istam Mr. Alibek	UE-HQ HRM Dept. УК УЭ
1-2	12 Lecture Plans proposed by JET / 12 Планов Лекций, предложенных JET	Official finalization Официальная завершение	25-Oct/2018	will prepared by NTC Staff будет подготовлен персоналом НУЦ	Copy of signed draft will be delivered to JET Копия подписанного черновика будет доставлена в JET	Mr. Istam	UE-HQ HRM Dept. УК УЭ
2	Accreditation system of O&M Staff / Система аккредитации персонала ЭиТО	ID Card of NTC Удостоверение личности для НУЦ	28-Feb/2019	not applied yet еще не применяется	Mr. Istam should inform Mr. Umid the progress every week, to get permission till end of February. Г-н Истам должен информировать г-н Умид о прогрессе каждую неделю, чтобы получить разрешение до конца февраля.	Mr. Istam Mr. Alibek	UE-HQ HRM Dept. УК УЭ
2-2	Record of prior training Записи предварительного обучения	Signed report of training, ①Mechanic 25traineee, ②Mechanic, Electric and C&I each 5trainee Подписанный отчет о тренинге, ① Механик 25 стажеров, ②Механик, Электрический и С & I каждые 5 че	①30 Oct 2018 ②31 Dec. 2018	① in process ② till Dec 2018 / в процессе	① Report with Mr. Ganiev's signature should be reported in Nov. ②Training Plan with Mr. Ganiev's signature should be reported in Nov. (report to UE-HQ, copy bring to Japan) ① Отчет с подписью г-на Ганиева должен быть представлен в ноябре. ② План обучения с подписью г-на Ганиева должен быть представлен в ноябре (отчет для UE-HQ, копия привезти в Японию)	Mr. Istam Mr. Alibek	①②prepared by Staff of NTC/ Персонал НУЦ ①bring by Mr. Alisher and Mr. Latif
2-3	11 Individual Training Program proposed by JET 11 Индивидуальных программ обучения, предложенные JET	Official finalization Официальная завершение	15-Nov/2018	will prepared by NTC Staff будет подготовлен персоналом НУЦ	Final draft should be prepared by NTC Staff, by referring proposal and recommendation document by JET. Окончательный проект должен быть подготовлен персоналом НТК путем ссылки на предложение и рекомендательный документ JET.	Mr. Istam Mr. Alibek	UE-HQ HRM & Operatio Plan Dept.
2-4	7 Individual Training Program highly recommended by JET 7 Индивидуальных программ обучения, настоятельно рекомендуемых JET	Official finalization Официальная завершение	15-Nov/2018			Mr. Istam Mr. Alibek	UE-HQ HRM & Operatio Plan Dept.
~~2-5~~	~~10 Individual Training Program recommended by JET 10 Индивидуальных программ обучения, рекомендованные JET~~	~~Official finalization Официальная завершение~~	~~10-Feb/2019~~		No need to create Нет необходимости создавать	~~Mr. Istam Mr. Alibek~~	~~Staff of NTC Персонал НУЦ~~
3	Accreditation of Trainer till 2022-1st quarter /Аккредитация инструктора до 1 квартала 2022	Accredited Trainer Аккредитованный инструктор	19-Oct/2018	Cooperation between NTC and UE-HQ HRM Сотрудничество между NTC и UE-HQ HRM	will be reported in Meeting on 19 October будет сообщено на совещании 19 октября	Mr. Istam Mr. Alibek	UE-HQ HRM Dept. УК УЭ
3-2	Accreditation of Trainer / Аккредитация инструктора	JOB Description of Trainer Должностная инструкция для инструктора	28-Feb/2019	will prepared by NTC Staff будет подготовлен персоналом НУЦ	Draft of "Job Description for trainer", referring with JET presentation, should be prepared. Необходимо подготовить проект «Описание работы для тренера», ссылаясь на презентацию JET.	Mr. Alibek Mr. Istam	UE-HQ HRM Dept. УК УЭ
3-3	Appointment of 3 full-time trainers Назначение 3 штатных инструкторов	Trainer for each field Инструктор для каждой области	28-Feb/2019	not yet еще нет	should be determined before the opening of NTC должны быть определены до начало НУЦ	Mr. Alibek Mr. Istam	UE-HQ HRM Dept. УК УЭ
3-4	Accreditation of Trainer by NTC / Аккредитация инструктора со стороны НУЦ	On-site training Program for Trainer Программа обучения на производстве для инструктора	~~10-Feb/2019~~	Completed Завершенный	"On-site training" are already described in draft of Lecture Plan. «Обучение на месте» уже описано в проекте плана лекций.	~~Mr. Istam Mr. Alibek~~	~~14 Chief Trainers 14 инструкторов~~

№	Subject / Предмет	Objectives / Цели	Deadline / Крайний срок	Current status / Текущее состояние	Consensus /Консенсус	Person in charge ответственное лицо	Co-person in charge сотрудничество человек
3-5	Accreditation of Trainer for courese No.9 / Аккредитация инструктора для курсе №9	Supplementary training for equipment description Дополнительная тренинги для описания оборудования	November ~ December Ноябрь-декабрь2018	need to schedule необходимо запланировать	Supplementary TOT should be implemented in December or January. Дополнительный ТОТ должен быть реализован в декабре или январе.	Mr. Watanabe / JET	JET
4	Monitoring & Evaluation System of Training by NTC Система мониторинга и оценки обучения НТЦ	Staff Training for Navoi CCPP-2 implemented in 2018 by NTC Обучение персонала для Навоийской ПГУ-2 реализованный в 2018 году NTC	31-Dec/2018	None	As the first report of "Monitoring & Evaluation System", Mr. Ganiev is to report to UE-HQ and JET В качестве первого отчета «Система мониторинга и оценки» г-н Ганиев должен отчитываться перед UE-HQ и JET	Mr. Istam Mr. Alibek	UE-HQ HRM Dept. УК УЭ
5	Training Center Building at CCPP-2 Строительство учебного центра на ПГУ-2	information of progress информация о прогрессе	November 2018 Ноябрь 2018 года	End of Nov, at the latest in mid Dec. Конец ноября, самое позднее в середине декабря.	should complete building at the end of Nov, at the latest, before middle of December должен завершить строительство в конце ноября, самое позднее, до середины декабря	Mr. Istam Mr. Alibek	Contractor подрядчик
6	Textbook Учебник	Binded Russian Textbook Переплетенные русскоязычные учебники	November ~ December Ноябрь-декабрь2018	in process / в процессе	JICA Needs 2 set of Russian Textbook, and delivery in December 2018. JICA нуждается в 2 наборах русского учебника и доставке в декабре 2018 года.	Mr. Istam	Staff of NTC Персонал НУЦ
7	Facility Объект	Display Desk and cover for 3D Model Подставка и акриловая крышка для 3D-модели люлаток	before No 3-5, i.e. middle of Nov. до № 3-5	in process / в процессе	Display Desk and cover for 3D Model are required for supplementary TOT of No 9. Дисплей и обложка для 3D-модели необходимы для дополнительного ТОТ № 9.	Mr. Istam	Staff of NTC Персонал НУЦ
8	Facility Объект	Request of desk, chair, shelf and etc., along the Drawing of JET. Запрос на стол, стул, полку и т. Д., По рисунку JET.	End of Nov, at the latest in mid Dec. / Конец ноября, самое позднее в середине декабря.	start to prepare начать готовить	NTC should manage procurement by contractor НУЦ должна управлять закупками подрядчика.	Mr. Istam	Staff of NTC Персонал НУЦ

Signature to confirm / Подпись для подтверждения

T Saito 斎藤

Mr. Saito

若林英人

Mr. Wakabayashi

Mr. Istam

Mr. Alibek

Appendix 14

Annex
To the Order of JSC «Uzbekenergo»
Dated 2.11.2015 № 458

PLAN
of new employee training and education of engineers and technicians in LLC «Xodimlar tayorlash markazi» for 2016

№	Name of specialties	Training time	Number of persons	Name of enterprises	Responsible
1	2	3	4	5	6
			J A N U A R Y		
1.	Electricians of Emergency Crew on routine switching velocity 0,4-6-10 kV	4.01 – 23.01	29	Navoi Mining Metallurgical Combinat (NMMC)-5, Uztransgaz-5, Kashkadarya Enterprise Territorially Electrical Networks (KashETEN)-3, AMMC-1,Tashkent City Enterprise Electrical Networks -3 Surkhandarya Enterprise Territorially Electrical Networks -2, Tashkent Enterprise Electrical Networks -2, Khorezm Enterprise Electrical Networks 2, Surkhandarya Enterprise Territorially Electrical Networks -1, Andijan Enterprise Territorially Electrical Networks -1,Bukhara Enterprise Territorially Electrical Networks -1,AngrenTPP-1, Djizak Enterprise Territorially Electrical Networks -1, Surkhandarya TPP -1	**LLC «Xodimlar tayorlash markazi»**
2.	Electrical/gas welders (practice by place of work)	4.01- 23.01	23	Uztransgaz -10, N.AngTPP-2,AngTPP-1, FergTPP-1, SamETEN -1, JSC «ET»-1, Tash EM-1,Tash TPP-1,TashCHP-1, KashETEN -1, KhorezmETEN-1, Surkhandarya TPP-1, Navoi -1	**LLC «Xodimlar tayorlash markazi**
3.	Strappers	4.01 – 16.01	25	Uztransgaz -7,N.AngTPP-4,TashTPP-2, Kashkadarya Enterprise Electrical Networks -2,SRP JSC «ET»-1,Central Intersystem Electrical Network -2, FerCHP-1,Tashkent Enterprise Electrical Networks -1,Samarkand TPP- 1, UzKEC-1, Tashkent Enterprise Electrical Networks -1, Andijan Enterprise Electrical Networks -1, Khorezm Enterprise Electrical Networks -1	**LLC «Xodimlar tayorlash markazi**

1	2	3	4	5	6
4.	Sales Deputy Directors of RES	4.01-16.01	28	Andijan Enterprise Electrical Networks -2, Bukhara Enterprise Electrical Networks -2, Djizak Enterprise Electrical Networks -2, Kashkadarya Enterprise Electrical Networks -2, KK Enterprise Electrical Networks -2, Namangan Enterprise Electrical Networks -2, Navoi Enterprise Electrical Networks -2, SD Enterprise Electrical Networks -2, Surkh Enterprise Electrical Networks -2, Samarkand Enterprise Electrical Networks -2, Tashkent City Enterprise Electrical Networks -2, Tashkent Enterprise Electrical Networks -2,Fergana Enterprise Electrical Networks -2, Khorezm Enterprise Electrical Networks -2	**LLC «Xodimlar tayorlash markazi** Tashkent City Enterprise Electrical Networks
5.	Repairmen of pumping equipment	18.01 – 30.01	22	Uztransgaz -6, ToshIM-3, TashTPP-3, AMMC -2, Ang TPP-1, N.Ang TPP-1, MubCHP-1, TahTPP-1,TashCHP-1, «Ilgor»-1, SD Enterprise Electrical Networks-1, Chirchik Chirchik HPS-1	**LLC «Xodimlar tayorlash**

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6.	Electricians on electrical installations testing and measurement.	25.01-13.02	24	AMMC -6, NMMC -4, Uztransgaz -4, VIES-2, Sam Enterprise Electrical Networks- 2, Kashkadarya Enterprise Electrical Networks -1, Tashkent Enterprise Electrical Networks -1, Andijan Enterprise Electrical Networks -1, Namangan Enterprise Electrical Networks -1, Surkhandarya Enterprise Electrical Networks -1, SIES-1	**LLC «Xodimlar tayorlash markazi**
7.	Electricians on maintenance of Substation 2-3 labor grade.	25.01- 13.02	17	Kashkadarya Enterprise Electrical Networks -2, Fergana Enterprise Electrical Networks -2, Andijan Enterprise Electrical Networks -1, Bukhra Enterprise Electrical Networks -1, Djizak Enterprise Electrical Networks- 1, KK Enterprise Electrical Networks -1, Navoi Enterprise Electrical Networks -1, SD Enterprise Electrical Networks -1, Samarkand Enterprise Electrical Networks -1, Tashkent Enterprise Electrical Networks -1, Tashkent Enterprise Electrical Networks -1, U-ZMES-1, Namangan Enterprise Electrical Networks -1, Khorezm Enterprise Electrical Networks -1, S-Z –ZMES -1.	**LLC «Xodimlar tayorlash markazi**
8.	Chief mechanics of boiler equipment, mechanics of power generating unit.	25.01-13.02	13	Uztransgaz -5, TashTPP-4, Navoi TPP -2, SDTPP-1, TashCHP-1.	**LLC «Xodimlar tayorlash markazi LLC «Xodimlar tayorlash markazi** Tashkent TPP
			F E B R U A R Y		
9.	Information and communication technologies courses	1.02 – 13.02	14	CIES-5, Kashkadarya Enterprise Electrical Networks -2, KK Enterprise Electrical Networks -2, SDTPP-2, TashHPS -1, Namangan Enterprise Electrical Networks -1, JSC« ORGRES»-1	**LLC «Xodimlar tayorlash markazi** Energo ASU
10.	Technical and engineering employees, responsible for maintenance FMS in normal condition.	1.02 -13.02	22	AMMC -9, Uztransgaz -3, SDTPP-2, BMЭC-1 TashHPS -1, NavoiTPP-1, UzKEC-1 TashCHP-1, SD Enterprise Electrical Networks -1, Tashkent Enterprise Electrical Networks -1, Ammofos -1	**LLC «Xodimlar tayorlash markazi**
1	**2**	**3**	**4**	**5**	**6**
11.	Distance protection panel lines of 110- 220 kV type SHDE -2801, SHDE-2802.	1.02 -20.02	13	NP «ESAN»-3, U-ZMES-2, SDTPP-1, TalTPP-1, MubCHP-1, Kashkadarya Enterprise Electrical Networks -1, Khorezm Enterprise Electrical Networks -1,CIES-1, SIES-1, Beruniy section -1	**LLC «Xodimlar tayorlash markazi** CSRZA
12.	Mechanics of boiler equipment	8.02 – 27.02	25	AMMC -12, Uztransgaz -9, Navoi TPP -2, Angren TPP-1, MubCHP-1	**LLC «Xodimlar tayorlash markazi**
13.	Sales engineers of RES	15.02 -27.02	28	Andijan Enterprise Electrical Networks -2, Bukhara Enterprise Electrical Networks -2, Djizak Enterprise Electrical Networks -2, Kashkadarya Enterprise Electrical Networks -2, Andijan Enterprise Electrical Networks KK Enterprise Electrical Networks -2, Enterprise	**LLC «Xodimlar tayorlash markazi** Tashkent

				Namangan Electrical Networks -2, Navoi Enterprise Electrical Networks -2, SD Enterprise Electrical Networks -2, Surkh Enterprise Electrical Networks -2, Samarkand Enterprise Electrical Networks -2, Tashkent City Enterprise Electrical Networks -2, Tashkent Enterprise Electrical Networks -2, Fergana Enterprise Electrical Networks -2, Khorezm Enterprise Electrical Networks -2	City Enterprise Electrical Networks
14.	Electricians on exploitation PC 2-3 labor grade	15.02-5.03	22	Khorezm Enterprise Electrical Networks -3, Djizak Enterprise Electrical Networks -3, Uztransgaz -2, SD Enterprise Electrical Networks -1, And Enterprise Electrical Networks -1, Bukhara Enterprise Electrical Networks -1, Kashakadarya Enterprise Electrical Networks -1, KK Enterprise Electrical Networks-1, Navoi Enterprise Electrical Networks-1, Fergana Enterprise Electrical Networks -2, Samarkand Enterprise Electrical Networks 2, Tashkent City Enterprise Electrical Networks -2 Tashkent Enterprise Electrical Networks -2	**LLC «Xodimlar tayorlash markazi**
15.	Specialists on operation and maintenance complete transformer substations 110-35-6-10 kV using complete switchgear for outdoor installation K-47, K-59 type of Samara plant.	22.02-12.03	23	NMMC -5 Uztransgaz -4, AMMC-3, Samarkand Enterprise Electrical Networks -2, Khorezm Enterprise Electrical Networks -2, Djizak Enterprise Electrical Networks-1, Tashkent City Enterprise Electrical Networks -1, KKEnterprise Electrical Networks -1,SD Enterprise Electrical Networks -1, NCE «ESAN»-1, Navoi TPP-1, Fergana TPP -1	**LLC «Xodimlar tayorlash markazi** CSRZA
16.	Repairmen of gas equipment	22.02-5.03	26	Uztransgaz - 26	**LLC «Xodimlar tayorlash markazi** Tash TPP
			M A R C H		
17.	Repairmen of pumping equipment	14.03 – 26.03	21	Uztransgaz -6,TashIM -3, TashTPP -2, AMMC -2, Angren TPP -1, N.Angren TPP-1, Takh TPP -1,Tash CHP -1, «Ilgor»-1, Tal TPP- 1, Fergana CHP-1,FarkhHPS -1	**LLC «Xodimlar tayorlash markazi**
1	**2**	**3**	**4**	**5**	**6**
18.	Sales engineers of RES	14.03-26.03	28	Andijan Enterprise Electrical Networks -2, Bukhara Enterprise Electrical Networks -2, Djizak Enterprise Electrical Networks -2, Kashakadarya Enterprise Electrical Networks -2, KK Enterprise Electrical Networks -2, Namangan Enterprise Electrical Networks -2, Navoi Enterprise Electrical Networks -2, SD Enterprise Electrical Networks -2, Surkhandarya Enterprise Electrical Networks -2, Samarkand Enterprise Electrical Networks -2, Tashkent City Enterprise Electrical Networks -2, Tashkent Enterprise Electrical Networks -2, Fergana Enterprise Electrical Networks -2, Khorezm Enterprise Electrical Networks -2	**LLC «Xodimlar tayorlash markazi** Tashkent City Enterprise Electrical Networks
19.	Electricians of Emergency Crew and duty operators of Substation of 35 kV and above on routine switching	14.03-2.04	19	NMMC -7, Tashkent Enterprise Electrical Networks -2, AMMC -2, Uzmetkombinat -2, Bukhra Enterprise Electrical Networks -1, Navoi Enterprise Electrical Networks -1, Tashkent City Enterprise Electrical Networks -1, Fergana Enterprise Electrical Networks -1, Khorezm Enterprise Electrical Networks -1, Andijan Enterprise Electrical Networks -1	**LLC «Xodimlar tayorlash markazi**

20.	Boiler equipment operators and boiler equipment patrol lineman (new preparedness)	14.03-2.04	24	Fergana CHP-6, TashTPP-5, Angren TPP -2, N.Angren TPP-4, TakhTPP-2, TashCHP-2, Navoi TPP -1, SDTPP-1, TalTPP -1.	**LLC «Xodimlar tayorlash markazi** TashTPP
21.	Engineers on Accident-Prevention Rules	14.03-26.03	22	AMMC -5, Uztransgaz -4, Fergana Enterprise Electrical Networks -2, Khorezm Enterprise Electrical Networks -2, Djizak Enterprise Electrical Networks -1, Kashkadatya Enterprise Electrical Networks -1, Surkhandarya Enterprise Electrical Networks -1, Tashkent Enterprise Electrical Networks -1, N.Angren TPP -1, Tash CHP -1,SD Enterprise Electrical Networks -1, TashIM -1, UzKEC-1	**LLC «Xodimlar tayorlash markazi** SNTB
22.	Employer rating of electrical/gas welders	28.03 -16.04	18	TashCHP-5, AngrenTPP-4, SDTPP-2,TakhTPP- 2 Uztransgaz -2,Fergana Enterprise Electrical Networks -1,SRP JSC O «ЭТ»1, «Ilgor»-1	**LLC «Xodimlar tayorlash markazi**
		A P R I L			
23.	Electricians on maintenance of Substation 4-6 labor grade.	4.04- 23.04	19	Uztransgaz -2, AMMC-2, Kashakadarya Enterprise Electrical Networks -2, Uzmetkombinat -2, Andijan Enterprise Electrical Networks -1, Djizak Enterprise Electrical Networks -1, Navoi Enterprise Electrical Networks-1, Samarkand Enterprise Electrical Networks -1, Tashkent Enterprise Electrical Networks -1, Khorezm Enterprise Electrical Networks -1.	**LLC «Xodimlar tayorlash markazi**
24.	Sales Deputy Directors of RE	4.04 – 16.04	28	Andijan Enterprise Electrical Networks -2, Bukhra Enterprise Electrical Networks -2, Djizak Enterprise Electrical Networks -2, Kashakadarya Enterprise Electrical Networks -2, KK Enterprise Electrical Networks -2, Namangan Enterprise Electrical Networks -2, Navoi Enterprise Electrical Networks -2, SD Enterprise Electrical Networks -2, Surkh Kashakadarya Enterprise Electrical Networks -2, Samarkand Enterprise Electrical Networks -2, Tashkent City Enterprise Electrical Networks -2, Tashkent Enterprise Electrical Networks -2, Fergana Enterprise Electrical Networks -2, Khorezm Enterprise Electrical Networks -2	**LLC «Xodimlar tayorlash markazi** Tashkent City Enterprise Electrical Networks
1	**2**	**3**	**4**	**5**	**6**
25.	Electricians cablemen- cable jointers of cable communication	4.04 – 16.04	14	AMMC -4 NMMC -3, Uztransgaz -2,N.Angren TPP -2, TashHPS -1, Samarkand Enterprise Electrical Networks -1,Namangan Enterprise Electrical Networks-1	**LLC «Xodimlar tayorlash markazi** FF Energoaloka
26.	Electro mechanics 4-5 labor grade on operation and maintenance of automatic equipment of measurement instrument (measurement of power consumption , pressure, pyrometry)	4.04 – 16.04	15	SD TPP-2, TashTPP-2, TalTPP -2, Uztransgaz -2 Angren TPP-1, TakhTPP-1,MubTPP-1,Fergana CHP-1 NMMC-1,Uzentamir -2.	**LLC «Xodimlar tayorlash markazi** Ensozlash
26a	Specialists Temperature Coefficient of Delay calculation	4.04-16.04	12	NMMC -4, AMMC -2, Kashakadarya Enterprise Electrical Networks -1, Khorezm Enterprise Electrical Networks -1 Andijan Enterprise Electrical Networks -1, Djizak Enterprise Electrical Networks -1, KK Enterprise Electrical Networks -1 Samarkand Enterprise Electrical Networks-1.	**LLC «Xodimlar tayorlash markazi** CSRZA
27.	Chief mechanics and patrol lineman	11.04-30.04	28	TashTPP-5, NMMC -4,TakhTPP-3,TashCHP	**LLC**

	of turbine equipment			-3, Angren TPP-2, SDTPP-2, TalTPP-2,Fergana CHP-2, AMMC -2, N.Angren TPP-1,Navoi TPP-1,MubCHP-1	**«Xodimlar tayorlash markazi** TashTPP
28.	Foremen	18.04-23.04	18	Samarkand Enterprise Electrical Networks -4,Djizak Enterprise Electrical Networks -2, Kashakadarya Enterprise Electrical Networks -2, Tashkent Enterprise Electrical Networks -2,Khorezm Enterprise Electrical Networks -2,Andijan Enterprise Electrical Networks -1, VIES -1,U-ZIES-1,Uztransgaz -1 Surkhandarya Enterprise Electrical Networks -1,Fergana Enterprise Electrical Networks -1	**LLC «Xodimlar tayorlash markazi** SNTB
29.	Dispatchers ODG RES и ODS of Electric Networks Enterprise	25.04-14.05	17	Djizak Enterprise Electrical Networks -3, Kashakadarya Enterprise Electrical Networks -2, Tashkent Enterprise Electrical Networks -2, Khorezm Enterprise Electrical Netwoks -2, Andijan Enterprise Electrical Networks -1,Navoi Enterprise Electrical Networks -1, SD Enterprise Electrical Networks -1,Surkhandarya Enterprise Electrical Networks -1, Samarkand Enterprise Electrical Networks -1, Uztransgaz -1, Bukhra Enterprise Electrical Networks -1,Namangan Enterprise Electrical Networks -1	**LLC «Xodimlar tayorlash markazi**
30.	Strappers	18.04-30.04	24	Uztransgaz -7,H.AngTPP-3,TashTPP-3, Kashakadarya Enterprise Electrical Networks -2, JSCAO«ET»-1,CIES- 1 Fergana CHP -1, Tashkent Enterprise Electrical Networks -1, Tashkent City Enterprise Electrical Networks -1 Mub CHP -1,Navoi Enterprise Electrical Networks -1,Fergana Enterprise Electrical Networks -1 UzKEC -1	**LLC «Xodimlar tayorlash markazi**
31.	Battery assemblers	18.04-30.04	22	AMMC -6,U-ZIES -3, Djizak Enterprise Electrical Networks -2, CIES-2 Navoi TPP -1,TashTPP-1,TalTPP-1,MubCHP-1 N.B.HPS.-1,U. Chirchik HPS -1,SD Enterprise Electrical Networks - 1 Tashkent City Enterprise Electrical Networks -1, Fergana Enterprise Electrical Networks -1	**LLC «Xodimlar tayorlash markazi** Akkuenergo
1	**2**	**3**	**4**	**5**	**6**
32.	Relay personnel on operation and maintenance of Relay Protection of Substation 110-220 kV on dc control power	25.04-14.05	18	NMMC -5,VIES-1,NCO «ESAN»-2, Samarkand Enterprise Electrical Networks -1 Tashkent City Enterprise Electrical Networks -1 UIES-1, SDTPP-1,Chirchik HPS -1,And EEN-1, KashkadaryaEEN-1,NamanganEEN -1,SurkhandaryEEN -1, Uzmetkombinat -1.	**LLC «Xodimlar tayorlash markazi** CSRZA
32a	Electricians of Electric Power Line 4-6 labor grade.	4.04-23.04	16	NMMC -5, АГМК-3, Kashkadarya Enterprise Electrical Networks -1, Samarkand Enterprise Electrical Networks -1 VIES -1, Uztransgaz -1, Uzmetkombinat -1 Djizak Enterprise Electrical Networks -1, Tashkent City Enterprise Electrical Networks -1, Khorezm Enterprise Electrical Networks -1.	**LLC «Xodimlar tayorlash markazi** Fergana Enterprise Electrical Networks VIES
M A Y					
33.	Electricians on electrical meters	2.05-14.05	23	Uztransgaz -9, NMMC -3, Djizak Enterprise	**LLC**

	installation and replacement.			Electrical Networks- 3 Kashkadarya Enterprise Electrical Networks -2,KK Enterprise Electrical Networks -1, Tashkent Enterprise Electrical Networks -1 Fergana Enterprise Electrical Networks -1,АГМК-1, Uzmetkombinat -1, EnSozlash-1.	**«Xodimlar tayorlash markazi** Tashkent City Enterprise Electrical Networks
34.	Electricians on exploitation of rayon station 4-6 labor grade.	16.05-4.06	28	Khorezm Enterprise Electrical Networks - 6,AMMC-5, Samarkand Enterprise Electrical Networks -4, Djizak Enterprise Electrical Networks -3,NMMC-3, Kashkadarya Enterprise Electrical Networks -2, SD Enterprise Electrical Networks -2, Tash Enterprise Electrical Networks -2, Tashkent City Enterprise Electrical Networks -1	**LLC «Xodimlar tayorlash markazi**
35.	Electricians on electrical installations testing and measurement.	2.05-21.05	24	AMMC -6, NMMC 3, Uztransgaz -4, Samarkand Enterprise Electrical Networks -2 VIES -2,Bukhara Enterprise Electrical Networks -1, Tashkent Enterprise Electrical Networks -1, Djizak Enterprise Electrical Networks -1,Узметкомбинат-1, Navoi Enterprise Electrical Networks -1 Tashkent City Enterprise Electrical Networks -1,U-ZIES-1.	**LLC «Xodimlar tayorlash markazi** Ensozlash
36.	Sales engineers of RES	16.05-28.05	28	Andijan Enterprise Electrical Networks -2, Bukhara Enterprise Electrical Networks -2, Djizak Enterprise Electrical Networks -2, Kashkadarya Enterprise Electrical Networks - 2, KK Enterprise Electrical Networks -2, Namangan Enterprise Electrical Networks -2, Navoi Enterprise Electrical Networks -2, SD Enterprise Electrical Networks -2, Surkhandarya Enterprise Electrical Networks -2, Samarkand Enterprise Electrical Networks -2, Tashkent City Enterprise Electrical Networks -2, Tashkent Enterprise Electrical Networks - 2,Fergana Enterprise Electrical Networks - 2, Khorezm Enterprise Electrical Networks -2	**LLC «Xodimlar tayorlash markazi** Tashkent City Enterprise Electrical Networks
37.	Gas cutters	16.05-28.05	23	N.AngTPP-9,AngTPP-3,TashTPP-3, Uztransgaz -3,TalTPP-2,SDTPP-1, JSC «ET»-1, NavoiTPP-1	**LLC «Xodimlar tayorlash markazi**
1	**2**	**3**	**4**	**5**	**6**
38.	Work safety wardens	16.05-28.05	25	AMMC -9, Uztransgaz -3, Djizak Enterprise Electrical Networks - 2, Fergana Enterprise Electrical Networks -2,N.AngTPP-1,SDTPP-1, TashTPP-1,TashCHP -1,KadHPS -1, Andijan Enterprise Electrical Networks -1, Kashkadarya Enterprise Electrical Networks - 1, Khorezm Enterprise Electrical Networks -1, Tashkent City Enterprise Electrical Networks -1	**LLC «Xodimlar tayorlash markazi** SNTB
39.	Instrumentation worker of makeup demineralizer XVO	16.05-28.05	21	AMMC -7, «Ilgor»-5, TakhTPP-2, MubCHP-2, Uztransgaz -2, NavoiTPP-1 SDTPP-1, FerganaCHP-1	**LLC «Xodimlar tayorlash markazi** Узэн.созлаш
40.	Relay personnel CHP, TPP on auxiliaries of power plants operation and maintenance.	23.05-11.06	10	N.Angren TPP-2, Navoi TPP -2,TashCHP-2, SDTPP- 1,TalTPP-1,MubCHP - 1,FerganaCHP-1	**LLC «Xodimlar tayorlash markazi** CSRZA
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41.	Strappers	6.06-18.06	24	Uztransgaz -7, N.Angren TPP -3,TashTPP-3, Kashkadarya Enterprise Electrical Networks -1,JSC «ET»-2,CIES-1, Fergana TPP-1, Tashkent Enterprise Electrical Networks -1,Tashkent City Enterprise Electrical Networks -1, MubCHP-1,Navoi Enterprise Electrical Networks -1,U-ZIES-1, UzKEC-1	**LLC «Xodimlar tayorlash markazi**
42.	Electricians on cable lines operation and installation	6.06-25.06	28	AMMC -12, NMMC -6, Tashkent City Enterprise Electrical Networks -3, Tashkent Enterprise Electrical Networks -2, Andijan Enterprise Electrical Networks -1, Djizak Enterprise Electrical Networks -1, Kashkadarya Enterprise Electrical Networks -1, Fergana Enterprise Electrical Networks -1, Uztransgaz -1	**LLC «Xodimlar tayorlash markazi**
43.	Machinists of boilers PTMB, KVGM DKVR, GM	6.06-25.06	18	«Ilgor»-8,TashIM-5, JSC «Ammofos»-2 TalTPP-1, TashCHP-1, AMMC-1.	**LLC «Xodimlar tayorlash markazi** TashTPP
44.	Mechanics on gas equipment operation and maintenance	6.06-18.06	20	Navoi TPP -1, SDTPP-1,TashTPP-4,TalTPP-2, MubCHP-2,NMMC-1, AMMC - 7, Uzmetkombinat 1, «Ilgor»-1.	**LLC «Xodimlar tayorlash markazi** TashTPP
45.	Technical and engineering employees, on control for safe operation of FMS.	13.06-25.06	27	AMMC -10, Uztransgaz -8,TashCHP-3, TashTPP-1,N.Angren TPP-1,UIES- 1, JSC «ET»-1,UzKEC-1, «Ilgor»-1	**LLC «Xodimlar tayorlash markazi**
1	**2**	**3**	**4**	**5**	**6**
46.	Persons responsible for operational condition and safe operation of pressure vessel	13.06-25.06	23	Uztransgaz -9,AMMC-6,TashTPP-1,SDTPP-1 TashCHP-1,N.B.HPS -1,Uzbekcoal -1, Navoi TPP -1,CIES-1,JSC «ET»-1	**LLC «Xodimlar tayorlash markazi** TashTPP
47.	Sales engineers of RES	13.06-25.06	28	Andijan Enterprise Electrical Networks -2, Bukhara Enterprise Electrical Networks -2, Djizak Enterprise Electrical Networks -2, Kashkadarya Enterprise Electrical Networks -2, KK Enterprise Electrical Networks -2, Namangan Enterprise Electrical Networks -2, Navoi Enterprise Electrical Networks -2, SD Enterprise Electrical Networks -2, Surkhandarya Enterprise Electrical Networks -2, Samarkand Enterprise Electrical Networks -2, Tashkent City Enterprise Electrical Networks -2, Tashkent Enterprise Electrical Networks -2,Fergana Enterprise Electrical Networks -2, Khorezm Enterprise Electrical Networks -2	**LLC «Xodimlar tayorlash markazi** Tashkent City Enterprise Electrical Networks
48.	Specialists on environment protection.	20.06 -25.06	24	Uztransgaz -10, NMMC -4, AMMC -3, TashTPP-2 TashCHP-1, Tashkent Enterprise Electrical Networks -1, VIES-1, Uzensozlash-1, JSC «ORGRES» -1	**LLC «Xodimlar tayorlash markazi** COOC
49	Electricians of Electric Power Line 4-6 labor grade	6.06-25-06	15	NMMC -5, AMMC -3,КашПТЭС-1, Samarkand Enterprise Electrical Networks -1 VIES -1,Uztransgaz -1, Uzmetkombinat -1, SD Enterprise Electrical Networks -1, Tashkent Enterprise Electrical Networks -1	**LLC «Xodimlar tayorlash markazi** Fergana Enterprise

					Electrical Networks VIES
50.	Compressor installation operators 4-6 labor grade.	27.06-9.07	19	AMMC -7, Uztransgaz -4, «Ilgor»-5, TalTPP-1, SDTPP-1, CIES-1.	**LLC «Xodimlar tayorlash markazi** TashTPP
51	Electrical/gas welder Н.П.	27.06-16.07	22	Uztransgaz -10, N,Angren TPP-1,AngrenTPP- 1,Fergana CHP-1, Samarkand Enterprise Electrical Networks -1, JSC «ET»-1, TashIM-1,TakTPP-1, Djizak Enterprise Electrical Networks - 1, UzKEC -1, Tashkent City Enterprise Electrical Networks -1, MubCHP-1, Tashkent Enterprise Electrical Networks-1	**LLC «Xodimlar tayorlash markazi**
			J U L Y		
52.	Mechanics on gas equipment operation and maintenance.	11.07 -23.07	25	Uztransgaz -25	**LLC «Xodimlar tayorlash markazi** TashTPP
53.	Electricians on electrical equipment maintenance electrical stations.	11.07-30.07	22	NMMC-6,KadHPS -4,TashIM-3,TalTPP-3 N.Angren TPP-2,SDTPP-1,TashTPP-1, MubCHP-1, TashHPS-1	**LLC «Xodimlar tayorlash markazi** Ensozlash
1	**2**	**3**	**4**	**5**	**6**
54.	Strappers	11.07-23.07	24	Uztransgaz-6,N.Angren TPP-4,TashTPP-3, Kashkadarya Enterprise Electrical Networks -1, JSC «ET»-2,CIES-1, Fergana CHP -1, Tashkent Enterprise Electrical Networks -1,SDTPP-1, Andijan Enterprise Electrical Networks -1, Khorezm Enterprise Electrical Networks -1,TashIM- 1, UzKECK-1	**LLC «Xodimlar tayorlash markazi**
55.	Engineers on Safety Regulations	11.07-23.07	21	AMMC -4, Uztransgaz -4, Fergana Enterprise Electrical Networks –2, Khorezm Enterprise Electrical Networks -2, Djizak Enterprise Electrical Networks -1, Kashkadarya Enterprise Electrical Networks -1, NMMC-1, Surkhandarya Enterprise Electrical Networks -1, Tashkent Enterprise Electrical Networks -1, SDTPP-1, Andijan Enterprise Electrical Networks -1,UIES-1, «Ilgor»-1	**LLC «Xodimlar tayorlash markazi** SNTB
56	Sales Deputy Heads of RES	11.07-23.07	28	Andijan Enterprise Electrical Networks C-2, Bukhara Enterprise Electrical Networks -2, Djizak Enterprise Electrical Networks -2, Kashkadarya Enterprise Electrical Networks -2, KK Enterprise Electrical Networks -2, Namangan Enterprise Electrical Networks -2, Navoi Enterprise Electrical Networks -2, SD Enterprise Electrical Networks -2, Surkhandarya Enterprise Electrical Networks -2, Samarkand Enterprise Electrical Networks -2, Tashkent City Enterprise Electrical Networks -2, Tashkent Enterprise Electrical Networks -2, Fergana Enterprise Electrical Networks -2, Khorezm Enterprise Electrical Networks -2	**LLC «Xodimlar tayorlash markazi** Tashkent City Enterprise Electrical Networks
57	Computer courses	18.07-30.07	27	Kashkadarya Enterprise Electrical Networks -	**LLC**

	MS WORD, MS EXCEL			4, Surkhandarya Enterprise Electrical Networks -4,TashTPP-3, N.AngTPP-3, Tashkent City Enterprise Electrical Networks -3, SDTPP-2, U.Chirchik HPS -2, Tashkent Enterprise Electrical Networks -2, Khorezm Enterprise Electrical Networks -2, TashHPS -1,Uztransgaz -1.	**«Xodimlar tayorlash markazi** En.ASU
			A U G U S T		
58	Electricians 4-5 labor grade on operation and maintenance automations and measuring instruments (protection, warning system, electrical)	1.08-20.08	12	SDTPP-2,TashTPP-2,TalTPP-2,AMMC-2, AngTPP-1,TakhTPP-1,MubCHP-1,Fergana CHP-1.	**LLC «Xodimlar tayorlash markazi** Ensozlash
59.	Engineer-technical workers, responsible for maintenance of hydro mechanical transmission in working condition.	1.08-13.08	21	AMMC -8, Uztransgaz -4, SDTPP-1, TashHPS-1, Ammofos - 1,TashTPP-1, Navoi Enterprise Electrical Networks -1, Surkhandarya Enterprise Electrical Networks - 1, Khorezm Enterprise Electrical Networks - 1, JSC «ET»-1, «Ilgor»-1	**LLC «Xodimlar tayorlash markazi**
1	**2**	**3**	**4**	**5**	**6**
60.	Chief metrologists, engineers-metrologists responsible for measuring instruments conditions.	1.08 – 13.08	27	Uztransgaz -15,Uzbekcoal -1,Navoi TPP-1, SDTPP-1, Kashkadarya Enterprise Electrical Networks -1, NMMC -1,AngTPP-1, TashHPS-1,Andijan Enterprise Electrical Networks -1, Djizak Enterprise Electrical Networks -1 Tashkent Enterprise Electrical Networks - 1,VIES-1,Uzensozlash -1	**LLC «Xodimlar tayorlash markazi** Ensozlash
61.	Electricians on substations maintenance 2-3 labor grade.	1.08-20.08	17	Kashkadarya Enterprise Electrical Networks - 2, Fergana Enterprise Electrical Networks -2, Andijan Enterprise Electrical Networks -1, Bukhra Enterprise Electrical Networks -1, Djizak Enterprise Electrical Networks -1,KK Enterprise Electrical Networks -1, Navoi Enterprise Electrical Networks -1, SD Enterprise Electrical Networks -1, Samarkand Enterprise Electrical Networks -1, Tashkent City Enterprise Electrical Networks -1 Tashkent Enterprise Electrical Networks - 1,U-ZIES-1, Surkhandarya Enterprise Electrical Networks -1,VIES-1,Beruinskiy section -1	**LLC «Xodimlar tayorlash markazi**
62.	Relay personnel on operation and maintenance of ccomplete transformer substations 110-35-6-10 kV using complete switchgear for outdoor installation of Chirchik plant.	8.08-27.08	21	AMMC -4, NMMC -3, Samarkand Enterprise Electrical Networks -4, Djizak Enterprise Electrical Networks 1, JSC «ORGRES»-2,KK Enterprise Electrical Networks -1,Namangan Enterprise Electrical Networks -1, SD Enterprise Electrical Networks -1, Surkhandarya Enterprise Electrical Networks -1, Fergana Enterprise Electrical Networks -1 Khorezm Enterprise Electrical Networks 1,Uztransgaz-1	**LLC «Xodimlar tayorlash markazi** CSRZA
63.	Personnel related to receipt, release and using of mineral oil.	8.08-13.08	17	Uztransgaz -7, NMMC -3, AMMC -2, Uzmetkombinat-1,Ammofos -1, SDTPP-1, Tashkent City Enterprise Electrical Networks -1,VIES-1	**LLC «Xodimlar tayorlash markazi**
64.	Engineers on Safety Technique Regulations and Regulations of Fire Safety	15.08-27.08	31	NMMC -5, AMMC -4, Uztransgaz -3,N. Angren TPP-2 Kashkadarya Enterprise Electrical Networks - 2, Surkhandarya Enterprise Electrical	**LLC «Xodimlar tayorlash**

				Networks -2, Tashkent Enterprise Electrical Networks -2, Fergana Enterprise Electrical Networks -2, Khorezm Enterprise Electrical Networks -2,TashTPP-1, FerganaCHP-1,TashCHP-1,Andijan Enterprise Electrical Networks - 1 Djizak Enterprise Electrical Networks -1, SD Enterprise Electrical Networks -1, JSC «ET»-1	**markazi** SNTB
65.	Sales engineers of RES	15.08-27.08	28	Andijan Enterprise Electrical Networks -2, Bukhra Enterprise Electrical Networks -2, Djizak Enterprise Electrical Networks -2, Kashkadarya Enterprise Electrical Networks -2, KK Enterprise Electrical Networks -2, Namangan Enterprise Electrical Networks -2, Navoi Enterprise Electrical Networks -2, SD Enterprise Electrical Networks -2, Surkhandarya Enterprise Electrical Networks -2, Samarkand Enterprise Electrical Networks -2, Tashkent City Enterprise Electrical Networks -2, Tashkent Enterprise Electrical Networks -2, Fergana Enterprise Electrical Networks -2, Khorezm Enterprise Electrical Networks -2	**LLC «Xodimlar tayorlash markazi** Tashkent City Enterprise Electrical Networks
1	**2**	**3**	**4**	**5**	**6**
S E P T E M B E R					
66.	Electricians on exploitation of RS 2-3 labor grade.	5.09-24.09	22	Khorezm Enterprise Electrical Networks -3, Djizak Enterprise Electrical Networks -3,Uztransgaz - 2, SD Enterprise Electrical Networks -1, Andijan Enterprise Electrical Networks -1, Bukhra Enterprise Electrical Networks -1 Kashkadarya Enterprise Electrical Networks -1,KK Enterprise Electrical Networks -1, Navoi Enterprise Electrical Networks -1, Fergana Enterprise Electrical Networks -2, Samarkand Enterprise Electrical Networks -2, Tashkent City Enterprise Electrical Networks -2, Tashkent Enterprise Electrical Networks -2.	**LLC «Xodimlar tayorlash markazi**
67.	Information and communication technologies courses	5.09-17.09	14	CIES-4, Kashkadarya Enterprise Electrical Networks -2,KK Enterprise Electrical Networks -2, SD Enterprise Electrical Networks -2TashHPS-1,Khorezm Enterprise Electrical Networks -1, U-ZIES-1, JSC «ORGRES»-2	**LLC «Xodimlar tayorlash markazi** En. ASU
68.	Specialists on operation and maintenance of complete transformer substations 11035-6-10 kV using complete switchgear for outdoor installation of K-47, K59 type of Samara plant	5.09-24.09	22	NMMC -4, Uztransgaz 4, AMMC -2, Samarkand Enterprise Electrical Networks -2 Khorezm Enterprise Electrical Networks -2, Djizak Enterprise Electrical Networks -1, SD Enterprise Electrical Networks -1, Namangan Enterprise Electrical Networks -1, Tashkent Enterprise Electrical Networks -1, Tashkent City Enterprise Electrical Networks -1. Kashkadarya Enterprise Electrical Networks -1, Navoi Enterprise Electrical Networks -1,JSC «ORGRES»-1	**LLC «Xodimlar tayorlash markazi** CSRZA
69.	Persons responsible for safe production of crane operations.	5.09-17.09	31	AMMC -10, Uztransgaz -4, N.Angren TPP-2, Andijan Enterprise Electrical Networks -2, TashTPP-2, Khorezm Enterprise Electrical Networks - 1,	**LLC**

				SDTPP-1, Chirchik HPS-1, Tashkent Enterprise Electrical Networks -1, U-ZIES-1,JSC «ET»-1,TashIM -1, AngTPP-1, Tashkent City Enterprise Electrical Networks -1, TashTPP-1, UzKEC-1	**«Xodimlar tayorlash markazi**
70.	Sales engineers of RES	12-09-24.09	28	Andijan Enterprise Electrical Networks -2, Bukhra Enterprise Electrical Networks -2, Djizak Enterprise Electrical Networks -2, Kashkadarya Enterprise Electrical Networks -2, KK Enterprise Electrical Networks -2, Namangan Enterprise Electrical Networks -2, Navoi Enterprise Electrical Networks -2, SD Bukhara Enterprise Electrical Networks -2, Surkhandarya Enterprise Electrical Networks 2, Samarkand Enterprise Electrical Networks -2, Tashkent City Enterprise Electrical Networks -2, Tashkent Enterprise Electrical Networks -2, Fergana Enterprise Electrical Networks -2, Khorezm Enterprise Electrical Networks -2	**LLC «Xodimlar tayorlash markazi** Tashkent City Enterprise Electrical Networks
71	Persons responsible for operational condition and safe operation of pressure vessel	12.09-24.09	22	Uztransgaz -9,AMMC-6,TashTPP-1,SDTPP-1 KadHPS-1,N.B.HPS -1,Andijan Enterprise Electrical Networks -1, VIES-1, Ammofos-1	**LLC «Xodimlar tayorlash markazi** TashTPP
1	**2**	**3**	**4**	**5**	**6**
72.	Electricians on boilers, fittings, pipelines maintenance	12.09-24.09	34	AMMC-9,TashTPP-7, Uztransgaz -5,TalTPP-3 N.AngrenTPP-2, MubCHP-2, AngrenTPP-1 SDTPP-1,TashCHP-1,NavoiTPP-1,Fergana CHP-1, JSC «ET»-1.	**LLC «Xodimlar tayorlash markazi** Tash TPP
73.	Electricians on cable lines operation and installation.	12.09-30.09	15	Uztransgaz -3,Djizak Enterprise Electrical Networks -1, Tashkent City Enterprise Electrical Networks -2, Andijan Enterprise Electrical Networks -1, Samarkand Enterprise Electrical Networks -1,NMMC-1, Tashkent Enterprise Electrical Networks -1,Uzmetkombinat -1, Bukhara Enterprise Electrical Networks -1, KK Enterprise Electrical Networks -1, Surkhandarya Enterprise Electrical Networks -1, Khorezm Enterprise Electrical Networks -1	**LLC «Xodimlar tayorlash markazi** Tashkent City Enterprise Electrical Networks
74.	Electricians of Emergency Crew on functional switching in rayon stations 0,4-6-10 kV 35 кВ and above on operation switching	26.09-15.10	18	NMMC -6, Tashkent Enterprise Electrical Networks -2, AMMC-2, Bukhara Enterprise Electrical Networks -1 Uzmetkombinat -1,Navoi Enterprise Electrical Networks -1, Fergana Enterprise Electrical Networks -1, Tashkent City Enterprise Electrical Networks -1, Khorezm Enterprise Electrical Networks -1,KK Enterprise Electrical Networks -1, SD Enterprise Electrical Networks -1.	**LLC «Xodimlar tayorlash markazi**
75.	Electricians on testing and measurement in electrical installations	26.09-15.10	24	AMMC -6, NMMC -4, Uztransgaz -3, Samarkand Enterprise Electrical Networks -2 VIES-2, Bukhra Enterprise Electrical Networks -1, Kashkadarya Enterprise Electrical Networks -1, Djizak Enterprise Electrical Networks -1, Navoi Enterprise Electrical Networks -1, Tashkent City Enterprise Electrical Networks -1, U-ZIES-1, Uzmetkombinat -1	**LLC «Xodimlar tayorlash markazi** Uzensozlash

76.	Gas cutters	26.09-15.10	22	Uztransgaz -10, H. AngrenCHP -1, AngrenTPP-1, FerCHP-1, Samarkand Enterprise Electrical Networks 1, JSC «ET»-1, TashIM -1,TalTPP-1, Djizak Enterprise Electrical Networks -1, UzKEC-1 Tashkent City Enterprise Electrical Networks -1, Chirchik HPS-1, Fergana Enterprise Electrical Networks -1.	**LLC «Xodimlar tayorlash markazi**
O C T O B E R					
77.	Sales Deputy Heads of RES	3.10-15.10	28	Andijan Enterprise Electrical Networks -2, Bukhra Enterprise Electrical Networks -2, Djizak Enterprise Electrical Networks -2, Kashkadarya Enterprise Electrical Networks - 2, KK Enterprise Electrical Networks -2, Namangan Enterprise Electrical Networks -2, Navoi Enterprise Electrical Networks -2, SD Enterprise Electrical Networks -2, Surkhandarya Enterprise Electrical Networks -2, Samarkand Enterprise Electrical Networks -2, Tashkent City Enterprise Electrical Networks -2, Tashkent Enterprise Electrical Networks -2, Fergana Enterprise Electrical Networks -2, Khorezm Enterprise Electrical Networks -2	**LLC «Xodimlar tayorlash markazi** Tashkent City Enterprise Electrical Networks
1	**2**	**3**	**4**	**5**	**6**
78	Personnel related to receipt, release and using of mineral oil.	3.10-8.10	17	Uztransgaz -6, NMMC 2, AMMC - 3,TashTPP-1 Uzmetkombinat -1, Ammofos -1, Fergana Enterprise Electrical Networks -1, UzKEC -1, «Ilgor»-1	**LLC «Xodimlar tayorlash markazi**
79.	Relay personnel on operation and maintenance PS 110-220 kV in constant operational current	10.10-29.10	18	NMMC -4,VIES-2, NCO «ESAN»-1, Sam Enterprise Electrical Networks -1, Tashkent City Enterprise Electrical Networks -1, Uzmetkombinat -1, Navoi TPP-1, N.B.HPS-1, Chirchik HPS-1, Djizak Enterprise Electrical Networks -1,KK Enterprise Electrical Networks-1, Navoi Enterprise Electrical Networks - 1, Khorezm Enterprise Electrical Networks -1, U-ZIES -1.	**LLC «Xodimlar tayorlash markazi** CSRZA
80.	Dispatchers ODG RES и ODS of Electric Networks Enterprise	17.10-5.11	17	Djizak Enterprise Electrical Networks -3, Kashkadarya Enterprise Electrical Networks - -2, Tashkent Enterprise Electrical Networks -- 2, Khorezm Enterprise Electrical Networks -2, Andijan Enterprise Electrical Networks - - 1,Navoi Enterprise Electrical Networks - 1, SD Enterprise Electrical Networks -1, Surkhandarya Enterprise Electrical Networks -1, Sam Enterprise Electrical Networks -1, Uztransgaz - 1 Bukhara Enterprise Electrical Networks -1, Namangan Enterprise Electrical Networks -1.	**LLC «Xodimlar tayorlash markazi**
81.	Verificators electrical measuring instruments	17.10-5.11	15	N.AngTPP-1,Navoi TPP-1,SDTPP-1, TashTPP-1,Fergana TPP-1, AAndijan Enterprise Electrical Networks -1, Bukhra Enterprise Electrical Networks - 1,TalTPP-1,Djizak Enterprise Electrical Networks - 1, Kashkadarya Enterprise Electrical Networks - -1, KK Enterprise Electrical Networks -1, CIES-1, Fergana Enterprise Electrical Networks - 1, U-ZIES-1,Uzensozlash -1.	**LLC «Xodimlar tayorlash markazi** Uzensozlash

82.	Compressor installation operators 2-6 labor grade.	17.10-29.10	19	AMMC -7, Uztransgaz -5, «Ilgor»-4, TalTPP-1, Navoi TPP -1, TashTPP-1.	**LLC «Xodimlar tayorlash markazi** TashTPP
83.	Gas cutters	17.10-29.10	22	N.AngTPP-9, AngrenTPP-3, TashTPP-3, Uztransgaz -3, TalTPP-2, MubCHP- 1 Navoi TPP-1.	**LLC «Xodimlar tayorlash markazi**
84.	Work safety wardens	17.10-29.10	25	AMMC -8, Uztransgaz -3, Djizak Enterprise Electrical Networks -2, Fergana Enterprise Electrical Networks -2, N.Angren TPP-2, SDTPP-1, TashTPP-1,TaskCHP -1, KadHPS-1, Andijan Enterprise Electrical Networks -1, Kashkadarya Enterprise Electrical Networks -1, Khorezm Enterprise Electrical Networks -1, TashTPP-1	**LLC «Xodimlar tayorlash markazi** SNTB
1	**2**	**3**	**4**	**5**	**6**
85.	Electricians of Electric Power Line 2-3 labor grade.	17.10-5.11	28	VIES-4, Uztransgaz -7, Andijan Enterprise Electrical Networks -2, Bukhara Enterprise Electrical Networks -2, Kashkadarya Enterprise Electrical Networks -2, Samarkand Enterprise Electrical Networks -2, Fergana Enterprise Electrical Networks - -2,U-ZIES-2,Namangan Enterprise Electrical Networks - 1, SD Enterprise Electrical Networks -1, Tashkent Enterprise Electrical Networks - -1, UIES-1, Djizak Enterprise Electrical Networks - 1.	**LLC «Xodimlar tayorlash markazi** Fergana Enterprise Electrical Networks VIES
			N O V E M B E R		
86.	Electricians on Substations 4-6 labor grade.	7.11-26.11	18	Uztransgaz -6, AMMC -3, Kashkadarya Enterprise Electrical Networks - - 2,VIES-1 Uzmetkombinat -1, Andijan Enterprise Electrical Networks -1, Djizak Enterprise Electrical Networks -1, Navoi Enterprise Electrical Networks -1, Samarkand Enterprise Electrical Networks - 1, Tashkent Enterprise Electrical Networks - 1.	**LLC «Xodimlar tayorlash markazi**
87.	Specialists on TCD	7.11-19.11	12	NMMC -4, AMMC -1, Kashkadarya Enterprise Electrical Networks -1, Fergana Enterprise Electrical Networks -1, Tashkent City Enterprise Electrical Networks -1, Khorezm Enterprise Electrical Networks -1,CIES-1, U-ZIES-1,JSC «ORGRES»-1	**LLC «Xodimlar tayorlash markazi**
88.	Electricians on electrical meters installation and replacement.	7.11-19.11	22	Uztransgaz -8, NMMC -4, Djizak Enterprise Electrical Networks - 2, KK Enterprise Electrical Networks -1, Kashkadarya Enterprise Electrical Networks -2, AMMC - 1, Tashkent Enterprise Electrical Networks -1, Fergana Enterprise Electrical Networks -1,Uzmetkombinat-1, Tashkent City Enterprise Electrical Networks -1	**LLC «Xodimlar tayorlash markazi** Tashkent City Enterprise Electrical Networks
89.	Electrical/gas welders	7.11-26.11	22	Uztransgaz -10, N.Angren TPP -1,Angren TPP-1,	

				Fergana CHP-1, Samarkand Enterprise Electrical Networks -1,JSC«ET»-1, UzKEC-1,TahTPP-1,TashCHP-1, Kashkadarya Enterprise Electrical Networks -1, Khorezm Enterprise Electrical Networks -1, Enterprise Electrical Networks -1, S-ZIES-1	**LLC «Xodimlar tayorlash markazi**
90.	Information and communication technologies courses	7.11-19.11	13	CIES-4, Kashkadarya Enterprise Electrical Networks -2,KK Enterprise Electrical Networks -2,SDTPP-1, JSC «ORGRES»-1, TashHPS-1,Namangan Enterprise Electrical Networks -1 Khorezm Enterprise Electrical Networks -1	
91.	Mechanics on operation and maintenance of gas equipment.	7.11-19.11	25	Uztransgaz -25	**LLC «Xodimlar tayorlash markazi** TashTPP
1	**2**	**3**	**4**	**5**	**6**
92	Chief metrologists, engineers - metrologists, responsible for measuring instruments condition.	14.11-26.11	27	Uztransgaz -14, Uzbekcoal-2, Navoi TPP- 1, SDTPP-1, Kashkadarya Enterprise Electrical Networks -1,NMMC-1, Bukhara Enterprise Electrical Networks -1 N. Angren TPP-1,U. Circhik HPS-1, Samarkand Enterprise Electrical Networks -1, Khorezm Enterprise Electrical Networks -1,U-ZIES-1, AMMC -1.	**LLC «Xodimlar tayorlash markazi** Ensozlash
93.	Sales engineers of RES	14.11-26.11	28	Andijan Enterprise Electrical Networks -2, Bukhara Enterprise Electrical Networks -2, Djizak Enterprise Electrical Networks -2, Kashkadarya Enterprise Electrical Networks -2, KK Enterprise Electrical Networks -2, Namangan Enterprise Electrical Networks -2, Navoi Enterprise Electrical Networks -2, SD Enterprise Electrical Networks -2, Surkhandarya Enterprise Electrical Networks -2, Samarkand Enterprise Electrical Networks -2, Tashkent City Enterprise Electrical Networks -2, Tashkent Enterprise Electrical Networks -2, Fergana Enterprise Electrical Networks -2, Khorezm Enterprise Electrical Networks -2	**LLC «Xodimlar tayorlash markazi** Tashkent City Enterprise Electrical Networks
94.	Electricians on cable lines operation and installation.	28.11-17.12	14	Uztransgaz -2, Djizak Enterprise Electrical Networks -2, Tashkent City Enterprise Electrical Networks -1, Andijan Enterprise Electrical Networks -1, Samarkand Enterprise Electrical Networks -1, Tashkent Enterprise Electrical Networks -1, Fergana Enterprise Electrical Networks -1, «Ilgor»-1, NMMC -1, Uzmetkombinat -1, Kashkadarya Enterprise Electrical Networks 1, SD Enterprise Electrical Networks -1	**LLC «Xodimlar tayorlash markazi** Ensozlash
D E C E M B E R					
95.	Mechanics on gas equipment operation and maintenance	5.12-17.12	25	Uztransgaz -25	**LLC «Xodimlar tayorlash markazi** TashTPP
96.	Electricians of Emergency Crew on functional switching in rayon stations 0,4-6-10 kV	5.12-24.12	28	NMMC -5,Uztransgaz -5, Kashkadarya Enterprise Electrical Networks -3 Tashkent City Enterprise Electrical Networks -3, SD Enterprise Electrical Networks, D Enterprise Electrical Networks -2,Khorezm Enterprise Electrical Networks -1,	

				AMMC -2,Surkhandarya Enterprise Electrical Networks -1,Fergana Enterprise Electrical Networks -1 Djizak Enterprise Electrical Networks -2,SDTPP-1, Tashkent Enterprise Electrical Networks -2	
97.	Specialists of calculation posts type PVZ-90	5.12-24.12	22	NMMC -9,VIES-4,NCO «ESAN»-2,TalTPP-1, UIES-1,MubCHP-1, Kashkadarya Enterprise Electrical Networks -1 U.Chirchik HPS-1,Namangan Enterprise Electrical Networks -1,U-ZIES-1	**LLC «Xodimlar tayorlash markazi** CSRZA
98.	Persons responsible for safe production of crane operations	5.12-17.12	30	AMMC -10,Uztransgaz -3,N.AngTPP -2, Andijan Enterprise Electrical Networks -2,TashTPP-1, Khorezm Enterprise Electrical Networks -1, SDTPP-1U.Chirchik HPS-1,Tashkent Enterprise Electrical Networks -1, U-ZIES-1,JSC «ET»-1,TashIM-1, Navoi TPP-1,CIES-1,TashTPP-2,SD Enterprise Electrical Networks, DEnterprise Electrical Networks-1	**LLC «Xodimlar tayorlash markazi**
1	**2**	**3**	**4**	**5**	**6**
99.	Sales engineers of RES	5.12-17.12	28	Andijan Enterprise Electrical Networks -2, Bukhra Enterprise Electrical Networks -2, Djizak Enterprise Electrical Networks -2, Kashkadarya Enterprise Electrical Networks -2, KKEnterprise Electrical Networks -2, Namangan Enterprise Electrical Networks -2, Navoi Enterprise Electrical Networks -2, SD Enterprise Electrical Networks -2, Surkhandarya Enterprise Electrical Networks -2, Samarkand Enterprise Electrical Networks -2, Tashkent City Enterprise Electrical Networks -2, Tashkent Enterprise Electrical Networks -2, Fergana Enterprise Electrical Networks -2, Khorezm Enterprise Electrical Networks -2	**LLC «Xodimlar tayorlash markazi** Tashkent City Enterprise Electrical Networks
100	Persons responsible for operational condition and safe operation of pressure vessel	12.12-24.12	22	Uztransgaz -8,AMMC-5,TashTPP-2, TashCHP-1 , KadHPS -1,Uzbekcoal-1, Ammofos-1, Khorezm Enterprise Electrical Networks -1, SIES-1, «Ilgor»-1.	**LLC «Xodimlar tayorlash markazi** TashTPP
101	Manufactures of works	19.12-24.12	18	Samarkand Enterprise Electrical Networks-4, Djizak Enterprise Electrical Networks -2, Kashkadarya Enterprise Electrical Networks -2, Tashkent Enterprise Electrical Networks -2, Khorezm Enterprise Electrical Networks -2, Andijan Enterprise Electrical Networks -1, VIES-1, U-ZIES-1, Uztrangaz -1, Tashkent City Enterprise Electrical Networks -1,SIES-1,	**LLC «Xodimlar tayorlash markazi** SNBT

Total - 2260 persons

Including:
New preparedness - 188 persons
Employee training and education - 1008 persons
Workers training and education - 1064 persons

Director LLC «Xodimlar tayorlash markazi» **B.S. Nurmatov**

*** Terms of courses can be changed**

Appendix 15

Draft final by JET on 25th May, 2018

Manual for preparing Training Plan

1. Purpose

This manual is intended to prepare "Training Plan" for New Navoi Training Center (NTC) to train O&M staffs for CCPP.

2. Manual user

Director of NTC and Chief trainer of each subjects use this manual and prepare Training Plan for the next year, and for midterm plan.

3. Schedule for preparing Annual Training Plan

After Lecture Plan for the next year is prepared, NTC prepares the draft of Annual Training Plan for the next year considering contents of Lecture Plan by September and submit it, i.e. each Lecture Plan and Draft of Annual Training Plan draft, to Department "Work with personnel" of UE Headquarter (UE-HQ).

Department "Work with personnel" distributes Annual Training Plan draft to each CCPP and Power Plant Operation Department of UE-HQ, aggregates the attendance needs for training (Number of trainees; including new employees, Timing of training, etc.) and submit it to NTC in October.

NTC confirms the attendance needs for training in each CCPP, readjusts the training implement timing, etc., finalizes the Annual Training Plan, and submits it to Department "Work with personnel". Department "Work with personnel" announces the Annual Training Plan by the end of December. NTC also should create the Midterm Training Plan in every 3 years, according to these information, for grasping the whole impression of information, with cooperation of Plant Operation Department of UE-HQ.

4. Responsible trainer for preparing Annual Training Plan

Chief trainers for each training subject appointed by NTC Director cooperate with the others Chief trainers in the same field to prepare Training Plan for each field.

NTC administration confirms the draft of Annual Training Plan for each field, adjusts it as necessary, coordinates the draft of Annual Training Plan, and NTC Director approves it.

Chief trainers readjust the draft of Annual Training Plan by confirming the training attendance needs of each CCPP. And also readjust the Lecture Plan if needed.

NTC administration coordinates and finalizes Annual Training Plan.

NTC Director approves Annual Training Plan.

5. How to prepare Training Plan

Training Plan, refer to attachment 1 and attachment 2, should be prepared as follows.

【Step1 ; Preparation of the draft of Annual Training Plan】

NTC prepares the draft of Annual Training Plan for the next year by September. Since the draft of Annual Training Plan is for confirming the training attendance needs, NTC plans to implement a lot of training as far as practicable.

Chief trainer cooperates with the others in the same field (3 fields; machinery, electricity, facility field) and prepares Annual Training Plan for each field.

NTC administration confirms that there is no duplication of the schedule, equipment, target trainees, place of training, etc. and revises it as necessary. NTC administration coordinates the draft of Annual Training Plan for the 3 fields, NTC Director approves it, and submits it to Department "Work with personnel" of UE-HQ.

【Step2 ; Finalization of Training Plan】

Chief trainer of each course cooperates with the others in the same field to examine training attendance needs receive from UE-HQ and readjusts the number of training, the schedule, the number of trainee , etc., as necessary.

NTC administration coordinates and finalizes Annual Training Plan. Director of NTC approves it and submits it to UE-HQ by the end of December. UE-HQ publishes the finalized annual training plan for next year, to each CCPP and Power Plant Operation Department of UE-HQ.

【Step3 ; Creation of Midterm Training Plan】

NTC Director and administration cooperate with Plant Operation Department of UE-HQ to create Midterm Training Plan in every 3 years, according to the installation plan of CCPP and current Annual Training Plan. NTC Director manage the resource enhancement of Training Center, if there were needs of some investment depending on Midterm Training Plan.

End of Manual

Appendix 15 - attachment-1

(Example) Annual Training Plan ▼end of the project As of 2018.01.28

Year	2017										2018												2019											
Month	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	
JET mission / TOT in JPN			8th		9th						10th	11th	JPN			12th			13th					14th											
COD of CCPP	-> Navoy CCPP1, Tashkent CHP									▼Tashkent CCPP, Talimarjan CCPP1,2												▼Tashkent CHP				Navoy CCPP2, Turakurgan CCPP1,2▼										
other event													▼Completion of TC																						
periodical maintenance of CCPP		▼Trial Training									MI (Navoy 1)▼																	CI (TashkentCCPP)▼								Total
1 Non-destructive testing																10						20		20	10	20								80
2 Vibration analysis for rotating machine																					20		20		20		20						20		100
3 Remaining life assessment																						10		10		10									30
4 Gas Turbinecombined power generation equipment		35														10					20		20		20		20					10	10	145
5 GT Hot Parts Maintenance		35																				10		10		10									65
6 Details of Electrical facilities for GT CCPP																						10		10		10		10						10	50
7 Operation & Control Theory of GT Combined Cycle Power Plant																10					20		20		20		20						20	110
8 Details of Control & Instrument Devices for GT CCPP																					10		10		10		10					10		50
9 GT Operation & Maintenance		35														10						20		20		20								105
10 GT Control System		35																			10		10		10		10					10		85
11 GT Electrical Control System																					10		10		10		10					10		50
12 GT O&M Lecture																						10		10		10		10					10	50

Annual Training plan of JSC "NTPP"'s Training Centre

＊1 Training schedule should be clarified for each target trainee, number of trainee, consideration of same condition course if needed, duration and so on.

＊2 Target Trainee should be classified, as a manager, engineer, operation staff, new employee and etc.

Course subject	Training Schedule *1	Trainer	Number of hours	Target Trainee ＊2 (number of people)	Equipment for course
1. Non Destructive Inspection technology	①○○～●● ②△△～▲▲ ③□□～■■			① Manager（x） ② Engineer（y） ③ Operation Staff（z）	
Overview of penetrant testing					
Overview of Magnetic particle testing					
Overview of practical training Ultra sonic testing					
4. Gas Turbine Combined Cycle power generation					
Overview of Navoi TPP					
Basics of Combined Cycle Power Generation					
Basic Knowledge of Gas Turbines					
Periodic and Combustor Inspections					
Heat Recovery Steam Generator					
Steam Turbine					
Trouble Examples					
5. Gas Turbine Hot Parts Maintenance					
Basics of Gas Turbine Hot Parts					
Basics of Gas Turbine Hot Parts (Auxiliary material)					
Inspections and Tests					
Damage and Repair					
Remaining Life Assessment					
Remaining Life Assessment [Exercise]					
Hot Parts Control Method					
GT Maintenance					
6. Details of Electrical Facilities for Gas Turbine Combined Cycle Power Plant					
Summary					
Static Frequency Converter					
Automatic Voltage Regulator					
Excitation System					

Circuit Breaker					
Generator Protection Relay					
Basic Concept for Inspection and Maintenance					
Practice (Digital Relay adjustment)					
Control and Instrument					
Summary					
Fundamental of Control System					
Digital system					
Actuators in CCPP					
Sensors in CCPP					
Sub-systems in CCPP					
Practice of C&I System Implementation					
Conclusion					
7. Operation & Control Theory of Gas Turbine Combined Cycle Power Plant					
Summary					
System Configuration of CCPP					
Gas Turbine Control					
Gas Turbine OPS Screen					
Principles of fuel limit					
The output of the control signal (CSO)					
- Frequency controller control (GVCSO)					
- Load control (LDCSO)					
- Blade path temperature control (BPCSO)					
- Exhaust gas temperature control (EXCSO)					
- Fuel limit control (FLCSO)					
Fuel gas distribution					
Cyclogram					
Steam System Control					
CCPP Operation					
CCPP Monitoring & Protection					
Conclusion					
9-1 CO_2 Fire Fighting System for Gas Turbine and Fuel Gas Unit & Fire Detection System for GT Control Package					
CO2 FF SYSTEM FOR GT					

PACKAGE					
9-2 TRAINING MANUAL FOR INTRODUCTION TO GAS TURBINE INLET, EXHAUST SYSTEMS AND ACCESSORIES					
Inlet air system					
9-3 GT AUXILIARY EQUIPMENTS					
9-4 HEAT EXCHANGERS					
9-5 Gas Turbine Maintenance					
Planned Outage					
Outage Planning					
Tools					
Foreign Material Control					
Lay Down Plan					
9-6 Major inspection					
Major Inspection of Gas Turbines					
№3 Remaining Life Assessment technologies					
Importance of Remaining Life Assessment					
Basics of Metal					
Aging mechanism					
Examples of damage					
Remaining life assessment technologies					
Examples of assessment					
Measures to improve strength					
№ 10 GT System Description and P&I diagram					
Fuel gas system					
Air and flue system					
Anti-icing system					
Hazardous Area Classification					

Operation procedure					
General description of unit interlock					
GT casing air cooling system					
Blade washing procedure					
Fuel gas last chance net skid					
General knowledge of combuster tuning					

Appendix 16

Proposed by JICA Expert Team
revised on 26th April, 2018

Manual for preparing Lecture Plan/ Lesson Plan

1. Purpose

This manual is for preparing "Lecture Plan/ Lesson Plan" of New Navoi Training Center (NTC), to implement training O&M Staffs of CCPP.

2. Manual user and target subject

Trainer of New NTC will utilize this manual, to create Lecture Plan/ Lesson Plan, of Class Room training/ Practical training, for each training subject of New NTC. Target subjects of this manual are prepared by "The Project for Establishment of the Combined Cycle Gas Turbine (CCGT) O&M Training Center". They are 12 subjects for O&M CCPP, classified in Machinery field, Electricity field and Facility field.

3. Creation timing of Lecture Plan/ Lesson Plan

Lecture Plan should be created and submitted to Director NTC, before making annual Training Plan.

4. Responsible Trainer to create Lecture Plan/ Lesson Plan

Chief Trainer, appointed by Director NTC for each subject, have responsibility to create Lecture Plan with cooperation of other trainer for the same subject. Other Trainer for the same subject should cooperate to create Lecture Plan under Chief Trainer.

5. Necessary information in Lecture Plan/ Lesson Plan

The Lecture Plan is equivalent to the so-called syllabus. So, it should include the necessary issues as follows. (Form of Lecture Plan are attached.)

① Title of Training Course/ Subject number and Title

② Responsible Trainer's Name, such like as under
(i) Chief Trainer (responsible to prepare Lecture Plan)
(ii) Deputy Trainer (implementing Training)
(iii) Assistant Trainer (Apprentice/new trainer, in many case to assist practical training)

③ Trainee's number
Standard Number of Trainee for suitable training

④ Target Trainee, Jobs & positions
Target trainee should be classified, new employee, O&M staff, Engineer and Manager. Training should be carried out separately, because the focal point to train will different among them, even if for the same subject.

⑤ Course Period/ Duration
Training schedule, from starting day to completion day.
How long it take days and hours to implement training.

⑥ Course contents and hours
All subjects include chapter/ subtitles, and training schedule should be divided and planned necessary

hours for each subtitle.

⑦ Equipment

Necessary equipment and supplementary goods for training should be prepared, without overlapping other training course/ classes at the same time.

⑧ Milestone/ Check point of training

Key point of training and/or stress point of training should be prepared before training. It should be prepared depends on target trainee, because the main point of view will be deferent among them.

⑨ Evaluation criteria

Chief trainer should prepare evaluation criteria, to judge the trainee's achievement of training, prior. Evaluation issues will be as follows.

(a) Mandatory value of attendance rate of training; attendance will be recorded by specialist NTC

(b) Attitude in training; will checked by Trainer in charge

(c) Aggressiveness like as question in training; will checked by Trainer in charge

(d) Result of completion examination; score of test/ objective fact

(e) Other point of view for evaluation; It should be discussed among Director, Chief Trainer and Trainer in charge of NTC, and add this evaluation in the case of necessary.

(f) Aptitude for course; Director, Chief Trainer and Trainer in charge of NTC will check all of result from (a) to (e), to judge the pass or fail.

⑩ Specific Question & typical Answer (Q&A)

Q&A for completion examination should be prepared by Chief trainer, as a Lecture plan, before implementation of training. It is able to use for training and for completion examination. It should be prepared depends on target trainee, because the main point of view will be deferent among them.

Trainer in charge implement completion examination, and could select actual question from Q&A to use.

6. Revision of Lecture Plan/ Lesson Plan

Lecture plan should be revised by each year, according to the result of last year performance and feedback from trainees. It should be improved step by step along every year. So that, Lecture plan should be created before starting training annually.

End of manual

Lecture/Lesson plan *Form* **Date: _____ ___, 2018.**

Training Centre for the operation and maintenance of CCPP
"CONFIRMED BY"
Director of Training Centre
_____ Shukhrat Dostov.

1. Number and name of the training course, and Trainer
   Course №z. xxxxxxx-title-xxxxxxxxx
   Responsible instructor for this course
   Chief:
   Deputy:
   Others:
2. Standard number of trainees, and his Position/JOB
   yyy trainees.
   Target Audience:
   "Name of Organization"; New employee/ or O&M Staff & workers/ or Engineer/ or Manager
3. Course duration (hours)
   From day month year; to day month year
   A days (B hours)
4. Course content and hours

№	Chapter Name (Chapter Title)	Days	Hours
1		First	7
2		Second	3
3		Second	4
4		Third	6
5		Third	1

5. Required equipment for this course
   Equipment Name (equipment list, if needed)
6. Milestones in this course

№	Control points in details
1	
2	
3	
4	

7. Questions and typical answers for the final course exam
   It should be described that till when and by whom, Q&A list on section 9 in next page will be prepared.
8. Criteria to evaluate trainees

№	Parameters	Result / Criteria
1	Training attendance record of each trainee	Attend rate (%)
2	Number of questions asked by each trainee by each, and its quality	Number, attitude etc.
3	Understanding of the lecture, results of completion examination	Passing score

Chief trainer should prepare specific questions and typical answers for completing the course exam to confirm understanding of the course. More than 10 question required.

9. Specific Q&A, for course No z (xxxxxxxxxxxxxxxxxxxxxxxxxx)

Q&A should be more than 10, Question can be used both in training and in examination.

No	Chapter	Question (drawings are separated)	Typical answer (drawings are separated)
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			

Chief trainer should prepare specific questions and typical answers for completing the course exam to confirm understanding of the course. More than 10 question required.

Appendix 17

by JET on 24th April, 2018

revise2 on 16th May 2018

Manual for Authorization of Trainer under the Project

1. Purpose

This manual is for authorization the trainer of New Navoi Training Center (NTC) under the Project.

2. Manual user and target trainer

"The Project for Establishment of the Combined Cycle Gas Turbine (CCGT) O&M Training Center", (hereinafter "the Project"), utilize this manual to authorize the trainer of New NTC from Trainer Candidate, for each training course of New NTC. Target Trainer Candidate of this manual are trained in the Project. There are 12 subjects, classified in Machinery field, Electricity field and Facility field, and each subject needs several trainers to implement suitable training course.

3. Scope of Authorization

Each authorization of Trainer will be scope within each by each training course (subject). So, Trainer Candidate needs to complete the training for the required subject.

4. Requirement to become Trainer Candidate

① Candidate should be recommended by Uzbekenergo Headquarter.

② Candidate should passed the interview by JICA Expert Team (JET).

JET implement the interview, with care of the background, knowledge, interview attitude, etc., and judges whether he is appropriate personnel for Trainer Candidate.

5. Basic condition to become Trainer

③ Trainer Candidate shall be trained by TOT in Uzbekistan, for the subject which he will become in charge.

④ Trainer Candidate shall be trained by Training in Japan for the Project, implemented by JICA.

Japanese expert of each subject judge the degree of candidate's comprehension based on the question and answer during above training and the quality of the Mock-UP training. JET will make authorization to become trainer or not, with the result of training and attendance record.

If some additional training is required to compensate lack of training for candidate, for example for a practical training, other Authorized Trainer could implement additional training to become trainer. For example, Authorized Trainer can confirm the candidate's ability as a trainer within actual training course for O&M staff. These training could be implemented with assist by Authorized Trainer. NTC can appoint him as a trainer with JET's advice after completion of additional training, during the Project. In the case after the Project, additional training should be according to clause 7(A) of “the Manual for Appointment and Role of Trainer of NTC”.

7. Authorization

JET will authorize the trainer with the training result, for each training course/ subject. Sample form of the authorization document is attached.

8. Expire date of authorization

Authorization of trainer will be expired the end of December within 3 years. If it is need to extend the valid period as a trainer, trainer should pass the course for trainer/ manager class of the same subject, implemented by New NTC. (Please refer the Manual for Appointment and Role of Trainer of NTC”)

End of Manual

SAMPLE 1

The Project for Establishment of the
Combined Cycle Gas Turbine (CCGT)
Operation and Maintenance Training Center in Uzbekistan

Authorized Trainer

for New Navoi Training Center

This is certify that

Mr. NAME SURNAME

is authorized valid till the end of 2021, by the Project

has successfully completed Training, with excellent ability to become trainer for the subject of

"Subject/ Course Title"

Trainings organized under the Project including "Training in Japan" and "TOT in Uzbekistan", consist of basic and advanced training module, and also theoretical and practical training

dated July. 2018

Mr. Shukhrat O. Dostov
Director
Navoi Training Center

Navoi TC Stamp

Mr. Yukihiro MURATA
Chief Advisor
JICA Expert Team

JICA

SAMPLE 2

The Project for Establishment of the Combined Cycle Gas Turbine (CCGT) Operation and Maintenance Training Center in Uzbekistan

Authorized Trainer

for New Navoi Training Center

This is certify that

Mr. NAME SURNAME

is authorized valid till the end of 2021, by the Project

has successfully completed Training, with excellent ability to become trainer for the subject of

"Subject/ Course Title"

Trainings organized under the Project including "Training in Japan" and "TOT in Uzbekistan", consist of basic and advanced training module, and also theoretical and practical training

dated July, 2018

Mr. Shukhrat O. Dostov
Director
Navoi Training Center

Navoi TC Stam

Mr. Yukihiro MURATA
Chief Advisor
JICA Expert Team

JICA

Appendix 18

by JET on 24th April, 2018
revised on 26th April, 2018

Manual for Appointment and Role of Trainer of NTC

1. Purpose

This manual is for appoint the trainer by Navoi Training Center (NTC), and clarify for his role.

2. Manual user and target trainer

Director NTC utilize this manual to appoint the trainer of NTC for each by each training course, to refill and replace with the trainer transfer. Target trainer candidates are selected from experienced staff, as follows.

3. Scope of Appointment

Each appointment will be scope within each by each training course (subject). So, Trainer candidate needs the experiences for the required subject.

4. Requirement to become Trainer candidate

① Candidate should be recommended by Uzbekenergo Headquarter.

② Candidate have to already completed the target training courses implemented by NTC.

③ Candidate should have the experiences of major inspection of CCGT, or at least periodic inspection related to target training subject/ course.

Experiences of Training in Japan in “the Project for Establishment of the Combined Cycle Gas Turbine (CCGT) O&M Training Center" (hereinafter the Project), is possible alternative for above condition. If he had no experiences of these, he should completed with the course for trainer/manager class of the relevant subject implemented by NTC.

5. Selection and registration of Trainer

④ Candidate should passed the interview by NTC.

Director NTC, and Chief Trainer responsible in the target subject, implement the interview with care of the background, knowledge, interview attitude, etc., and judges whether he is appropriate personnel for trainer.

⑤ Registration to UE Headquarter

Director NTC should notify the result of interview to “Department of Work with Personnel” of UE Headquarter、and need to register to UE Headquarter.

6. Appointment of trainer

Director NTC will appoint the trainer by each training course/ subject. Sample form of the appoint document is attached.

7. Class/ Rank of trainer and his role

Trainer should be classify the class/ Rank, as Assistant, Deputy and Chief Trainer, according to their experiences and role as a trainer.

(a) Assistant Trainer

Apprentice/new trainer, within 1 year or less experience as a trainer, is Assistant Trainer, except Authorized trainer by the Project. Assistant Trainer can implement training class under guidance with Deputy Trainer or Chief Trainer. When practical training with equipment is conducted, Assistant Trainer will participate as aid trainer in many cases. And also, almost Assistant Trainer is part time trainer of NTC. If Director NTC and Chief Trainer acknowledged him as a superior ability, he can implement training as Deputy Trainer without guidance.

Director NTC and Chief Trainer can confirm the ability of Assistant Trainer within actual training course for

O&M staff. If some additional training is required to improve ability of Assistant Trainer, Chief Trainer could implement additional training, with the course for trainer/manager class of the relevant subject.

(b) Deputy Trainer

Deputy Trainer can implement training without help from other trainer, except for practical training requiring assistant. Training should be according with Lecture Plan/ Lesson Plan as created.

Deputy Trainer should cooperate with creating Lecture Plan/ Lesson Plan, before making annual training plan of next year. Full time Deputy Trainer is the best, but some of them could be part time.

(c) Chief Trainer

Chief Trainer can implement training without help from other trainer, except for practical training requiring assistant. Training should be according with Lecture Plan/ Lesson Plan as created.

Chief Trainer should create Lecture Plan/ Lesson Plan with cooperation of Deputy Trainer, before making annual training plan of next year. Creating Lecture Plan/ Lesson Plan are for Annual training plan of Training center, including the course for trainer/ manager class.

Chief Trainer should be full time, or even if part time who should stay Training Center during almost period of training season, at least to be able to respond all of training in his field. Chief Trainer should be selected by Director NTC from experienced Deputy Trainer.

8. Valid of appointment

Appointment of trainer will be valid till the end of December within 3 years. If it is need to extend the valid period as a trainer, trainer should pass the course for trainer/ manager class of the same subject.

End of Manual

SAMPLE 1

Combined Cycle Gas Turbine (CCGT)
Operation and Maintenance Training Center

Appointment of Trainer

for Navoi Training Center

This is certify that

Mr. NAME SURNAME

is appointed valid till the end of ****

with excellent ability and experiences to become trainer for the subject of
"Subject/ Course Title"
including basic and advanced experiences, and also theoretical and practical knowledge.
dated ****, 2019

Mr. Shukhrat O. Dostov
Director
Navoi Training Center

NTC Stamp

SAMPLE 2

Combined Cycle Gas Turbine (CCGT)
Operation and Maintenance
Training Center

Appointment of Trainer

for Navoi Training Center

This is certify that

Mr. NAME SURNAME

is appointed valid till the end of ****

with excellent ability and experiences to become trainer
for the subject of

"Subject/ Course Title"

including basic and advanced experiences, and also
theoretical and practical knowledge.

dated ****, 2019

Mr. Shukhrat O. Dostov
Director
Navoi Training Center

NTC Stamp

Appendix 19

Monitoring Report of NTC Trainings

【 July 2018 ～ December 2018】

Navoi Thermal Power Plant / Navoi Training Center
Date of the Appproval by NTPP Director General :
(Submission Date to Uzbekenergo)
Date of the Appproval by NTPP Head of Human Resources :
Date of the Approval of Director of NTC :
Date of the Orriginal Draft at NTC :

Uzbekenergo
Date of the Appproval by Uzbekenergo /Deputy Chairman for Foreign Economic Relations :
Date of Approval by Head of Foreign Economic Rekations :
Date of the Appproval by Uzbekenergo /Head of Work with Personnell :

Report & Approval

Navoi Thermal Power Plant / Navoi Training Center		
Navoi Thermal Power Plant	Director General	(Approval Signature)
	Name Mr. Kahramon GANIEV	
	Head of Human Resources	(Approval Signature)
	Name Mr. Alibek KHAITOV	
Navoi Training Center	Director	(Approval Signature)
	Name Mr. Istam SUVANOV	
	Head of Trainer	(Approval Signature)
	Name Mr. Alisher BAXTIYOROVICH	

Uzbekenergo		
Uzbekenergo	Dep. Chairman of Foreign Economic Rekations	(Approval Signature)
	Name : Mr. Djamshid ABDUSALAMOV	
	Head of Foreign Economic Rekations	(Approval Signature)
	Name : Ms. Aizoda SEITIYAZOVA	
	Head of Work with Personnel Department	(Approval Signature)
	Name : Mr. Batir TASHPULATOV	

Reviews of Trainings (1)

Overviews of Trainings		Title of Trainings	Period: Date of Start		Date of End	Days	Purpose of Trainings: (#)	Additional Information	Number of Trainees: Total	Passed	Failed	Number of Trainers: Total	Chief	Assist.	Expected Outputs for the Management of Trainees
	(1)			～											
	(2)			～											
	(3)			～											
	(4)			～											
	(5)			～											
	(6)			～											
	(7)			～											
	(8)			～											
	(9)			～											
	(10)			～											
	(11)			～											
	(12)			～											
	(13)			～											
	(14)			～											
	(15)			～											

Purpose
(a) New commer
(b) Skill up
(c) Promotion
(d) Job rotation
(e) Others

Reviews of Trainings (2)

	Comprehensive Evaluation	Challenges & Obstacles to Implement Trainings (Business)	Actions to Mitigate the Challenges & Obstacles
Trainees			
Trainers			
Textbooks & Curriculum			

Appendix 20

MINUTES OF MEETINGS
BETWEEN
JAPAN INTERNATIONAL COOPERATION AGENCY
AND
JOINT-STOCK COMPANY "UZBEKENERGO"
FOR AMENDMENT OF THE RECORD OF DISCUSSIONS
ON
THE PROJECT FOR ESTABLISHMENT OF THE COMBINED CYCLE GAS TURBINE (CCGT) OPERATION AND MAINTENANCE TRAINING CENTER

The Japan International Cooperation Agency (hereinafter referred to as "JICA") and UZBEKENERGO hereby agree that the Record of Discussions on the Project for Establishment of the Combined Cycle Gas Turbine (CCGT) Operation and Maintenance Training Center (hereinafter referred to as the "Project") signed on January 27, 2015 will be amended by adding the clause III.3;

1. III. UNDERTAKINGS OF UZBEK SIDE

   3. Uzbekenergo acknowledges that the textbooks provided from JICA Experts Team contain proprietary information and are sole and exclusive property of The Chugoku Electric Power Co., Inc., i.e. "Chugoku EPCO", Power Engineering and Training services, Inc., i.e. "PET", Mitsubishi Hitachi Power Systems, Ltd. i.e. "MHPS" and Nippon Koei Co. Ltd., i.e. "Nippon Koei" (hereinafter referred to as "the Four Companies") , and to be used solely by staffs in charge of operation and maintenance in Uzbekenergo including the subsidiaries (hereinafter referred to as "the Companies") , for the purpose for which it is furnished. Neither these documents, nor any information obtained therefrom are to be reproduced, transmitted, disclosed, discussed with any third party, or used otherwise, in whole or in part, without first receiving the express of written authorization of the Four Companies. The confidentiality of the Four Companies is to be protected and secured by the mutual best effort between the Companies and the Four Companies.

   Reason: The amendment of the existing Record of Discussions is proposed to protect proprietary information of the Four Companies and to avoid misusage of the information outside the Project.

This amendment will become effective as of 19/06/2017

Annex 1 : Record of Discussions (signed on January 27, 2015)

Tashkent, 19/06/2017

Mr. Katsutoshi Fushimi
Chief Representative
JICA Uzbekistan Office

Mr. Ruslan G. barakshi
First Deputy Chairman of the Board
JSC "Uzbekenergo"

Appendix 21

Evaluation Format for Mock-Up Training

Evaluation Items	Execution check	Max Scoiring Standard	Evaluation Score
I. Evaluation of qualities ~ Do you feel the following qualities in class ?		20	0
(1) **Basic knowledge**		10	0
Is there sufficient knowledge of the subjects in charge ?			
(2) **Actual experience in the field**		5	0
Is there sufficient knowledge of the site to support the basic knowledge ?			
(3) **Attitude as lecturer**		5	0
Does a positive attitude as a lecture appear ?			
II. Evaluation of lecture ~ Evaluate the following points in class		80	0
(1) **Understanding of the text**		10	0
Does the lecturer understand the contents of the text to use ?			
Does the lecturer know the relation between contents of the textbook and actual JOB?			
(2) **Utilization of the textbook**		10	0
Is the usage of the printed text and PPT appropriate ?			
Does the lecturer appropriately provide supplementary explanations ?			
(3) **How to proceed lectures**		20	0
Is the time allocation of lecture appropriate ?			
Is there a way to proceed with a lecture theat gave a sharp contrast ?			
Is the volume, rhythm and speed of the way of speaking appropriate ?			
Is the attitude, expression, behavior, eye contact of the lecturer appropriate ?			
Is the use of the white board appropriate in the supplementaly explanation ?			
Whether motivation, passion, misson sense are communicated to trainees ?			
(4) **Behavior motivating learning**		20	0
Does the lecturer explain at the beginning what to do the lecture of the day ?			
Are the lecturer doing explanation of the relation between the lecture and the whole ?			
Does the lecturer make ingenuity to interest trainees ?			
Are the lecturer doing the lecture summary ?			
(5) **Behavior to make contents understand**		20	0
Is the timing and number of illustrative descriptions appropriate ?			
Does the lecturer have devised to explain important points again ?			
Doese the lecturer ask questions to confirm the degree of understanding ?			
Does the lecturer confirm the degree of comprehension from the expression, attitude and response of trainees ?			
Does the lecturer prompt question from the students and responds appropriately ?			

● Date of Mock-UP	
● Time of Mock-UP	
● Target Person of Evaluation	
● Textbook No.	
● Textbook Title	

■ Evaluator		
■ Evaluation Score	>>>>>>>>	0

■ Comments of Evaluator

Conclution of Evaluation

Appendix 22

Minutes of Meeting
for
The First Joint Coordinating Committee (JCC)
on Japan Technical Cooperation Project for
Establishment of
the Combined Cycle Gas Turbine (CCGT)
Operation and Maintenance Training Center
in
Uzbekistan

The 1st Joint Coordinating Committee (hereinafter referred to as "JCC") Meeting on Japan Technical Cooperation Project for Establishment of the Combined Cycle Gas Turbine (CCGT) Operation and Maintenance Training Center in Uzbekistan (hereinafter referred to as "the Project") was held on February 26, 2016 at the Head Quarter of JSC Uzbekenergo.

As a result of discussions in the JCC Meeting, Japanese side and Uzbekistan side have confirmed the main items described in the sheets attached hereto.

Tashkent, February 26, 2016

Mr. Katsutoshi Fushimi
Chief Representative
JICA Uzbekistan Office

Mr. Iskandar S. Basidov
Chairman of the Board
JSC Uzbekenergo

Протокол
Первого совещания
Совместного Координационного Комитета (СКК)
Проекта технического содействия Японии
Создания учебного центра
по эксплуатации
и техническому обслуживанию
парогазовых установок комбинированного цикла (ПГУ) в Узбекистане

Первое совещание Совместного координационного комитета (далее по тексту «СКК») по проекту технического содействия Японии созданию учебного центра по эксплуатации и техническому обслуживанию парогазовых установок комбинированного цикла(ПГУ) в Узбекистане (далее «Проект») было проведено 26 февраля 2016 года в Головном офисе АО «Узбекэнерго».

Японская и узбекская стороны подтвердили основные вопросы, обсужденные в рамках совещания СКК, которые представлены в приложениях, прикрепленных к настоящему документу.

Ташкент, 26 февраля 2015 г.

Г-н Кацутоши Фушими
Глава представительства
Японского агентства международного сотрудничества в Узбекистане

Г-н Искандар С. Басидов
Председатель правления
АО «Узбекэнерго»

ATTACHMENT

1. The JICA Experts Team has explained about the scope of works for the Project, overall schedule and the contents to be conducted (Attachment 1-3). The JICA Experts Team requested close collaboration from Uzbek side for the implementation of project activities as well as for organizing the JCC Meeting, which is to be held once a year at minimum during the project period.

2. Japanese side and Uzbek side agreed on the overall schedule and the scope of work of the technical assistance to be implemented by the JICA Experts Team and to carry out the technical assistance in close coordination and cooperation.

(End)

Attachment 1: Presentation Papers (Project Plan, Training Plan, Baseline Survey)

Attachment 2: Overall Schedule of the Project

Attachment 3: Project Design Matrix version 1 (PDM-1)

Attachment 4: Attendance List of the JCC Meeting

Attachment 5: Summary of Q&A Session and Discussions

ПРИЛОЖЕНИЕ

1. Группа экспертов ДЖАЙКА предоставила информацию об объеме работ Проекта, общем графике и содержании запланированных мероприятий (Приложение 1-3). Группа экспертов JICA отметила необходимость тесного сотрудничества со стороны Узбекистана в осуществлении деятельности проекта, а также в организации совещания СКК, которое будет проходить, как минимум, один раз в годв течение всего проектного периода.

2. Японская и узбекская стороны пришли к соглашению относительно общего графика и объема работ по оказанию технической поддержки, которая будет осуществляться Группой экспертов ДЖАЙКА, а также договорились, что данная техническая поддержка будет осуществляться в тесном взаимодействии и сотрудничестве.

(Конец)

Приложение 1: Представление докладов (План проекта, Учебная программа, Базисное исследование)

Приложение 2: Общий график проекта

Приложение3: Дизайн Матрица Проекта-Версия 1 (РМП- 1)

Приложение4: Список участников Совещания СКК

Приложение 5: Итоги сессии «Вопросы и ответы» и обсуждения

Appendix 23

Minutes of Meeting
for
The Second Joint Coordination Committee (JCC)
on Japan Technical Cooperation Project for
Establishment of
the Combined Cycle Gas Turbine (CCGT)
Operation and Maintenance Training Center
In Uzbekistan

The 2nd Joint Coordination Committee (hereinafter referred to as "JCC") Meeting on Japan Technical Cooperation Project for Establishment of the Combined Cycle Gas Turbine (CCGT) Operation and Maintenance Training Center in Uzbekistan (hereinafter referred to as "the Project") was held on May18, 2017 at the Navoi TPP.

As a result of discussions in the JCC Meeting, Japanese side and Uzbekistan side have confirmed the main items described in the Main Points Discussed and the sheets attached hereto.

Tashkent, May 25, 2017

Mr. Katsutoshi FUSHIMI
Chief Representative
JICA Uzbekistan Office

Mr. Shukhrat SHERALIEV
Deputy Chairman of Board
JSC «Uzbekenergo»

Протокол совещания
Второго
Совместного Координационного Комитета (СКК)
Проекта технического содействия Японии
Создания учебного центра
по эксплуатации
и техническому обслуживанию
парогазовых установок комбинированного цикла (ПГУ)
в Узбекистане

Второе совещание Совместного координационного комитета (далее по тексту «СКК») по проекту технического содействия Японии по созданию учебного центра по эксплуатации и техническому обслуживанию парогазовых установок комбинированного цикла(ПГУ) в Узбекистане (далее «Проект») было проведено 18 мая 2017 года на Навоийской ТЭС.

Японская и узбекская стороны подтвердили основные вопросы, обсужденные в рамках совещания СКК, которые представлены в приложениях, прикрепленных к настоящему документу.

Ташкент, 25 мая 2017 г.

Г-н Кацутоши Фушими
Глава представительства
Японского агентства международного сотрудничества в Узбекистане

Г-н Шухрат Шералиев
Заместитель Председателя Правления
АО «Узбекэнерго»

Main Points Discussed

1. At JCC, the summary of Monitoring Sheet, the progress of each Project activities, evaluation on the Project progress and countermeasures on the current issues were presented and acknowledged among Project members. (Attachments 1&2)

2. Japanese side and Uzbekistan side mutually confirmed new Project organization chart.(Attachment 3)

3. PDM Ver.4 was presented at JCC. Both side agreed that verifiable indicators to evaluate the Project overall goals need to be modified as current indicators could be affected by external factors and are not reliable. Both side agreed to fix exact values of indicators by March 2018.(Attachment 4)

4. Japanese side and Uzbekistan side both acknowledged and agreed on the current issues of the Project as well as the next steps to take in order to complete the scheduled Project activities for Phase 1. Responsible persons from both Uzbekistan side and Japanese side were nominated for each action (Attachment 5).

In addition to the context of Attachment 5, Japanese side had discussed and agreed with Uzbekenergo HQ on the following matters prior to JCC, as these matters could affect the effectiveness and efficiency of the Project.

- Issuance of long-term permission to enter Navoi TPP training center. Uzbekistan side agreed to issue long-term permission for JET members for

Основные Обсуждённые Вопросы

1. Краткое содержание листа Мониторинга, прогресс выполнения каждой деятельности по Проекту, оценка прогресса проекта и контрмеры по текущим вопросам были представлены и одобрены среди участников проекта во время проведения СКК. (Приложения 1 и 2)

2. Японская и узбекская стороны пришли к соглашению относительно новой организационной схемы Проекта. (Приложение 3)

3. ДМП (версия №4) была представлена во время проведения СКК. Обе стороны согласились с тем, что проверяемые показатели для оценки наивысших целей проекта должны быть изменены, так как на текущие показатели могут влиять внешние факторы и они не являются надежными. Обе стороны согласились зафиксировать точные значения показателей к марту 2018 года. (Приложение 4)

4. Японская и узбекская стороны подняли и согласовали текущие вопросы проекта, а также следующие шаги, которые необходимо предпринять для завершения запланированных мероприятий Проекта на Фазе 1. Ответственные лица из Узбекистана и Японии были назначены на каждое мероприятие (Приложение 5).

Помимо контекста Приложения 5, японская сторона обсудила и согласовала с АО «Узбекэнерго» следующие вопросы до проведения СКК, поскольку эти вопросы могут повлиять на действенность и эффективность Проекта:

- Выдача долгосрочного разрешения на посещение учебного центра Навоийской ТЭС. Узбекская сторона согласилась

the period of Project phase 1, as current single-entry permission issuance procedure takes too long.	выдать долгосрочное разрешение для членов группы японских экспертов JICA на период Фазы 1 Проекта, поскольку действующая процедура выдачи однократных разрешений занимает слишком много времени.
● Allocation of Counterparts from Uzbekenergo HQ. For Project Output 1 and 2, Japanese side requested Uzbekistan side to nominate a contact person in charge to discuss further on institutionalization of the policy for O&M system of CCPP, as well as training plan. Uzbekenergo agreed and nominated Mr. Usmanov (Head of Department of foreign economic relations and investment attraction) as a contact person.	● Выделение контрагентов из головного офиса АО «Узбекэнерго». В отношении Результатов Проекта 1 и 2 японская сторона обратилась к узбекской стороне с просьбой назначить ответственного контактного лица для дальнейшего обсуждения вопроса об институционализации политики в отношении системы эксплуатации и технического обслуживания ПГУ, а также плана обучения. АО «Узбекэнерго» согласилась и назначила в качестве контактного лица г-на Усманова (начальника департамента внешнеэкономических связей и привлечения инвестиций).
● Training in Japan in December 2017. Uzbekenergo agreed to update JICA with the list of participants for the training from trainer candidate as well as from management level by July 2017 (the total number of participants must be 10).	● Обучение в Японии в декабре 2017 года. АО «Узбекэнерго» согласилась проинформировать JICA о списке участников для обучения, состоящего из кандидатов в инструкторы, а также из людей управленческого уровня к июлю 2017 года (общее количество участников должно быть 10).
5. The JICA Experts Team requested close collaboration from Uzbekistan side for the implementation of Project activities as well as for organizing the JCC Meeting, which is to be held once a year at minimum during the project period.	5. Группа экспертов JICA обратилась с просьбой о тесном сотрудничестве со стороны Узбекистана для осуществления мероприятий по Проекту, а также для организации совещания СКК, которое будет проводиться как минимум один раз в год в течение проектного периода.
(End)	*(Конец)*

Attachment 1: Presentation Papers (Outline of JCC, Monitoring Report, Development & preparation of Human Resource Development Plan for O&M Personnel, Road Map of Training Plan, Road Map of Accreditation System and Evaluation / Timeline & Proposal for Problem Solving) **Attachment 2:** Monitoring Sheet Ver.3 **Attachment 3:**New Project Organization Chart **Attachment 4:** Project Design Matrix(PDM-4) **Attachment 5:**Problems and Solutions **Attachment6:**List of the JCC Meeting Participants	**Приложение 1:** Представление докладов (План Работы СКК, Отчет о Мониторинге, Разработка и Подготовка Плана подготовки кадров для Персонала по ЭиТО, Дорожная карта Плана Обучения, Дорожная карта Системы Аккредитации и Оценки / Сроки и Предложение для Решения Проблем) **Приложение 2:** Мониторинг Лист, Версия №3 **Приложение3:** Новая Организационная Структура Проекта **Приложение4:** Дизайн Матрица Проекта-Версия 4 (ДМП-4) **Приложение 5:** Проблемы и Решения **Приложение 5:** Список участников СКК

Appendix 24

Minutes of Meeting for The Third Joint Coordination Committee (JCC) on Japan Technical Cooperation Project for Establishment of the Combined Cycle Gas Turbine (CCGT) Operation and Maintenance Training Center In Uzbekistan	**Протокол совещания Третьего Совместного Координационного Комитета (СКК) Проекта технического содействия Японии Создания учебного центра по эксплуатации и техническому обслуживанию парогазовых установок комбинированного цикла (ПГУ) в Узбекистане**
The 3rd Joint Coordination Committee (hereinafter referred to as "JCC") Meeting on Japan Technical Cooperation Project for Establishment of the Combined Cycle Gas Turbine (CCGT) Operation and Maintenance Training Center in Uzbekistan (hereinafter referred to as "the Project") was held on July10, 2018 at JSC Navoi Thermal Power Plant (hereinafter referred to as "N TPP").	Третье совещание Совместного координационного комитета (далее по тексту «СКК») по проекту технического содействия Японии по созданию учебного центра по эксплуатации и техническому обслуживанию парогазовых установок комбинированного цикла(ПГУ) в Узбекистане (далее «Проект») было проведено 10 июля 2018 года на Навоийской тепловой электростанции(здесь и далее по тексту «Навоийская ТЭС»).
As a result of discussions in the JCC Meeting, Japan side and Uzbekistan side have confirmed the main items described in the Main Points Discussed and the sheets attached hereto.	В результате обсуждений на заседании СКК сторона Японии и Узбекистана подтвердили основные пункты, описанные в Основных Обсужденных вопросах, и прилагаемых к ним листах.
Tashkent, July 23, 2018	Ташкент, 23 июля 2018 г.
高坂宗夫 Mr. Muneo TAKASAKA Chief Representative JICA Uzbekistan Office	高坂宗夫 Г-н Мунэо ТАКАСАКА Глава представительства Японского агентства международного сотрудничества в Узбекистане
Mr. Shukhrat SHERALIEV Deputy Chairman of Board JSC «Uzbekenergo»	Г-н Шухрат Шералиев Заместитель Председателя Правления АО «Узбекэнерго»

Main Points Discussed	Основные Обсуждённые Вопросы
1. Structure of Navoi Training Center	1. Структура учебного центра Навои
(1) Director of NTC Mr. Istam Suvanov is appointed as Director of Navoi Training Center. (2) Discussion on the new scheme a. In order to receive trainees from CCGTs under Uzbekenergo, comprehensive discussion on scheduling, budget and etc. are required. b. JICA is willing to join such meeting. c. Before the government approval as the official training center, JICA/JET will issue the written recognition for internal accreditation.	(1) Директор НУЦ Г-н Истам Суванов назначен директором Навоийского учебного центра. (2) Обсуждение новой схемы а. Для того, чтобы получать стажеров от ПГУ в рамках «Узбекэнерго», требуются комплексные обсуждения по планированию, бюджету и т. д. б. ЛСА готова присоединиться к такой встрече. с. До утверждения правительством официального учебного центра, ЛСА / JET выдаст письменное признание внутренней аккредитации.
2. Presentation Papers at JCC	2. Презентационные документы в СКК;
Japan side (1) Monitoring Report - Summary of Monitoring Sheet #6 -; As the summary of Monitoring Sheet #6, the progress of each Project activities, evaluation on the Project progress and countermeasures on the current issues were presented and acknowledged among the Project members. (Attachments 1-(1))	Японская сторона (1) Отчет о мониторинге - Обзор мониторинг листа № 6 -; В качестве обзора мониторинг листа № 6 были представлены и признаны членами Проекта ход выполнения каждой проектной деятельности, оценка прогресса проекта и контрмеры по текущим вопросам. (Приложения 1- (1))
(2) Evaluation (DAC- Five Criteria); a "Relevance": High b "Effectiveness": Lower or Fair c "Efficiency": Lower or Fair d "Impact": N/A (at present) e "Sustainability": Fair Details are reviewed in the attachment. (Attachments 1-(2))	(2) Оценка (DAC-Пять критерий); a «Актуальность»: высокий b «Действенность»: ниже или справедливо c «Эффективность»: ниже или справедливо d «Воздействие»: Н / П (в настоящее время) e «Устойчивость»: справедливо Подробности рассматриваются в приложении. (Приложения 1- (2))
Uzbekistan side (3) Monitoring and Evaluation Scheme; Following the advice presented by JET, Monitoring and Evaluation Scheme on "NTC Training" will be conducted after completion of the current training of the staff of Navoi-2 GT Unit.	Узбекская сторона (3) Схема мониторинга и оценки; Следуя рекомендациям JET, система мониторинга и оценки «Обучения НУЦ» будет проведена после завершения текущего обучения персонала блока Навои-2 ГТ. (Приложения 1- (3))

(Attachments 1-(3))	
(4) The Scheme of Personnel Training for Operation and Maintenance of CCGT 450MW in Navoi TPP; "Training Plan" of the current training for the staff of Navoi-2 GT Unit was reviewed and presented how the important mission of NTC is to be carried out for the test operation of GT Unit by the staff trained by NTC. (Attachments 1-(4))	(4) Схема подготовки персонала для эксплуатации и технического обслуживания ПГУ 450 МВт на Навоийской ТЭС; «План обучения» текущего обучения персонала блока «Навои-2 ГТ» был рассмотрен и представлен, как должна быть проведена важная миссия НУЦ для ввода в эксплуатацию блока ГТ персоналом, прошедшим подготовку в НУЦ. (Приложения 1- (4))
3. Project Design Matrix (PDM) Ver.5 PDM Ver.5 was presented at JCC. Japan side and Uzbekistan side confirmed the contents of the PDM except the target figures of verifiable indicators of the Project overall goals. The figures indicated in the current PDM Ver.5 is presented by NTC as the tentative forecast as follows; (1) Number of assigned trainers: 15 (2) Number of accredited trainees of CCPP O&M: 260 The both sides agreed the target figures of the verifiable indicators of the Project overall goals will have to be discussed and fixed during the 13th Mission scheduled in October 2018. (Attachment 2 : PDM Ver.5)	3. Дизайн Матрица Проекта (ДМП) Вер.5 ДМП Вер.5 был представлен в СКК. Японская и Узбекские стороны подтвердили содержание ДМП, за исключением целевых значений поддающихся проверке показателей Наивысшей цели Проекта. Цифры, указанные в текущем ДМП Вер.5, представлены НУЦ в качестве предварительного прогноза следующим образом: (1) Количество назначенных инструкторов: 15 (2) Количество аккредитованных обучаемых по ЭиТО ПГУ: 260 Обе стороны договорились, что целевые значения поддающиеся проверке показателей наивысшей цели Проекта, должны быть обсуждены и исправлены во время 13-й миссии, запланированной на октябрь 2018 года. (Приложение 2: ДМП Вер.5)
4. Construction site of NTC building After the discussion on the presentations, both sides discussed and agreed on the construction site of the training rooms of NTC to be in "Engineering Center" of CCPP-2 site instead of Navoi conventional power plant, which is announced by Mr. Akmal Fayziev, the representative of Uzbekenergo and NTPP, according to the proposal from Mr. Ganiev of General Director of NTPP and Project Director of the Project.	4. Строительная площадка здания НУЦ После обсуждения презентаций, обе стороны обсудили и согласовали строительную площадку учебных помещений НУЦ, которые будут в «Инженерном центре» площадки ПГУ-2 вместо Навоийской старой электростанции, о чем объявил г-н Акмал Файзиев, представитель «Узбекэнерго» и НТЭС, по предложению г-на Ганиева генерального директора НТЭС и директора проекта.

The attendee from JICA Head Quarter, Mr. Shigeru Sugiyama of Group Director stated that the schedule of the construction of NTC building and the tentative or final location site of installation of SFC (Static Frequency Converter) are to be clarified during the 3rd JCC discussion. The following are clarified points of the discussion; (1) Uzbekenergo / NTPP has agreed with the contractor to build the training rooms of NTC in CCPP-2 site without change of the contract. (2) Planned original function of "Engineering Center" will be transferred to the other building without any issues. (3) Upon receiving the revised layout of the training rooms from JET, the construction will commence to be completed within two-month time. (4) JET will submit the revised layout before two weeks from July 25, 2018. *(End)*	Посетитель из штаб-квартиры ЛСА, г-н Шигеру Сугияма/ Директора группы заявил, что график строительства здания НУЦ и предварительный или окончательный сайт местоположения установки SFC (Статический преобразователь частоты) должны быть уточнены во время обсуждения третьего СКК. Ниже приводятся уточненные моменты обсуждения; (1) «Узбекэнерго» / НТЭС согласовали с подрядчиком без изменения договора. (2) Запланированная оригинальная функция «Инженерного центра» будет перенесена в другое здание. (3) После получения пересмотренного плана размещения учебных помещений от JET, строительство начнется и будет завершено в течение двух месяцев. (4) JET представит пересмотренный план размещения до двух недель с 25 июля 2018 года. *(Конец)*
Attachment 1: Presentation Papers (1) Monitoring Report - Summary of Monitoring Sheet #6 – (2) Evaluation (DAC) (3) Monitoring and Evaluation Scheme (4) The Scheme of Personnel Training for Operation and Maintenance of CCGT 450MW in Navoi TPP **Attachment 2:** PDM Project Design Matrix Ver.5 (July 10, 2018) **Attachment 3:** Attendees and Program of JCC	**Приложение 1**: Презентационные документы (1) Отчет о мониторинге - Обзор мониторинг листа № 6 - (2) Оценка (DAC) (3) Схема мониторинга и оценки (4) Схема подготовки персонала для эксплуатации и технического обслуживания ПГУ 450 МВт на Навоийской ТЭС **Приложение 2**: ДМП Дизайн Матрица Проекта Вер.5 (10 июля 2018 г.) **Приложение 3**: Участники и программа СКК

Appendix 25

The Project for Establishment of the Combined Cycle Gas Turbine (CCGT) Operation and Maintenance Training Center In Uzbekistan

Date: 10th August, 2018

To: Mr. Kahramon K. GANIEV / Project Director, General Director of Navoi TPP
Mr. Istam SUVANOV/ Director Navoi Training Center
Mr. Musaev Alisher/ Chief Trainer Candidate NTC
Mr. Eshev Khamdam/ Chief Trainer Candidate NTC
Ms. Adilova Yulduzkhon/ Specialist NTC
CC; Mr. Ruslan Mubarakshin/ First Deputy Chairman of the Board Uzbekenergo
Ms. Daniyarova Feruza/ Deputy head of Foreign Economic Relations and Investment Dept.
Ms. Giazova Munisa/ Specialist of Department Work with Personnel

Request to prepare "Individual Training Program for CCPP"

At 12th-mission in July 2018, it was discussed between Navoi Training Center (herein after, referred to as NTC) and JICA Expert Team (herein after, referred to as JET), for "Individual Training Program".

The conclusions, i.e. agreed points of discussion are

a) Proposal of draft for "Individual Training Program for O&M staff of CCPP" will be submitted by e-mail from JET, in August 2018.
b) Recommendation of draft for "Individual Training Program for related organization/ staff of CCPP" will be submitted from JET by e-mail in August 2018.
c) NTC will review and amend the draft to formulate the document till next mission.
d) NTC and JET will finalize the draft of documents in the next mission with agreement.

Target staff of "Proposal" are for the staff under the "Sift Head of CCPP". Related organizations/ personnel for "Recommendation", are including "Manager of CCPP", "Program Engineer", "Maintenance staff and Head", "GBCS staff and Head", "Related Unit staff and Head" and so on. Specifically, please refer the following document draft list.

(A) Proposal to revise or to create, including 11 document, are as attached data of "Proposal".
1) ENG Initial Training Program for New Employee rev, to create
2) ENG 1-17 Individual Training Program Shift Head rev, to revise
3) ENG Individual Training Program Senior Operator rev, to create
4) FS-48 Individual Training Program・GT Operator rev, to revise
5) ENG 1-18 Individual Training Program・ST Operator rev, to revise
6) ENG 1-22 Individual Training Program BOP Operator rev, to revise
7) ENG Individual Training Program・GBCS Operator rev, to create
8) ENG 1-19 individual training program Pastrol GT rev, to revise
9) ENG 1-21 Individual Training Program・ST Patrol rev, to revise
10) ENG 1-20 Individual Training Program HRSG Patrol rev, to revise
11) ENG Individual Training Program - Patrol GBCS rev, to create

(B) Recommendation to create, including 17 documents, are as attached data of "Recommendation".
12) ENG Individual Training Program Leading Eng TME, Highly recommend to create
13) ENG Individual Training Program Electronics Eng, Highly recommend to create
14) ENG Individual Training Program Leading Eng Program, Highly recommend to create
15) ENG Individual Training Program -Program Eng-, Highly recommend to create
16) ENG Individual Training Program Inspector Metal Lab, Highly recommend to create
17) Eng Individual Training Program for worker related CCPP, Highly recommend to create
18) Eng Individual Training Program for Technician Cat I, Highly recommend to create
19) ENG Individual Training Program Unit Manager, Recommend to create
20) ENG Individual Training Program Deputy Head of Operation, Recommend to create
21) ENG Individual Training Program Deputy Head of Maintenance, Recommend to create

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22) ENG Individual Training Program Maintenance Master CCPP, Recommend to create
23) ENG Individual Training Program Head of GBCS, Recommend to create
24) ENG Individual Training Maintenance Master GBCS, Recommend to create
25) ENG Individual Training Program Head of Electrical Unit, Recommend to create
26) ENG Individual Training Program Senior Electrician Maintenance GBCS, Recommend to create
27) ENG Individual Training Program Head of Shift Station, Recommend to create
28) Eng Individual Training Program Head of CWT Unit, Recommend to create

If you could review these draft and made them standard of NTC and/or NTPP, it will be highly appreciated and draw the success of the Project.

For reference, please check sheet named "Proposal List", "Recommendation List" and "Model case of Training-Unit", of attached Excel data "List of Individual Training Program rev1".

Best Regards,

齋藤孝史 齋藤

Takashi SAITO / Sub Chief Advisor
JICA Expert Team of the Project

Appendix 26

Work Flow for the 1st Phase

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
		2015 fiscal year							2016 fiscal year												2017 fiscal year						
		9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10
Activities by Outputs	in Japan	Prepa-ration		1st		2nd			3rd		4th		5th		6th		7th						8th		9th		
	in Uzbekistan		1st		2nd			3rd		4th		5th			6th		7th					8th		9th			

Output 1: Operation and maintenance policy of CCPP is developed
- 1.1 To identify the current situation and issues on O&M of CCPP including installation plan and internal regulation.
- 1.2 To discuss about the policy for O&M system of CCPP
- 1.3 To establish and propose the development policy and plan
- 1.4 To support regularization and institutionalization of the policy for O&M system of CCPP

1.1 To identify the current situation and issues on O&M of CCPP including installation plan, internal regulation.

1.2 To discuss about the policy for O&M system of CCPP

1.3 To establish and propose the development policy and

1.4 To support regularization and institutionalization of the policy for O&M system of CCPP

Output 2: Human resource development plan, training plan, and accreditation system of CCPP O&M are developed.
- 2.1 To confirm the current situation and issues on capacity of CCPP O&M staff, human resource development and staff deployment plan and accreditation system of Uzbekenergo, and training in existing training center .
- 2.2 To plan a roadmap of human resource development, staff deployment and accreditation system of Uzbekenergo.
- 2.3 To develop training plan for capacity building of O&M of CCPP
- 2.4 To implement training plan* for capacity building of O&M of CCPP
- 2.5 To plan and implement trainings, periodical inspection and periodical repair work of O&M of CCPP in the training center**
- 2.6 To implement monitoring and evaluation system for training of O&M of CCPP

2.2 To plan a roadmap of human resource development, staff deployment and accreditation system of Uzbekenergo.

2.1To confirm the current situation and issues on capacity of CCPP O&M staff, human resource development and staff deployment plan and accreditation system of Uzbekenergo, and training in existing training center .

2.3 To develop training plan for capacity building of O&M of CCPP

2.4 To implement training plan* for capacity building of O&M of CCPP

2.5 To plan and implement trainings, periodical inspection and periodical repair work of O&M of CCPP in the training center**

2.6 To implement monitoring and evaluation system for training of O&M of CCPP

Output 3: Training curricula, materials and equipment of CCPP O&M are developed.
- 3.1 To develop curricula*** and training materials for CCPP O&M training
- 3.2 To try out and improve curricula and training material which have been developed
- 3.3 To make an installation plan of necessary training equipment for O&M of CCPP
- 3.4 To install necessary training equipment for O&M of CCPP
- 3.5 To advise for improvement of training facilities by Uzbekenergo

3.1 To develop curricula*** and training materials for CCPP O&M training

3.2 To try out and improve curricula and training material which have been developed

3.3 To make an installation plan of necessary training equipment for O&M of CCPP

3.4 To install necessary training equipment for O&M of CCPP

3.5 To advise for improvement of training facilities by Uzbekenergo

Output 4: Instructors of CCPP O&M are trained and secured.
- 4.1 To nominate candidates for instructors
- 4.2 To train instructors through activties in 3-1 and 3-2
- 4.3 To train necessary instructors through training in Uzbekistan and Japan
- 4.4 To feedback on the trainings O&M of CCPP
- 4.5 To examine the possibility of external resources for instructors
- 4.6 To establish an accreditation system of instructors

4.1 To nominate candidates for instructors

4.1 To nominate candidates for instructors

4.1

4.2 To train instructors through activties in 3-1 and 3-2

4.3 4.3 4.3 4.3 4.3 4.3 4.3 4.3

4.4 To feedback on the trainings O&M of CCPP

4.5 To examine the possibility of external resources for instructors

4.6 To establish an accreditation system of instructors

5: Monitoring, Reports and Documents
- 5.1 Inception Report
- 5.2 Work Plan
- 5.3 Baseline Survey
- 5.4 Monitoring Sheet
- 5.5 Procurement Plan
- 5.6 JCC and Workshop
- 5.7 Progress Report
- 5.8 Project Completion Report

Ic/R
Work Plan
Monitoring Sheet
Baseline
Monitoring Sheet 1
Procurement Plan
MonitorinSheet2
Monitoring Sheet3
Monitoring Sheet 4
1st JCC
1st Workshop
Progress Report
2nd Workshop
2nd JCC
Project Completion
Relocation of the training center form Tashkent to Navoi
Start the CCPP Smulator Installation Project
Start the lecture at Navoi training center (Only Classroom lecture)
Complecation of the renovation of Navoi training

[Reference Information]
CCPP Simulator Installation [another JICA Project]

Others

Work Flow for the 2nd Phase

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
		2018 fiscal year																	
		12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5
Activities by Outputs	**in Japan**	Prepa-ration		10th & 11th						12th			13th					14th	
	in Uzbekistan		10th		11th				12th			13 th					14th		
Output 1: Operation and maintenance policy of CCPP is developed. ・1.1 To identify the current situation and issues on O&M of CCPP including installation plan, internal regulation.		**1.1 To identify the current situation and issues on O&M of CCPP including installation plan, internal regulation.**																	
Output 2: Human resource development plan, training plan, and accreditation system of CCPP O&M are developed. ・2.1 To discuss and propose a policy for O&M system of CCPP, including scope of service agreement with manifacturers ・2.2 To plan an accreditation system and road map ・2.3 To consider and plan scope of training ・2.4 To implment training plan* for capacity building of O&M of CCPP ・2.5 To implement trainings of O&M of CCPP in the training center** ・2.6 To implement monitoring and evaluation system for training of O&M of CCPP		**2.1To discuss and propose a policy for O&M system of CCPP, including scope of service agreement with manifacturers**																	
		2.2 To plan an accreditation system and road map																	
					2-3 To consider and plan scope of training														
								2.4 To implment training plan* for capacity building of O&M of CCPP											
						2.5 To implement trainings of O&M of CCPP in the training center													
				2.6 To implement monitoring and evaluation system for training of O&M of CCPP															
Output 3:Training curricula, materials and equipment of CCPP O&M are developed. ・3.1 To develop curricula and training materials for CCPP O&M training ・3.2 To try out and improve curricula and training material developed ・3.3 To make a installation plan of necessary training equipment for O&M of CCPP		**3.1 To develop curricula*** and training materials for CCPP O&M training**																	
		3.2 To try out and improve curricula and training material developed																	
		3.3 To make a installation plan of necessary training equipment for O&M of CCPP																	
Output4: Instructors of CCPP O&M are trained and secured. ・4.1 To nominate candidates for instructors ・4.2 To train necessary instructors through training in Uzbekistan ・4.3 To train necessary instructors through training in Japan ・4.4 To establish accreditation system of instructors ・4.5 To exmine possibility of external resources for instructors		**4.1 To nominate candidates for instructors**																	
			4. 2		**4. 3**				**4. 2**			**4. 2**							
		4.4 To establish accreditation system of instructors																	
		4.5 To exmine possibility of external resources for instructors																	
5: Monitoring, Reports and Documents ・5.1 Work Plan ・5.2 Monitoring Sheet ・5.3 JCC and Workshop ・5.4 Project Completion Report		Work Plan		Monitoing Sheet 5				3rd JCC		MonitorinSheet6		3rd Workshop			Monitoring Sheet7		4th JCC		Project Completion Report

Appendix 27

План урока **Дата: «___»_____2018г**

Учебный центр по эксплуатации и техобслуживанию ПГУ
«УТВЕРЖДАЮ»
Директор учебного центра
_____ Достов Ш.О.

1. *Номер и название учебного курса/ Title & Trainer*

№1. Неразрушающийконтроль/№1. Non-destructiveinspection

Ответственный инструктор для данного курса

Главный: Махмудов Азиз/Chief: MakhmudovAziz

Заместитель: ИсламовИсмаил/Deputy: IslamovIsmail

Другие: ДжамаловБаходир/ Others: JamalovBakhodir

Стандартное количество слушателей/ Number of trainee

10 слушателей.

Целевые слушатели:Работники АО «НТЭС»,

Персонала эксплуатации и технического обслуживания/O&M Staff of Navoi TPP

2. *Продолжительность курса (часы)/Course duration (hours)*

Из дневного месяца, года; до дневного месяца, года

3 дня (21 час)

3. *Содержание курса и часы/ Course contents*

№	Главы	дни	часы
1	Технологии неразрушающих методов испытаний Примеры применения в реальной станции	первый	7
2	Сущность метода капиллярного контроля	второй	3
3	Сущность метода магнитной дефектоскопии	второй	4
4	Сущность практического обучения методу вертикально ориентированной ультразвуковой дефектоскопии.	третий	6
5	Анкетирование	третий	1

4. *Необходимое оборудование для данного курса/ Equipment*

Лабораторные приспособления для проведения неразрушающего контроля

5. Контрольные точки данного кур*са/Milestones*

№	Контрольные точки в деталях
1	Тестирование после обучения учебника № 1 до практического занятия Test, after Classroom lecture, before practical training
2	После проведения каждого метода задавать контрольные вопросы по каждому методу дефектоскопиии After each subtitle, ask each inspection method of defectoscopy.
3	
4	

6. *Вопросы и типичные ответы для заключительного экзамена курса/Q&A for the final course exam*

Подготовить, конкретные вопросы и типичные ответы для завершения экзамена курса, чтобы подтвердить понимание курса, более 10 вопросов. Опишите конкретные вопросы и ответы на другой странице.

Preparing concretequestions and typical answers for completing the course exam to confirm understanding of the course, more than 10 questions. Please describe concreteQ&A in next page.

7. *Критерии оценки слушателе*й/ Criteria

№	Параметры	Результат
1	Уровень посещаемости тренинга (%)/ attendance rate	
2	Количество заданных вопросов /Количество вопросов, заданных каждым стажером по каждому, и его качество Number of questions asked from each trainee by each, and its quality	
3	Понимание лекции, Результаты теста завершения Understanding of the lecture, results of completion examination	

9. Specific Q&A, for course No 1 (Non-destructive inspection)

Конкретный список вопросов и ответов, курса № 1 (Неразрушающий контроль)

Q&A should be more than 10 / Вопросы и ответы должны быть более 10

No	Chapter глава	Question/ Вопрос (drawings separated/чертежи разделены)	Typical answer/ Типичный ответ (drawings separated/чертежи разделены)
1		What is non destructive testing?	Tests carried out without destroying the test object, and detecting the presence of damage, their location, size, shape and distribution on product.
2		Methods of non destructive inspection?	Radiographic testing, Ultrasonic testing, Visual inspection, Magnetic particle inspection, Color flaw detection, Eddy current eddy flaw detection.
3		What are defects?	A defect is defined as each separate nonconformity of products to the requirements established by the normative documentation.
4		What kinds of defects exist?	Defects are divided into explicit, hidden, critical, significant, and not very significant, correctable and incorrigible.
5		What defects occur on the welded joint?	Cracks, impurities, pores, tungsten hits, slag inclusions, undercuts, fracture
6		Ways to improve the accuracy of non-destructive testing methods?	The choice of the optimal method of research Use of optimal equipment (during inspections and adjustments) Execution of research by a certified technologist Evaluation based on integrated results
7		Selecting the best method of control?	Properties of the object under study Types of processing History of processing and operation
8		The difference between damage and defects	Damage: lack of integrity, revealed as a result of non-destructive methods of control. Defect: damage beyond the standards and Instructions and resulting in the inability to recognize the product's conformity
9		Advantages and disadvantages of Radiographic testing?	Advantages (a) Suitable for the diagnosis of internal defects, has a wide range of applications (welding joints of objects, forged metal, etc.) (b) The ability to diagnose damage even in thick objects (steel 500 mm, aluminum 1200 mm) (c) The possibility of intuitively determining the two-dimensional shape, volume, localization of internal defects, as well as predicting the type of defect. Disadvantages (a) Cracks, i. e. defects having a certain area but very thin can be diagnosed if the X-rays are fed almost parallel to the side of the crack, but are not diagnosed when X-rays are applied perpendicular to the crack surface, since the difference in thickness is practically absent. (b) It is necessary to monitor radioactive radiation and health safety Entrance of forbidden entry areas, wearing a film dosimeter, etc.
10		Advantages and disadvantages of ultrasonic flaw detection?	Advantages (a) In the perpendicular direction of the rays, even the thinnest plane lesions can be easily detected. (stratification) (b) Possibility of internal flaw detection of

			large articles Disadvantages (a) Circular defects are detected by ultrasonic only if they are large enough or concentrated in one place. (b) Insufficient registration records. (c) A high level of professionalism is required to identify the type of defect.
11		What is the main control device on the visual-optical method?	Human eyes are the main control device.
12		What defects are found on the Color Flaw Detector?	Surface defects.

No	Chapter глава	Question/ Вопрос (drawings separated/чертежи разделены)	Typical answer/ Типичный ответ (drawings separated/чертежи разделены)
1		Что такое неразрушающий метод испытаний?	Испытания, приводящиеся без разрушения испытуемого объекта, и выявляющие наличие повреждений, их местонахождение, величину, форму и распределение по изделию.
2		Методы неразрушающего контроля?	Рентгенография, Ультразвуковое исследование, Визуальный осмотр, Магнитопорошковая дефектоскопия, Цветная дефектоскопия, Дефектоскопия вихревыми токами.
3		Что такое дефекты?	Дефектом называется каждое отдельное несоответствие продукции требованиям, установленным нормативной документацией.
4		Какие дефекты бывают?	Дефекты подразделяют на явные, скрытые, критические, значительные, и мало значительные, исправимые и неисправимые .
5		Какие дефекты бывают на сварном соединении?	Трещины, непровари, поры, попадания вольфрама, шлаковые виключения, подрезы, перелом
6		Способы повышения точности неразрушаюших методов контроля?	Выбор оптимального метода исследования Использование оптимального оборудования (при проведении осмотров и корректировки) Выполнение исследования сертифицированным технологом Оценка на основе комплексных результатов
7		Выбор оптимального метода контроля?	Свойства исследуемого объекта Виды обработки История обработки и эксплуатации
8		Разница между повреждениями и дефектами	Повреждение: отсутствие целостности, выявленное в результате неразрушаюших методов контроля . Дефект: повреждение, выходящее за пределы стандартов и Инструкций и приводящее к невозможности признать соответствие изделия
9		Достоинства и недостатки Рентгенографии?	Достоинства (а) Подходит для диагностики внутренних дефектов, обладает широким спектром применения (сварочные швы объектов, кованый металл и пр.) (б) Возможность диагностики повреждений даже в толстых объектах (сталь 500 мм, алюминий 1200 мм) (в) Возможность интуитивного определения двухмерной формы, величины, локализации внутренних дефектов, а также прогнозирования типа дефекта. Недостатки (а) Трещины, т.е. дефекты, имеющие определенную площадь, но очень тонкие, могут диагностироваться, если Х-лучи подаются практически параллельно стороне трещины, однако не

			диагностируются при подаче Х-лучей перпендикулярно поверхности трещин, т.к.разница в толщине практически отсутствует. (б) Необходимость контроля за радиоактивным излучением и охраны здоровья Введение запретных для входа участков, ношение пленочного дозиметра и пр.
10		Достоинства и недостатки ультразвоковой дефектоскопии?	Достоинства (а) При перпендикулярном направлении лучей можно легко обнаружить даже самые тонкие плоские повреждения. (расслоение) (б) Возможность внутренней дефектоскопии крупных изделий Недостатки (а) Круглые дефекты обнаруживаются ультразвуком только если они достаточно крупные или сконцентрированы в одном месте. (б) Недостаточно регистрационных записей. (в) Для идентификации вида дефекта необходим высокий уровень профессионализма.
11		Что является основным контрольным прибором на визуально-оптическом методе?	Глаза человека являются основным контрольным прибором.
12		Какие дефекты обнаруживаются на Цветном дефектоскопе?	Поверхностные дефекты .

План урока Дата: «___»_____2018г

Учебный центр по эксплуатации и техобслуживанию ПГУ
«УТВЕРЖДАЮ»
Директор учебного центра
_____ Сувонов И.А.

1. *Номер и название учебного курса/ Title & Trainer*

2. Изучение анализа вибрации во вращающихся механизмах
（Vibration Analysis）

Ответственный инструктор для данного курса/Responsible Instructor for this course
Главный: Исламов И.К.
Заместитель: Тошов И.Ш., Джамалов Б.Д.
Другие: Others:

2. *Стандартное количество слушателей*/ Number of trainee
10 слушателей. 10 Trainee
Целевые слушатели : Работники АО «НТЭС»
Персонала эксплуатации и технического обслуживания /O&M Staff of Navoi TPP

3. *Продолжительность курса (часы) /* Course duration
Из дневного месяца, года ; до дневного месяца, года
3 дня (21 час)

4. *Содержание курса и часы/* Course contents and hours

№	Главы	дни	часы
1	Основы вибрации	Первый	4
2	Техническое обслуживание в связи с вибрацией	Первый	3
3	Причины возникновения вибрации	Второй	3
4	Балансировка	Второй	4
5	Практические занятие	Третий	7
6	Практические занятие	Четвертый	6
7	Анкетирование	Четвертый	1

5. *Необходимое оборудование для данного курса/* Equipment
Не требуется (not required)

6. *Контрольные точки данного курса*/ Milstone

№	Контрольные точки в деталях
1	Контрольные вопросы после прохождения каждой главы Question after each chapter
2	Тестирования после прохождения данного учебника Test, after Classroom lecture
3	Проведение практические занятия Conducting practical exercises
4	Экскурсия по складу запасных частей и инструментов для инспекции ГТ On-site tour to the warehouse of spare parts and tools for inspection of GT

7. *Вопросы и типичные ответы для заключительного экзамена курса/ Q&A for the final course exam*
Подготовить, конкретные вопросы и типичные ответы для завершения экзамена курса, чтобы подтвердить понимание курса, более 10 вопросов. Опишите конкретные вопросы и ответы на другой странице.
Preparing concrete questions and typical answers for completing the course exam to confirm understanding of the course, more than 10 questions. Please describe concrete Q&A in another page.

8. *Критерии оценки слушателей*/ Criteria

№	Параметры	Результат
1	Уровень посещаемости тренинга (%)/ attendance rate	
2	Количество заданных вопросов/ Количество вопросов, заданных каждым стажером по каждому, и его качество Number of questions asked from each trainee by each, and its quality	
3	Понимание лекции, Результаты теста завершения Understanding of the lecture, results of completion examination	

9. Specific Q&A, for course No 2(Vibration Analysis)

Конкретный список вопросов и ответов, курса № 2 (Изучение анализа вибрации во вращающихся механизмах)

Q&A should be more than 10 / Вопросы и ответы должны быть более 10

No	Chapter глава	Question/ Вопрос (drawings separated/чертежи разделены)	Typical answer/ Типичный ответ (drawings separated/чертежи разделены)
1	1	Что такое вибрация?	Вибрация представляет собой колебания, повторяющиеся с одинаковым промежутком времени, в широком смысле вибрацией можно назвать возвратно-поступательное движение физического тела.
2	1	Как определяют собственную частоту колебаний физического тела?	собственная частота колебаний вращающегося тела определяется жесткостью оси и массой Т.е. $\omega = \sqrt{\frac{k}{M}}$
3	1	Что такое резонанс вращающегося тела?	В случае совпадения скорости вращения неуравновешенного вращающегося тела и собственной частоты колебаний, возникающее явление довольно большой амплитуды колебаний называют резонансом.
4	1	Описание терминов «Точкой высоты» и «Точка тяжести»?	-Точка высоты это- направление отклонения оси от центра вращения. -Точка тяжести это - направление центра тяжести от центра оси.
5	1	Как определить точку тяжести по отношению к точке высоты? How to determine the heavy spot with respect to the high spot?	При достаточно низком количестве оборотов оси точка высоты и точка тяжести практически совпадают, однако по мере повышения количества оборотов, точка высоты перемещается в обратное от направления вращения положение, а при достижении критической скорости точка высоты перемещается в положение отставания от точки тяжести на 90 градусов. Проведение измерения положения точки высоты в момент критической скорости, позволит также выяснить положение точки тяжести, что дает возможность установления положения, в котором необходимо добавление груза для балансировки.
6	2	Краткое объяснение важных моментов об измеряемых участков.	1. Толстый слой окрашивания поверхности ведет к затуханию вибрации, поэтому окраска должна производиться тонким и легко снимаемым слоем. 2. Участки, подвергаемые измерению, должны иметь определенное положение и быть хорошо означенными. Маркировка с помощью отметки керна не подходит для обозначения точки измерения в связи с тем, что датчик для измерения вибрации становиться нестабильным. 3. Если точка измерения в подшипниках качения будет неточной хотя бы на

Please clarify the specific Q&A/ section 9 before 12th mission

			ускорения в несколько раз. 4. Необходимо избегать неровных и изогнутых поверхностей, необходимо выбирать в качестве точки замера плоские поверхности, где возможно плотное прилегание, а также очистить поверхность от загрязнений и ржавчины.
7	2	Методы определение вибрации.	- Абсолютный метод определения: Сравнение данных замера на одном и том участке (обычно на подшипнике) со «стандартным критерием оценки». - Относительный метод определения: Данные периодических замеров на одном и том же участке сравнивают со временным рядом, взяв за показатель нормы данные первого замера, на основании чего делается заключение, во сколько раз возросла вибрация. - Взаимный метод определения: При наличии нескольких приборов одной модели проводится обобщающий замер всех приборов, и заключение делается на основании их взаимной оценки.
8	3	Причины возникновения вибрации	1.Вибрация по причине вращения несбалансированного груза 2.Вибрация по причине расцентровки 3.Вибрация по причине трения (контакта) 4.Нестабильные колебания (завихрение смазки и выбрасывание масла) 5.Вибрация из – за механического ослабления
9	3	Особенность нестабильные колебания (завихрение смазки и выбрасывание масла)	Частота колебаний 1/2 к количеству оборотов оси. Возникает при количестве оборотов более чем первая критичная скорость, и менее чем первая критическая скорость умноженная на 2. Количество оборотов, при котором затихают колебания, несколько меньше, чем количество оборотов, при котором зарождаются колебания. Количество оборотов при котором затихают колебания и количество оборотов при котором зарождаются колебания, находятся в неоднозначной зависимости.
10	3	Что такое расцентровка?	– это нарушение центровки, то есть соосности валов.
11	3	Особенность вибрации при расцентровке подшипников ?	При одновременной комбинации с отсутствием баланса, возникает 2-ух, 3-ёх и 4–ёхкратная вибрация.
12	4	Когда возникает несбалансированность?	При несовпадении центра тяжести и центра вращения
13	4	Как исправить несбалансированность?	Необходимо добавление веса массы m на стороне обратной положению центра тяжести.
14	4	Определение положение точки крепления пробного груза?	- при скорости, значительно уступающей критической, пробный груз добавляется в обратную от вектора колебаний сторону.

			- при скорости близкой к критической пробный груз добавляется с 90° - ным фазовым сдвигом, опаздывающим от вектора колебаний. - при скорости, значительно превышающей критическую, пробный груз добавляется в сторону вектора колебаний

План урока **Дата: «___»_____2018г**

Учебный центр по эксплуатации и техобслуживанию ПГУ
«УТВЕРЖДАЮ»
Директор учебного центра
_____ Достов Ш.О.

1. *Номер и название учебного курса/ Title & Trainer*
   №3 Технологии оценки остаточного резерва./No3 Remaining life assessment
   Ответственный инструктор для данного курса
   Главный: Байлиев Шухрат/ Chief: Bayliyev Shukhrat
   Заместитель: Джамалов Баходир/ Deputy: Djamalov Bakhodir
   Другие: Махмудов Азиз/ Others: Makhmudov Aziz
2. *Стандартное количество слушателей*/ Number of trainee
   10 слушателей.
   Целевые слушатели : Работники АО «НТЭС»
   Персонала эксплуатации и технического обслуживания /O&M Staff of Navoi TPP
3. *Продолжительность курса (часы) / Course duration (hours)*
   Из дневного месяца, года ; до дневного месяца, года
   3 дня (21 час)
4. *Содержание курса и часы/ Course contents*

№	Главы	дни	часы
1	Необходимость проведения оценки остаточного резерва	Первый	1
2	Основные сведения о металлах	Первый	1
3	Механизм	Первый	5
4	Примеры повреждений	Второй	4
5	Технологии оценки остаточного резерва	Второй	3
6	Примеры диагностики	Третий	2
7	Меры по повышению запаса прочности	Третий	5

5. *Необходимое оборудование для данного курса/ Equipment*
   не требуется / not required
6. *Контрольные точки данного курса/ Milestones*

№	Контрольные точки в деталях
1	Контрольные вопросы после прохождения каждой главы questions after each chapter
2	Тестирования после прохождения данного учебника Test, after Classroom lecture,
3	Проводить Экскурсию если график обучения совпадает графиком тех. обслуживания ГТ Conduct on-site training if the training schedule coincides with the maintenance schedule of GT

7. *Вопросы и типичные ответы для заключительного экзамена курса/ Q&A for the final course exam*
   Подготовить, конкретные вопросы и типичные ответы для завершения экзамена курса, чтобы подтвердить понимание курса, более 10 вопросов. Опишите конкретные вопросы и ответы на другой странице.
   Preparing concrete questions and typical answers for completing the course exam to confirm understanding of the course, more than 10 questions. Please describe concrete Q&A in next page.

8. *Критерии оценки слушателей*/ Criteria

№	Параметры	Результат
1	Уровень посещаемости тренинга (%) / attendance rate	
2	Количество заданных вопросов /Количество вопросов, заданных каждым стажером по каждому, и его качество Number of questions asked from each trainee by each, and its quality	
3	Понимание лекцииб, Результаты теста завершения Understanding of the lecture, results of completion examination	

9. Specific Q&A, for course No 3 (Remaining Life assessment)

Конкретный список вопросов и ответов, курса № 3 (Технологии оценки остаточного резерва.)

Q&A should be more than 10 / Вопросы и ответы должны быть более 10

No	Chapter глава	Question/ Вопрос (drawings separated/чертежи разделены)	Typical answer/ Типичный ответ (drawings separated/чертежи разделены)
1	3-1	What kinds of wear and damage are exist?	In general, wear of parts is divided into 4 types. 1. Corrosion 2. Abrasion 3. Wear 4. Crack All these types of wear determine the state of the parts and the reasons for their detection.
2	3-1	What is regular equipment inspection and why is it needed?	In order to determine the state of the parts and the performance of all hot parts. All these activities are needed to save money on equipment repairs.
3	3-1	Remaining life assessment technologies	Main material: destructive testing, hardness measurement, the method of crystal deformation, the method of structural comparison (the main material), the method of changing carbides, the method of measuring the distance between precipitate particles, the analytical method Welding joint: destructive testings, hardness measurement, carbide measurement method, electric resistance method, UT, A-parametric method, empty space area calculation method, empty areas density method, structural comparison method (welding joint), analytical method
4	3-2	Type of alloys and why you need to know them?	• Pure metal • Solid solution • Intermetallic If we know the structure of crystallization and the type of alloys we can determine their destinations and characteristics.
5	3-2	Defects of the crystal	In many metals there is a violation of the order of atoms - this phenomenon is called a crystal defect. Defects are divided into point, linear, planar and volumetric. A linear defect is the disordering and displacement of the lines formed when the lattice is ordered. Linear defects are divided into edge, spiral and combinations of two types. Packing defect (planar) Atoms form a lattice, creeping into each other. Infringements of uniform structure of such packing name a defect of packing
6	3-3	The mechanism of aging and degradation	Devices and parts used in the equipment of boilers and turbines, under high temperatures and high pressure undergo various aging and degradation processes, and also get damaged, which, without proper maintenance, leads to failures and serious breakages. As types of damage can be identified damage due to creep, aging, embrittlement, corrosion, as well as abrasion
7	3-3	Reason and timing of appearanceof creep	The most movable element are voids. These voids are such concepts that a slight emptiness appears in the crystal structure which has no connection with the remaining atoms of the

			crystal. By the time when it appears you can say so creep is divided into three stages first, second, third. First, plastic deformation (ε0) occurs due to physical activity. This is called the first. Usually the creep rate does not depend on time. This is the second stage. In the third stage, owing to the accumulation of dislocations at the boundary of the crystalline grain, small holes are formed, in places of a special stress concentration at the boundary of the crystalline grain, a slip zone appears, which provokes a further increase in the hole that grows into cavities and microscopic cracks
8	3-3	What is fatigue? How many stages does fatigue have?	Fatigue refers to a phenomenon in which on the surface of a material, due to repeated exposure to stress, cracks occur and progress. In the classification of processes of damage due to fatigue, there are 3 stages 1st stage Due to the processes of rearrangement of dislocations within the crystalline grain, and also as they accumulate at the boundaries in the crystalline grains on the surface of the material, numerous slip bands arise which progress and degenerate into microscopic cracks. It is difficult to detect visually damages due to fatigue before the appearance of signs in the form of slip bands. 2nd stage Further development of microscopic cracks appearing on the surface of the material. Upon the onset of this stage, the damage can be established visually using non-destructive testing methods (PT, MT, etc.), and also to reveal quantitative volumes of damage. 3rd stage The stage, during which microscopic cracks continue a stable increase in the internal part of the crystalline grain, degenerating into macroscopic cracks. Cracks are easy to detect by methods of nondestructive testing, even without examination of the material. It is believed that cracks on the surface of the material are in the open state.
9	3-3	What is the wear?	**Abrasion** An abrasion is called a phenomenon in which, as a result of the contact of one material with another material, the material surface is gradually subjected to separation. A typical example of abrasion is abrasion of bearings of pumps, fans, etc. There are cases when erosion due to interaction with a liquid is considered to be abrasion, in many cases the difference with erosion is not obvious
10	3-5	What is the remaining life of the parts?	Residual resource of parts is predicted using methods and means of diagnosis. At the same time, the values of the diagnostic parameters, the previous operating time and working conditions are taken into account. In this case, it is believed that the rate of wear or the regularity of the change in the diagnostic parameters remains constant. Due to the fact that - 85% of machine parts lose their

			performance due to wear, the greatest interest in practice is the wear parameter
11	3-5	What is the difference between defect analysis and destruction mechanism analysis?	Analysis of the defect (evaluation of the resource before the occurrence of a crack) An analysis method that determines the resource before the appearance of a macrocrack by evaluating the process that led to its occurrence Analysis of fracture mechanics (estimation of crack growth resource) The analysis method, which determines the resource before failure as a result of crack growth
12	3-5	Remaining Life Assessment Methods	The two main methods for diagnosing the residual resource of heat and power equipment are the "direct assessment method" and the "indirect assessment method". The method of direct evaluation consists of "destructive control" and "non-destructive testing"
13	3-5	Advantages and disadvantages of methods of destructive and non-destructive testing	"Destructive testing" Advantages It is possible to accurately estimate the state of a material defect at the time of evaluation disadvantages It requires time and money for sampling and restoration of the object is complicated in observation "Nondestructive testing" Advantages -Economy -the possibility of periodic observation disadvantages It requires time and money for sampling and restoration of the object is complicated in observation
14	3-5	What is a software(programm) analysis?	Software analysis is a standard method for analyzing voltage and temperature using, as a rule, the finite element method. The program includes data on the material (fatigue limit, creep limit, etc.), as well as operational statistics. To estimate the residual life, the values of real fatigue and creep damage are calculated and data on plans for further operation are entered.
15			
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No	Chapter глава	Question/ Вопрос (drawings separated/чертежи разделены)	Typical answer/ Типичный ответ (drawings separated/чертежи разделены)
1	3-1	Какие имеется виды износов и повреждений деталей	В основном износов детялей разделяются на 4 вида. 1. Коррозия 2. Трения 3. Износь 4. Трешины Все эти виды износов определяют состояние детелей и их выявления причины.
2	3-1	Что такое регулярный техосмотр оборудования и зачем оно нужно	Что бы определить состояние детелей и их работаспособность всех горячих частей. Все эти мероприятия нужны что бы сэкономит затрату на ремонт оборудования.
3	3-1	Методика диагностики эксплуатационного резерва	Основной материал: деструктивные испытания, измерение твердости, метод деформации зерна, метод структурного сравнения (основной материал), метод изменения карбидов, метод измерения расстояния между частицами осадка, аналитический метод Сварочный шов: деструктивные испвытания, измерение твердости, метод измерения карбидов, метод электрического сопротивления, УЗИ, А-параметрический метод, метод расчета доли пустой площади, метод плотности пустых участков, метод структурного сравнения (сварочный шов), аналитический метод
4	3-2	Тип сплавов и зачем нужно знать?	• Чистый металл • Твёрдый раствор • Интерметаллид Потому что если мы знаем структуры кристаллизации и тип сплавов мы можем определить их предназначения и характеристик.
5	3-2	Дефекты кристалла	Во многих металлах присутствует нарушение порядка атомов – это явление называют дефектом кристалла. Дефекты делятся на точечные, линейные, плоскостные и объёмные. Линейным дефектом называют разупорядочивание и смещение линий, сформированных при упорядочивании решётки. Линейные дефекты делятся на краевые, спиральные и сочетания двух типов. Дефект упаковки(плоскостной) Атомы образуют решётку, накрадываясь друг на друга. Нарушения равномерной структуры такой укладки называют дефектом упаковки
6	3-3	Механизм старения и деградации	Приборы и детали, используемые в оборудовании котлов и турбин, при высоких температурах и высоком давлении претерпевают различные процессы старения и деградации, а также получают повреждения, что без надлежащего технического обслуживания ведет к сбоям и серьезным поломкам. В качестве видов повреждений можно выделить повреждения по причине

			ползучести, старения, охрупчивания, коррозии, а также истирания
7	3-3	Из-за чего появляется пользучест и время появления его.	Наиболее подвижным элементом являются пустоты. Пустоты эти такое понятия что в кристалическом структуре появляется малейшая пустота которая не имеет связ с осталними атомами кристала. Если времени когда оно появляется можно сказать так ползучесть разделяется на трии стадии первая, вторая, третья. Вначале возникает пластическая деформация (ε0) по причине физической нагрузки. Это называется первая. Обычная скорость ползучести не зависит от времени. Эта уже вторая стадия. В третий стадии вследствие скопления дислокаций на границе кристаллического зерна происходит образование мелких отверстий, в местах особенной концентрации напряжения на границе кристаллического зерна возникает участок скольжения, провоцирующий дальнейшее увеличение отверстия, перерастающего в полости и микроскопические трещины
8	3-3	Что такое усталость? Сколько имеется стадия усталости?	Усталостью называется явление, при котором на поверхности материала вследствие многократного его подвергания напряжению возникают и прогрессируют трещины. В классификации процессов повреждения по причине усталости можно выделить 3 стадии **1–ая стадия** Вследствие процессов перегруппировки дислокаций внутри кристаллического зерна, а также по мере их накопления на границах в кристаллических зернах, находящихся на поверхности материала, возникают многочисленные полосы скольжения, которые прогрессируют и перерождаются в микроскопические трещины. Обнаружить визуально повреждения вследствие усталости до появления признаков в виде полос скольжения сложно. **2–ая стадия** Дальнейшее развитие микроскопических трещин, появившихся на поверхности материала. По наступлении данной стадии повреждения можно установить визуально при помощи методов неразрушающего контроля (ПТ, МТ и др.), а также выявить количественные объемы повреждения. **3–ая стадия** Стадия, во время которой микроскопические трещины продолжают стабильное увеличение внутренней части кристаллического зерна, перерождаясь в макроскопические трещины. Трещины легко поддаются обнаружению методами неразрушающего контроля даже без проведения экспертизы ткани. Считается, что трещины на поверхности материала находятся в открытом состоянии.

9	3-3	Что такое истирание	**Истирание** Истиранием называют явление, при котором в результате контакта одного материала с другим материалом поверхность материалов постепенно подвергается отделению. Типичным примером истирания является истирание подшипников насосов, вентиляторов и пр. Бывают случаи, когда эрозию вследствие взаимодействия с жидкостью причисляют к истиранию, во многих случаях разница с эрозией не является очевидной
10	3-5	Что такое остаточный ресурс деталей?	Остаточный ресурс деталей прогнозируют с применением способов и средств диагностирования. При этом учитывают значения диагностических параметров, предыдущую наработку и условия работы. В этом случае полагают, что скорость изнашивания или закономерность изменения диагностических параметров остаются постоянными. По причине того что - 85 % деталей машин теряют работоспособность в результате изнашивания, наибольший интерес на практике представляет параметр износа
11	3-5	Чем отличаются анализ дефекта и анализ механики разрушений	Анализ дефекта (оценка ресурса до возникновения трещины) Метод анализа, определяющий ресурс до возникновения макротрещины путем оценки процесса, приведшего к ее возникновению Анализ механики разрушений (оценка ресурса роста трещины) Метод анализа, определяющий ресурс до разрушения в результате роста трещины
12	3-5	Методы диагностики остаточного ресурса	Двумя основными методами диагностики остаточного ресурса теплоэнергетического оборудования являются «метод непосредственной оценки» и «метод косвенной оценки». Метод непосредственной оценки состоит из «разрушающего контроля» и «неразрушающего контроля».
13	3-5	Достоинства и недостатки методов разрушающего и неразрушающего контроля	«Разрушающего контроля» *Достоинства* возможна высокоточная оценка состояния дефекта материала на момент оценки *недостатки* Требует затрат времени и средств на забор образцов и восстановление объекта сложен в наблюдении «Неразрушающего контроля» *Достоинства* -экономичний -возможность периодического наблюдения *недостатки* Требует затрат времени и средств на забор образцов и восстановление объекта сложен в наблюдении
14	3-5	Что такое програмный анализ ?	Программный анализ – это стандартный метод анализа напряжения и температуры с помощью, как правило, метода конечных

			элементов. В программу вводятся данные о материале (предел усталости, предел ползучести и др.), а также эксплуатационная статистика. Для оценки остаточного ресурса вычисляются значения реальных усталостных и ползучих повреждений и вводятся данные о планах дальнейшей эксплуатации.
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План урока **Дата: «___»_____2018г**

Учебный центр по эксплуатации и техобслуживанию ПГУ
«УТВЕРЖДАЮ»
Директор учебного центра
_____ Достов Ш.О.

1. *Номер и название учебного курса/ Title & Trainer*
   4. Оборудование комбинированной генерации газовой турбины
   (GT, combined power generation equipment)
   Ответственный инструктор для данного курса/Responsible Instructor for this course
   Главный: Худойкулов Лутфулло Chief: Khudoykulov Lutfullo
   Заместитель: Мусаев Алишер Deputy: Musayev Alisher
   Другие: Байлиев Шухрат Others:Bayliev Shukhrat
2. *Стандартное количество слушателей*/ Number of trainee
   10 слушателей. 10 Trainee
   Целевые слушатели : Работники АО «НТЭС»
   Персонала эксплуатации и технического обслуживания, Новые сотрудники ПГУ
   /O&M Staff of Navoi TPP, New employee for CCPP
3. *Продолжительность курса (часы)/* Course duration
   Из дневного месяца, года; до дневного месяца, года
   3 дня (21 час)
4. *Содержание курса и часы/* Course contents and hours

№	Главы	дни	часы
1	Обзор Навоийской ТЭС	первый	3
2	Основы комбинированного цикла выработки	первый	4
3	Основные знания о ГТ	второй	3
4	Периодическая инспекция и инспекция камеры сгорания	второй	4
5	Котел утилизатор	третий	2
6	Паровая турбина	третий	2
7	Примеры неисправностей	третий	2
8	Анкетирование	третий	1

5. *Необходимое оборудование для данного курса/* Equipment
   Не требуется/ not required
6. *Контрольные точки данного курса*/ Milstone

№	**Контрольные точки в деталях**
1	Контрольные вопросы после прохождения каждой главы Question after each chapter
2	Тестирования после прохождения данного учебника Test, after Classroom lecture
3	Короткометражные видеоролики с «YouTube»ба по оборудованию Short video clips from "You Tube" on equipment
4	Экскурсия по узлам основного оборудования On-site tour of the main equipment
5	

7. *Вопросы и типичные ответы для заключительного экзамена курса/Q&A for the final course exam*
   Подготовить, конкретные вопросы и типичные ответы для завершения экзамена курса, чтобы подтвердить понимание курса, более 10 вопросов. Опишите конкретные вопросы и ответы на другой странице.
   Preparing concretequestions and typical answers for completing the course exam to confirm understanding of the course, more than 10 questions. Please describe concreteQ&A in another page.

8. *Критериоценкислушателей*/ Criteria

№	**Параметры**	**Результат**
1	Уровеньпосещаемоститренинга (%)/ attendancerate	
2	Количество заданных вопросов/Количество вопросов, заданных каждым стажером по каждому, и его качество Number of questions asked from each trainee by each, and its quality	
3	Пониманиелекции, Результатытестазавершения Understanding of the lecture, results of completion examination	

9. Specific Q&A, for course No 4(GT, combined power generation equipment)

Конкретный список вопросов и ответов, курса № 4. Оборудование комбинированной генерации газовой турбины

Q&A should be more than 10 / Вопросы и ответы должны быть более 10

No	Chapter глава	Question/ Вопрос (drawings separated/чертежи разделены)	Typical answer/ Типичный ответ (drawings separated/чертежи разделены)
1		Parts of high-temperature elements	Combuster, turbine blade and vanes
2		Combuster parts	Fuel nozzles, combuster basket, transition pieces.
3		The temperature of the hot gas at the inlet and outlet of the turbine (on the F4 type)	1400°C at inlet 600°C at outlet
4		Types of heat-resistant materials	Doped alloy, cast alloy, ss blade alloy, obtained by the method of sprinkled crystal, PS blade.
5		Types of cooling	Convective cooling, (needle cooling) Film cooling, Ejection cooling
6		Inspection types	Non destructive testing (NDT) Destructive testing (DT)
7		Types of testing by (NDT)	Visual Testing, penetration Testing, luminescence penetrating method, Magnetic practical testing, microscopic research, borescope research, eddy current method, measurement control, microcracks research, Investigation of the surface structure.
8		An example of the repair process for corrosion of a fuel nozzle.	Check-application of temporary protective coating-purge (aluminum oxide) -cleaning-check using borescope-anti-corrosive measure-final check.
9		Interval of working hours between repairs of the turbine.	Every 12,000 hours
10		Replacing the hot part.	Combustion basket and transition piece every 36,000 hours. 1,2,3 row turbine blades and 1,2 row vanes, 1,2 row of the segments every 50,000 hours 3-row vanes and 3-row segments in 80,000 hours. 4 row vanes, 4 row blades and 4 row segments in 100,000 hours.

No	Chapter глава	Question/ Вопрос (drawings separated/чертежи разделены)	Typical answer/ Типичный ответ (drawings separated/чертежи разделены)
1		Части высокотемпературных элементов	Камбастр, направляющие лопатки, рабочие лопатки.
2		Части камбасторв	Топливные форсунки, камеры сгорания, переходные потрубки.
3		Температура горячего воздуха на входе и выходе тупбины (на F4 марке)	1400°C на входе 600°C на выходе
4		Типы термостойких материалов	Легированный сплав, литейный сплав, сс лопатка сплав, полученный методом напрвленной кристализации ,ПS лопатки.
5		Типы охлаждения	Конвективное охложление, (иголчатое охлаждение) Пленочное охлаждение, Ижекционное охлаждение
6		Типы инспекций	Неразрушающий контроль(НК) Разрушающий контроль(РК)
7		Типы тестиравания по (НК)	Визувлный контроль, контроль проникающими веществом, люменесцентный проникающий метод, Магнитно порошковый метод, исследования под микроскопом, исследования бороскопом, выхретоковый метод, измерителный контроль, исследования микротрещин, Исследование структуры поверхности.
8		Пример процесса ремонта при коррозии топливной форсунки.	Проверка-нанесение временного защитного покрытия –продувка (окись алюминия)-очистка-проверка с помощью дороскопа-антикаррозийной меры-заключительная проверка.
9		Промежуток рабочих часов между ремонтами турбины.	Каждые 12000 часов
10		Замена деталей горючей части.	Камера сгорания и переходной потрубок через 36,000 часов. 1,2,3 ступень рабочие и 1,2 ступень направлюшие лопатки, 1,2 ступень сигменты через 50,000 часов 3ступень направляюшие и 3ступен сигменты через 80.000 часов. 4 ступень направляюшие, 4 ступень рабочие и 4 ступень сигменты через 100,000 часов.

План урока **Дата: «___»_____2018г**

Учебный центр по эксплуатации и техобслуживанию ПГУ
«УТВЕРЖДАЮ»
Директор учебного центра
_____ Достов Ш.О.

1. *Номер и название учебного курса/ Title & Trainer*

5. Техническое обслуживание горячих частей газовой турбины
(GT Hot Parts Maintenance)

Ответственныйинструктордляданногокурса/Responsible Instructor for this course

Главный:Джамалов Б.Д.

Заместитель:Исламов И.К.,

Другие: Байлиев Ш.

Стандартное количество слушателей/Number of trainee

10 слушателей. 10 Trainee

Целевые слушатели : Работники АО «НТЭС»

Персонала эксплуатации и технического обслуживания/O&M Staff of Navoi TPP

2. *Продолжительность курса (часы)/* Course duration

Из дневного месяца, года ; до дневного месяца, года

3 дня (21 час)

3. *Содержаниекурсаичасы/*Course contents and hours

№	Главы	дни	часы
1	Базовые знания о высокотемпературных деталях ГТ	Первый	1.5
2	Базовые знания о высокотемпературных деталях ГТ (вспомогательные материалы)	Первый	1.5
3	Инспекция и тестирование	Первый	4
4	Повреждения и ремонт	Второй	3
5	Оценка остаточного ресурса	Второй	4
6	Оценка оставшегося срока эксплуатации	Третий	2
7	Методы контроля	Третий	2
8	Обслуживание газовой турбины	Третий	2
9	Анкетирование	Третий	1

4. *Необходимое оборудование для данного курса/* Equipment

Не требуется(not required)

5. *Контрольные точки данного курса*/ Milstone

№	Контрольные точки в деталях
1	Контрольные вопросы после прохождения каждой главы Question after each chapter
2	Тестирования после прохождения данного учебника Test, afterClassroomlecture
3	Проводить Экскурсию если график обучения совпадает графиком тех. обслуживания ГТ Conduct on-site training if the training schedule coincides with the maintenance schedule of GT
4	Экскурсия по складу запасных частей и инструментов для инспекции ГТ On-site tour to the warehouse of spare parts and tools for inspection of GT

6. *Вопросы и типичные ответы для заключительного экзамена курса/Q&Aforthefinalcourseexam*

Подготовить, конкретные вопросы и типичные ответы для завершения экзамена курса, чтобы подтвердить понимание курса, более 10 вопросов. Опишите конкретные вопросы и ответы на другой странице.

Preparing concretequestions and typical answers for completing the course exam to confirm understanding of the course, more than 10 questions. Please describe concreteQ&A in another page.

7. *Критерии оценки слушателей*/ Criteria

№	Параметры	Результат
1	Уровень посещаемости тренинга (%)/ attendance rate	
2	Количество заданных вопросов/ Количество вопросов, заданных каждым стажером по каждому, и его качество Number of questions asked from each trainee by each, and its quality	
3	Понимание лекции, Результаты теста завершения Understanding of the lecture, results of completion examination	

9. SpecificQ&A, forcourseNo5 (GT Hot Parts Maintenance)

Конкретный список вопросов и ответов, курса № 5 (Техническое обслуживание горячих частей газовой турбины)

Q&A should be more than 10 / Вопросы и ответы должны быть более 10

No	Chapter глава	Question/ Вопрос (drawings separated/чертежи разделены)	Typical answer/ Типичный ответ (drawings separated/чертежи разделены)
1	1	High-temperature parts and their types.	Parts located in the path of the passage of high-temperature gas: a flame tube, transition piece, blades and vanes, ring segment seals, and the like.
2	1	Types of cooling system for high-temperature parts.	- Convective cooling (free cooling) - Film cooling (used in turbine blades) - Injection cooling (used in turbine vanes)
3	2	Types of control and testing?	Non-destructive testing (NDT) at power plant Destructive testing (DT) at the factory of inspecting company
4	2	Types of testing.	- Visual control - Control of penetrating substances (PT) -Luminescent penetration method - Magnetic particle method (MPT) -Investigation under a microscope -Inspect borescope -Eddy current method -Measuring control -Investigation of microcracks -Cut surface structure investigation - Fatigue damage test (SP test) -Creeping deformation test -Hardness test -Extension test
5	3	Methods for assessment of remaining service life	- direct assessment methods are methods of destructive testing and non-destructive testing - methods of indirect assessment – is an analytical method
6	3	Describe each control method.	Methods of destructive testing are: -measurement of creep parameters; -measurement of the parameters of extension; -fatigue damage test The non-destructive testing method is: - investigation of the structure; - investigation of microcracks; -test for hardness; -Electric resistance test; -genogeneic analysis; - ultrasonic inspection. The analytical method is: -program analysis.
7	6	Types of control methods	- Life time monitoring - Control over the number of repair cases - Status monitoring
8	6	Important points in case of rotation	- Do not exceed the service life - Efficient use of life term - Ensuring appropriate time management
9		Describe the sequence of repair work.	- removal of the coating

			- Defect detection - elimination of defects - Welding repair work - heat treatment - re-coating
10		Types of repair of turbine vanes	**Coupon repair (with the help of an insert):** - this is the way in which the new part is replaced only with the part on which the cracks are accumulated and the new part is welded. **Repair by diffusion soldering:** is a repair method that involves homogenization with the base metal during welding, fusing in the cracks of the base metal by means of heat treatment by spraying the filler having essentially the same composition as the base metal.

No	Chapter глава	Question/ Вопрос (drawings separated/чертежи разделены)	Typical answer/ Типичный ответ (drawings separated/чертежи разделены)
1	1	Высокотемпературные детали и их виды.	Детали, расположенные на пути прохождения газов высокой температуры : это жаровая труба, перехрдной патрубок, статорные и роторные лопатки, кольцевые сегментные уплотнения и т.п.
2	1	Виды системы охлаждения высокотемпературных деталей.	- Ковективное охлождение (иголчатое охлаждение) - Пленочное охлаждение (используется в роторных лопатках) - Инжекционное охлаждение (используются в статорных лопатках)
3	2	Виды контроля и тестирований?	**Неразрушающий контроль (НК)**на электростанции ЭС **Разрушающий контроль (РК)** на заводе, инспектирующая компания
4	2	Типы тестирования.	- Визуальный контроль - Контроль проникающими веществам (ПВК) -Люминесцентный проникающий метод - Магнитно порошковый метод (МП) -Исследование под микроскопом -Исследование бороскопом -Вихретоковый метод -Измерительный контроль -Исследование микротрещин -Исследование структуры поверхности - Измерительный контроль -Исследование структуры разреза -Тест на усталостное повреждение (тест SP) -Тест на ползучую деформацию -Тест на твердость -Тест на растяжение
5	3	Методы оценки оставшегося срока службы	- методы прямой оценки - это методы разрушающего контроля и неразрушающего контроля - методы косвенной оценки – это аналитический метод
6	3	Опишите каждый метод контроля.	Методы разрушающего контроля – это: -измерение параметров ползучести; -измерение параметров ратяжения; -тест на усталостное повреждение Метод неразрушающего контроля – это: -исследование структуры; -исследование микротрещин; -испытание на твердость; -испытание на электрическое сопротивление; -ренгеноструктурный анализ; -ультразвуковой контроль. Аналитический метод – это: -программный анализ.
7	6	Виды методов контроля	- Контроль срока эксплуатации - Контроль над количеством случаев ремонта - Контроль над состоянием
8	6	Важные моменты в случае ратации	- Не превышать срок эксплуатации

			- Эффективное использование срока эксплуатации - Обеспечение соответствующего регулирования времени
9		Опишите последовательность ремонтных работ.	- удаление покрытия - выявление дефектов - устранение дефектов - сварочные ремонтные работы - термическая обработка - повторное нанесение покрытия
10		Виды ремонтов направляющих лопаток	**Купонный ремонт (с помощью вставки):** - это способ, при котором заменяется новой только та часть, на которой скопились трещины и новая часть приваривается. **Ремонт диффузионной пайкой твердым припоем:** - это способ ремонта, предполагающий гомогенизацию с основным металлом при сварке, вплавление в трещины основного металла с помощью термической обработки разбрызгиванием наполнителя, имеющего по существу тот же состав, что и основной металл.

План урока (Проект) **Дата: «___»_____2018г**

Учебный центр по эксплуатации и техобслуживанию ПГУ
«УТВЕРЖДАЮ»
Директор учебного центра
_____ Достов Ш.О.

1. Номер и название учебного курса/ *Title & Trainer*
   №6. Подробные данные об электрооборудовании для электростанции КЦ с газовой турбиной (Details of Electrical Facilities for GT CCPP)
   Ответственный инструктор для данного курса/Responsible Instructor for this course
   Главный:ЭшевХ : Chief: Eshev Khamdam
   Заместитель: Пармонов А, : Deputy: Parmanov Azim
   Другие:: Тошов С Others: Toshov S.
2. Стандартное количество слушателей/ Number of trainee
   10 слушателей.10 Trainee
   Целевые слушатели:

Продолжительность курса (часы)/ Course duration;Day(Hours)
Из дневного месяца, года ; до дневного месяца, года
4 дня (26 час)

3. Содержание курса и часы/Course contents and hours

№	Главы	Дни	Часы	Страницы
1	Введение	Первый	1	7
2	Статический преобразователь частоты	Первый	3	35
3	Автоматический регулятор напряжения	Первый	3	10
4	Система возбуждения генератора	Второй	3	12
5	Реле защиты генератора	Второй	4	30
6	Автоматический выключатель (размыкатель цепи)	Третий	3	13
7	Базовая концепция проверки (инспекции) и технического обслуживания	Третий	3	3
8	Практическая часть (СПЧ)	Четвертый	4	
9	Анкетирование	Четвертый	2	-

ПРИМЕЧАНИЕ: Инструктаж по техники безопасности проводится при изучение учебника №7.
NOTE: Instruction on work safety is conducted while studying the textbook No. 7.

4. Необходимое оборудование для данного курса/ Equipment
   Лабораторные приспособления/ Laboratory accessories
5. Контрольные точки данного курса/ Milstone

№	Контрольные точки в деталях
1	СПЧ, выключатель ,цифровой реле, АРВ. **SFC**, switch, digital relay, AVR.
2	
3	
4	

6. Вопросы и типичные ответы для заключительного экзамена курса/*Q&A for the final course exam*
   Подготовить, конкретные вопросы и типичные ответы для завершения экзамена курса, чтобы подтвердить понимание курса, более 10 вопросов. Опишите конкретные вопросы и ответы на другой странице.
   Preparing concretequestions and typical answers for completing the course exam to confirm understanding of the course, more than 10 questions. Please describe concreteQ&A in next page.

7. Критерии оценки слушателей/ Criteria

№	Параметры	Результат
1	Уровеньпосещаемоститренинга (%)/ attendancerate	
2	Количество заданных вопросов/ Количествовопросов, заданных каждым стажером по каждому, и его качество Number of questions asked from each trainee by each, and its quality	
3	Пониманиелекции, Результатытестазавершения Understanding of the lecture, results of completion examination	

9. Specific Q&A, for course No 1 (Details of Electrical Facilities for GT CCPP)

Конкретный список вопросов и ответов, курса № №6. Подробные данные об электрооборудовании для электростанции КЦ с газовой турбиной

Q&A should be more than 10 / Вопросы и ответы должны быть более 10

No	Chapter глава	Question/ Вопрос (drawings separated/чертежи разделены)	Typical answer/ Типичный ответ (drawings separated/чертежи разделены)
1	2	Methods of starting gas turbines.	The system is started using a frequency converter.
2	2	The purpose and function of the static frequency converter (SFC)	To overcome the initial torque of the generator and to create the required amount of combustion air ....
3	2	Principle of operation of thyristors	Conversion of AC to DC.
4	2	Inverter Functions	Conversion of DC to AC
5	2	List the basic protection of a power transformer.	Diff. protection. Gas protection Overcurrent and overload (per signal)
6	3	The role and application of AVR (automatic voltage regulator)	For stable maintenance of system voltage
7	3	Power supply AVR	The source of power of the AVR are the voltage and current transformers of the generator.
8	4	List the types of excitation system	Machine High-frequency Thyristor
9	4	Advantages and disadvantages of thyristor excitation	Benefits: convenience in operation. Static system without rotating parts. Weak points: cooling system - water.
10	4	What is the source of the initial excitation of the generators (GTG and STG)?	A source of a direct current (battery) or from own needs through rectifying installations
11	4	The purpose of the varistor (overvoltage limiter) in the excitation circuit of the generator?	Protection of thyristor elements from overvoltage.
12	4	The purpose of the contactor in the rotor circuit of the generator?	Shunts the winding of the rotor when the AGP is disconnected, by shunting the rotor winding at the quenching resistance
13	4	The effect of excitation current on the change in reactive power values at the generator terminals?	With increasing excitation current, the reactive power (overexcitation) increases; When the excitation current is reduced, the reactive power (underexcitation) decreases;
14	5	Types of used circuit breaks in CCGT	Ele gas Vacuum
15	5	Chemical composition and electrical properties of SF6 gas	S F6 six fluoride sulfur.
16	5	Advantages of gas SF6	Dielectric density is twice as high as air, non-toxic, non-incendive, non-corrosive, provides excellent arc extinction, excellent thermal conductivity.
17	5	Place of installation of gas-insulated and vacuum circuit breakers for protection of CCGT units	For protection of 6 kV installed vacuum switches. SF6 circuit breakers are used to protect generators and 220 kV electricity transmission lines.
18	5	The main technical parameters of the	Time off from 34 + -5 ms

		switch of the generator ST?	The duration of mechanical wear and tear 20 000 (on / off)
19	6	Types of basic protection of generators and transformers.	Diff generator protection, differential protection of units, gas protection trans-in, GZG, generator overload, overcurrent protection with start-up on min. tension, Prot. from the ground fault on the 220 kV side.
20	6	Type of digital (microprocessor) generator protection relay	M-3425A
21	6	Source of the current and voltage relay circuit?	Transformers of current and voltage of generators.
22	6	In case of emergency situations from which switches are the generators turned off?	At the same time, the AGP, VGi switches 220 kV are disconnected.
23	6	Differential protection range of the generator	From the generator current transformer to the output current transformers of the generator.
24			
Simple Questions			
1	2	Generator cooling system	Gas generator of hydrogen cooling, Steam generator of air cooling.
2	5	Purpose of circuit breaks	Switching off and on the circuit
3	5	Commutation equipment	
4	2	The purpose of the DC reactor in the SFC system	Smoothes DC systems.
5	2	Transformer cooling systems	Acceptable
6	2	Analog and digital signals	Periodic signals - analog Contact signals-discrete
7	2		

No	Chapter глава	Question/ Вопрос (drawings separated/чертежи разделены)	Typical answer/ Типичный ответ (drawings separated/чертежи разделены)
1	2	Способы запуска газовых турбин.	Система запускается с использованием преобразователя частоты.
2	2	Назначение и функция статического переобразователя частоты (СПЧ)	Для преодолевания начального вращающего момента генератора и для создания необходимого количества воздуха сжигания газа….
3	2	Принцип работы тиристоров	Преоброзование переменного тока на постоянный.
4	2	Функции инвертора	Переоброзование постоянного тока на переменный
5	2	Перечислить основные защиты силового трансформатора.	Диф.зашита. Газовая защита МТЗ и Перегруз (на сигнал)
6	3	Роль и применение АРН (автоматический регулятор напряжения)	Для стабильного поддержания системного напряжения
7	3	Источник питания АРН	Источником питания АРН являются трансформаторы напряжения и тока генератора.
8	4	Перечислить виды системы возбуждения	Машинная Высокочастотная Тиристорная
9	4	Преимущества и недостатки тиристорного возбуждения	Премущества: Удобства в эксплуатации. Статическая система без вращающихся частей. Слабые места: система охлаждения-водяная.
10	4	Что является источником начального возбуждения генераторов (ГГ и ПГ)?	Источник постоянного тока (батареи) или от собственных нужд через выпрямительные установки
11	4	Назначение варистора (ограничитель перенапряжения) в цепи возбуждения генератора?	Защита элементов тиристоров от перенапряжения.
12	4	Назначение контактора в цепи ротора генератора?	Шунтирует обмотку ротора при отключения АГП, путем шунтирования обмотки ротора на гасительном сопротивлении
13	4	Влияние тока возбуждения к изменению значений реактивной мощности на выводах генератора?	При увеличени тока возбуждения увеличивается реактивная мощность (перевозбуждение); При уменьшения тока возбуждения уменьшается реактивная мощность (недовозбуждение);
14	5	Типы применяемых выключателей на ПГУ	Элегазовые Вакуумные
15	5	Химический состав и электротехнические свойства элегаза	S F_6 шести фтористая сера.
16	5	Преимущества газа S F_6	Диэлектрическая плотность в два раза превышающая воздушную,нетоксичную, невоспламеняемость, некоррозийность, предоставляет отличное гашение дуги, отличная теплопроводность.

17	5	Место установки элегазовых и вакуумных выключателей для защиты устройств ПГУ	Для зашиты 6кВ установлены вакуумные выключатели. Для защиты генераторов и ЛЭП-220 кВ применяется элегазовые выключатели.
18	5	Основные технические параметры выключателя генератора ПТ?	Время отк 34+-5 мс Продолжительность механической изностойкости 20 000 (вкл/откл)
19	6	Виды основных защит генераторов и трансформаторов.	Диф защиты генератора, дифзащиты блоков, газовой защиты транс-в, ЗЗГ, перегруз генератора, МТЗ с пуском по мин. напряжению, Защ. от замыкания на землю со стороны 220 кВ.
20	6	Тип цифрового (микропроцессорного) реле защиты генратора	М-3425А
21	6	Источник цепи тока и напряжения реле?	Трансформаторы тока и напряжния генараторов.
22	6	При аварийных ситуациях от каких выключателей отключается генераторы?	Одновременно отключается АГП,ВГи выключатели 220 кВ.
23	6	Зона действия диф.защиты генератора	От трансформатора тока нейтрали генератора до выходных трансформаторов тока генератора.
24			
Простые вопросы			
1	2	Система охлаждения генераторов	Газогенератор водородного охлаждения, Парогенератор воздушного охлаждения.
2	5	Назначения выключателей	Отключения и включения цепи
3	5	Коммутационые аппаратуры	
4	2	Назначения реактора постоянного тока в системе СПЧ	Сглаживает системы постоянного тока.
5	2	Систем охлаждения трансформаторов	Принидутельная
6	2	Аналоговые и дискретные сигналы	Периодические сигналы –аналоговые Контактные сигналы -дискретные
7	2		

План урока (Проект) **Дата: «___»_____2018г**

Учебный центр по эксплуатации и техобслуживанию ПГУ
«УТВЕРЖДАЮ»
Директор учебного центра
_____ Достов Ш.О.

1. Номер и название учебного курса/ *Title & Trainer*

№7. Теория об эксплуатации и управлении теплоэлектростанции с газовой турбиной комбинированного цикла（Operation & Control Theory of GT CCPP)

Ответственный инструктор для данного курса/Responsible Instructor for this course
Главный:Нарзиев А.АChief: Narziev Akmal Abdulloevich
Заместитель: Эшев Х ,Худойкулов Л, Тошов И, Бозоров Ф
Deputy: Eshev Khamdam, Khudoykolov Lutfillo, Toshov Istam, Bazarov Faxriddin
Другие: Хасанов Л Others: Khazanov Latif.

2. Стандартное количество слушателей/ Number of trainee
10 слушателей.10 Trainee
Целевые слушатели:Новые сотрудники ПГУ
New employee for CCPP

3. Продолжительностькурса (часы)/ Course duration;Day(Hours)
Из дневного месяца, года ; до дневного месяца, года
3 дня (21 час)

4. Содержаниекурсаичасы/Course contents and hours

№	Главы	дни	часы	Страницы
1	Введение	Первый	1	4
2	Конфигурация системы ПГУ	Первый	3	7
3	Управление газовой турбины	Первый	3	24
4	Управление паровой системы	Второй	3	29
5	Эксплуатация ПГУ	Второй	4	11
6	Мониторинг и защита ПГУ	Третий	5	9
7	Заключение	Третий	1	1
8	Анкетирование	Третий	2	

5. Необходимое оборудование для данного курса/ Equipment
Не требуется (not required)

6. Контрольные точки данного курса/ Milstone

№	Контрольные точки в деталях
1	Технологическая защита, Управление газовой турбины, Управление паровой системы Protection technology, GT control, ST control
2	Мониторинг, Конфигурациясистема, Управления КУ Monitoring configuration of system, Management ***КУ***
3	Проводить Экскурсию если график обучения совпадает графиком тех. обслуживания ГТ Conduct on-site training if the training schedule coincides with the maintenance schedule of GT

7. Вопросы и типичные ответы для заключительного экзамена курса/*Q&A for the final course exam*
Подготовить, конкретные вопросы и типичные ответы для завершения экзамена курса, чтобы подтвердить понимание курса, более 10 вопросов. Опишите конкретны евопросы и ответы на другой странице.
Preparing concretequestions and typical answers for completing the course exam to confirm understanding of the course, more than 10 questions. Please describe concreteQ&A in next page.

8. Критерии оценки слушателей/ Criteria

№	Параметры	Результат
1	Уровеньпосещаемоститренинга (%)/ attendancerate	
2	Количество заданных вопросов/ Количествовопросов, заданных каждым стажером по каждому, и его качество Number of questions asked from each trainee by each, and its quality	
3	Пониманиелекции, Результатытестазавершения Understanding of the lecture, results of completion examination	

9. Specific Q&A, for course No 7 (Operation & Control Theory of GT CCPP)

Конкретный список вопросов и ответов, курса №7. Теория об эксплуатации и управлении теплоэлектростанции с газовой турбиной комбинированного цикла

Q&A should be more than 10 / Вопросы и ответы должны быть более 10

No	Chapter глава	Question/ Вопрос (drawings separated/чертежи разделены)	Typical answer/ Типичный ответ (drawings separated/чертежи разделены)
1	2	About the physical quantities used in the practice of production and consumption of electrical and thermal energy	International System of Units (SI),
2	2	The principle of operation and the thermal cycle of the CCGT	
3	2	The main differences between the combined-cycle plant and the traditional thermal power plant	
4	2	The main control valves of GTU and their task	Fuel gas is regulated by pressure control valves (PCV), flow control valves (FCV), temperature control valves (TCV) The air flow of the compressor is regulated by the inlet guide (IGV) and the bypass valve.
5	3	Which positions are fuel regulation classified?	Fuel regulation is classified into three following positions: Turbine speed and load regulation` □ Temperature control □ Gas flow control
6	3	What control modes are used on the gas turbine?	Turbine speed control (control mode of the rotation regulator (GVC) Load control (LDC mode) Blade path temperature control (BPTC mode) Exhaust gas temperature control (EGTC mode) Temperature control by fuel limitation (FL mode) Fuel control system for self-regulation (self-regulation mode)
7	3	The operating principle of the automatic fuel control system	Overview of fuel regulation system
8	3	What parameters govern the fuel consumption of the gas turbine?	Actual speed of the turbine Actual output power Set output power Actual blade path temperature Actual exhaust gas temperature Combustion basket casing pressure Atmosphere pressure setting fuel consumption from MTS mode setting fuel consumption from IGN mode setting fuel consumption from WUP mode
9	3	What is compressor compression ratio?	The compression ratio is the ratio of the gas pressure after compression to pressure before compression. The higher the compression ratio, the lower the compressor capacity.
10	3	What are the main parameters that affect the inlet guide system (IGV)?	The IGV is regulated using the following five parameters. 1. Actual speed of the turbine

			2. Actual inlet temperature of the compressor 3. Specified output power (load) 4. Actual outlet pressure of the compressor 5.Actual atmospheric pressure
11	4	Why is the load of a steam turbine completely depends on the load of GT in modern CCGT units?	The steam turbine receives uncontrolled exhaust heat from the gas turbine. Thus, the load of the steam turbine is completely depends on the load of the GT. As a result, the CCGT can perform highly efficient work not only when working at full load, but also at partial load.
12	4	Why is it important to adjust the water level in the drums of the HRSG?	In order to avoid the decrease in the water level in the drum, it is necessary to control the level in the drum of HRSG. When the HRSG is used with exhaust gases of low-level GT in the HRSG drums, the following faults will occur. Deformation of pipes, Swelling of pipes, Formation of cracks, Damage, Gap Also, if the level of the upper limit drum is increased, water will be thrown into the steam pipes and into the ST, which can damage the ST blades.
13	5	Start sequence of CCGT unit	Starting the condenser system Starting the HRSG Starting and accelerating the gas turbine Connecting the gas turbine to the grid Start-up and acceleration of the steam turbine Connecting the steam turbine to the grid
14	6	Protection, acting on the CCGT shutdown	Inadmissible vibrations of the bearing of the gas turbine Low oil pressure in the gas turbine bearing Low oil pressure of control oil Ignition failure High exhaust pressure Combustion basket failure Inadmissible vibrations of the bearing of the steam turbine Low oil pressure in the steam turbine bearing Low degree of vacuum condenser High temperature on exhaust steam turbine Deviation of steam drum level Stopping the feedwater pump Generator protection operation

No	Chapter глава	Question/ Вопрос (drawings separated/чертежи разделены)	Typical answer/ Типичный ответ (drawings separated/чертежи разделены)
1	2	О физических величинах, используемых в практике производства и потребления электрической и тепловой энергии	Международная система единиц (СИ),
2	2	Принцип работы и тепловой цикл ПГУ	
3	2	Основные отличия парогазовой установки от традиционной тепловой электростанции	
4	2	Основные регулирующие клапаны ГТУ и их задача	Топливный газ регулируется регулирующими клапанами давления (РКД), регулирующими клапанами расхода (РКР), регулирующими клапанами температуры (РКТ) Поток воздуха компрессора регулируется входным направляющим аппаратом (ВНА) и байпасным клапаном.
5	3	На какие позиции классифицируется регулирование топлива?	Регулирование топлива классифицируется на три следующие позиции: ➢ Скорость турбины и регулирование нагрузки ➢ Регулирование температуры ➢ Регулирование расхода газа
6	3	Какие режимы управления применяются на газовой турбине?	Регулирование скорости турбины (режим управления регулятора оборотов (GVC) Регулирование нагрузки (режим LDC) Регулирование температуры траектории лопасти (режим BPTC) Регулирование температуры выхлопного газа (режим EGTC) Регулирование температуры ограничением топлива (режим FL) Система регулирования топлива для саморегулирования (режим саморегулирования)
7	3	Принцип работы автоматической системы регулирования топлива	Общее представление системы регулирования топлива
8	3	Какими параметрами управляется расход топлива на газовой турбине?	Фактическая скорость турбины Фактическая выходная мощность Заданная выходная мощность Фактическая температура канала лопасти Фактическая температура выхлопного газа Давление кожуха камеры сгорания Атмосферное давление задание расхода топлива от режима MTS задание расхода топлива от режима IGN задание расхода топлива от режима WUP

9	3	Что такое степень сжатия компрессора?	Степенью сжатия называется отношение давления газа после сжатия к давлению до сжатия. Чем больше степень сжатия, тем меньше производительность компрессора.
10	3	Какие основные параметры влияют на систему управления входного направляющего аппарата (IGV) ?	IGV регулируется при помощи пяти следующих параметров. 1.Фактическая скорость турбины 2.Фактическая входная температура компрессора 3.Заданная выходная мощность (нагрузка) 4.Фактическое выходное давление компрессора 5.Фактическое атмосферное давление
11	4	Почему на современных ПГУ нагрузка паровой турбины полностью зависит от нагрузки ГТ ?	Паровая турбина получает неконтролируемое выхлопное тепло от газовой турбины. Таким образом, нагрузка паровой турбины полностью зависит от нагрузки ГТ. В результате, ПГУ может выполнять высокоэффективную работу не только при работе при полной нагрузке, но и при частичной нагрузке.
12	4	Почему важно регулировать уровень воды в барабанах КУ?	Во избежание снижения уровня воды в барабане, необходимо регулирование уровня в барабанах КУ. при работе КУ с выхлопными газами ГТ с низким уровнем в барабанах КУ произойдут нижеследующие неполадки. ➢ Деформация труб, ➢ Набухание труб, ➢ Образование трещин, ➢ Повреждение, ➢ Разрыв Также, при повышении уровня барабана верхного предела, произойдет заброс воды в паропроводы и в ПТ, что может привести к повреждению лопаток ПТ.
13	5	Последовательность запуска ПГУ	Запуск системы конденсатора Запуск КУ Запуск и ускорение газовой турбины Подключение газовой турбины к сети Запуск и ускорение паровой турбины Подключение паровой турбины к сети
14	6	Защиты, действующие на останов ПГУ	Недопустимые вибрации подшипника газовой турбины Низкое давление масла в подшипнике газовой турбины Низкое давление масла управляющего масла

			Отказ воспламенения Высокое давление выхлопа Отказ камеры сгорания Недопустимые вибрации подшипника паровой турбины Низкое давление масла в подшипнике паровой турбины Низкая степень вакуума конденсатора Высокая температура на выхлопе паровой турбины Отклонение уровня парового барабана Останов насоса питательной воды Работа защиты генератора

План урока (Проект) **Дата: «___»_____2018г**

Учебный центр по эксплуатации и техобслуживанию ПГУ
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_____ Достов Ш.О.

1. Номер и название учебного курса/ *Title & Trainer*
   №8 Детали КИП приборов для ПГУ, (Details of Control & Instrument Devices for GTCC)
   Ответственный инструктор для данного курса/Responsible Instructor for this course
   Главный: Тошов И.Ш. Chief: Toshov Istam Shukhratovich
   Заместитель: Хасанов Л.Б. ,Нарзиев А.А. Deputy: KhazanovLatif B, NarzievAkmalAbdulloevich
   Другие: Others:
2. Стандартное количество слушателей/ Number of trainee
   10 слушателей.10 Trainee
   Целевые слушатели: Новые сотрудники ПГУ
   New employee for CCPP
3. Продолжительностькурса (часы)/ Course duration; Day(Hours)
   Из дневного месяца, года; до дневного месяца, года
   4 дня (27час)
4. Содержаниекурсаичасы/ Course contents and hours

№	Главы	Дни	Часы	Страницы
1	Введение	Первый	1	3
2	Основы системы управления	Первый	2	11
3	Цифровая система	Первый	4	35
4	Приводные механизмы в ПГУ	Второй	4	41
5	Сенсоры в ПГУ	Второй	3	35
6	Подсистемы в ПГУ	Третий	2	10
7	Практика внедрения системы контроля и инспектирования	Третий	5	68
8	Практическиезанятия по применению контроллера	Четвёртый	2	
9	Заключение	Четвёртый	2	7
10	Анкетирование	Четвёртый	2	

5. Необходимое оборудование для данного курса/ Equipment
   не требуется/not required
6. Контрольные точки данного курса/ Milstone

№	Контрольные точки в деталях
1	Сенсор, контроллер, приводной механизм, Цифровой аналоговой преобразователь, аналоговый цифровой преобразователь, полевая шина, … Sensor, controller, Drive mechanism, DA converter, AD converter, field bus, ...
2	Проводить Экскурсию если график обучения совпадает графиком тех. обслуживания ГТ Conduct on-site training if the training schedule coincides with the maintenance schedule of GT

7. Вопросы и типичные ответы для заключительного экзамена курса*/Q&Aforthefinalcourseexam*
   Подготовить, конкретные вопросы и типичные ответы для завершения экзамена курса, чтобы подтвердить понимание курса, более 10 вопросов. Опишите конкретные вопросы и ответы на другой странице.
   Preparing concretequestions and typical answers for completing the course exam to confirm understanding of the course, more than 10 questions. Please describe concrete Q&A in next page.

8. Критерии оценки слушателей/ Criteria

№	Параметры	Результат
1	Уровеньпосещаемоститренинга (%)/ attendancerate	
2	Количество заданных вопросов/ Количествовопросов, заданных каждым стажером по каждому, и его качество Number of questions asked from each trainee by each, and its quality	
3	Пониманиелекции, Результатытестазавершения Understanding of the lecture, results of completion examination	

9. Specific Q&A, for course No 8 (Details of Control & Instrument Devices for GTCC)

Конкретный список вопросов и ответов, курса №8 Детали КИП приборов для ПГУ

Q&A should be more than 10 / Вопросов и ответов должно быть более 10

No	Chapter глава	Question/ Вопрос (drawings separated/чертежи разделены)	Typical answer/ Типичный ответ (drawings separated/чертежи разделены)
1	2	What is the automated process control system and its main purpose?	Automated process control system (APCS) - a complex of technical and software tools designed to automate the management of process equipment in industrial enterprises. Human participation is minimized, but still at the level of making the most responsible decisions. The main goals of automation of technological processes are: • Increase the efficiency of the production process. • Improved security. • Improved ecological compatibility. • Improved economy.
2	2	Required components of the process control system	Sensor, actuator, Controller
3	3	What is the difference between an analog signal and a digital signal?	An analog signal is a data signal described by continuous time functions, that is, the amplitude of its oscillations can take any values within the maximum. A digital signal is a data signal described by discrete time functions, that is, the amplitude of the oscillations assumes only strictly defined values. 1. The analog signal is continuous, digital is discrete. 2. When transmitting an analog signal, the risk of clogging the channel with interference is higher. 3. The analog signal is redundant. 4. The digital signal filters the interference and restores the original data. 5. The digital signal is transmitted in encrypted form. 6. Multiple digital signals can be sent instead of one analogue.
4	3	What is the communication protocol?	A communication protocol is a set of rules regulating the format and procedures for exchanging information between two or more independent devices, computers, programs or processes
5	4	What types of actuators are classed in CCGT?	They are classified into two types of operations ___ the operation is fully open \ fully closed (type A) ___ adjustable i. e. continuous adjustment of the opening degree (type B) Type (A) acts as a selection device, for example fully open / fully enclosed Type (B) acts as a device for adjusting the flow volume and / or pressure.
6	4	Classification of control valves	Regulating valves are classified into two types, i.e. type, working with the engine and electro-hydraulic servo-drive type. The type working with the engine is applied to the non-strict accuracy control system and the response The electro-hydraulic servo drive type is used for a strict accuracy and / or response control system.
7	5	What types of sensors are used at CCGTs	Sensor temperature, sensor pressure, flow sensor, vibration sensor, level sensor, speed sensor, differential pressure sensor, etc.
8	6	How is SCADA decoded and what does it mean?	SCADA (Supervisory Control And Data Acquisition) is a software package designed to develop or provide real-time systems for the collection, processing, display and archiving of information about a monitoring or control object. SCADA can be a part of the automated process control system, Automatic System for Control and Accounting of Electricity, environmental monitoring system, scientific experiment, building automation, etc. SCADA systems are

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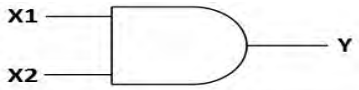
<tr><td></td><td></td><td></td><td>used in all sectors of the economy where it is required to provide operator control over technological processes in real time. This software is installed on computers and, for communication with the object, uses I / O drivers or OPC / DDE servers.</td></tr>
<tr><td>9</td><td>7</td><td>Functions performed by the PLC</td><td>PLC is a programmable logic controller, it is a microprocessor device intended for collecting, converting, processing, storing information and generating control commands, having a finite number of inputs and outputs, connected sensors, keys, actuators to the control object, and intended for operation in real time modes.</td></tr>
<tr><td>10</td><td>7</td><td>Logical elements and their truth tables</td><td>An electrical circuit designed to perform any logical operation with input data is called a logic element
The logical element "AND" is a conjunction, a logical multiplication, AND
 

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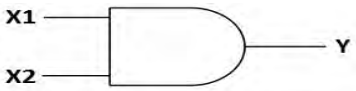
No	Chapter глава	Question/ Вопрос (drawings separated/чертежи разделены)	Typical answer/ Типичный ответ (drawings separated/чертежи разделены)
1	2	Что такое АСУТП и его основная цель?	Автоматизированная система управления технологическим процессом (АСУ ТП) — комплекс технических и программных средств, предназначенный для автоматизации управления технологическим оборудованием на промышленных предприятиях. Человеческое участие при этом сведено к минимуму, но всё же присутствует на уровне принятия наиболее ответственных решений. Основными целями автоматизации технологических процессов являются: • Повышение эффективности производственного процесса. • Повышение безопасности. • Повышение экологичности. • Повышение экономичности.
2	2	Требуемые компоненты системы управления технологическим процессом	Сенсор, Приводной механизм, Контроллер
3	3	Чем отличаются аналоговый сигнал и цифровой сигнал?	Аналоговый сигнал — сигнал данных, описываемый непрерывными функциями времени, то есть амплитуда колебаний его может принимать любые значения в пределах максимума. Цифровой сигнал — сигнал данных, описываемый дискретными функциями времени, то есть амплитуда колебаний принимает значения только строго определенные. Аналоговый сигнал непрерывен, цифровой — дискретен. При передаче аналогового сигнала выше риск забивания канала помехами. Аналоговый сигнал избыточен. Цифровой сигнал фильтрует помехи и восстанавливает исходные данные. Цифровой сигнал передается в зашифрованном виде. Несколько цифровых сигналов можно послать вместо одного аналогового.
4	3	Чтотакое коммуникационный протокол?	Коммуникационный протокол - совокупность правил, регламентирующих формат и процедуры обмена информацией между двумя или несколькими независимыми устройствами, компьютерами, программами или процессами
5	4	На какие типы классифицируются приводные механизмы в ПГУ ?	Они классифицируются на два типа операций ___операция полностью открыт \ полностью закрыт (тип А) ___ регулируемые то есть непрерывная настройка степени открытия(тип В) Тип (А) действует как устройство отбора, например полностью открытый \ полностью закрытый Тип(В)действует как устройство настройки объема потока и\или давления.
6	4	Классификация регулирующих клапанов	Регулирующие клапаны классифицируются на два типа, т.е. тип, работающий с двигателем и электрогидравлический сервоприводный тип. Тип, работающий с двигателем применяется для системыуправления нестрогой точности и ответа Электрогидравлический сервоприводный тип применяется для системы управления строгой точности и\или ответа.
7	5		Сенсор температуры, сенсордавления, сенсор расхода, сенсор

<table>
<tr><td></td><td></td><td>Какие типы сенсоров используются на ПГУ</td><td>вибрации, сенсор уровня, сенсор числа оборотов, сенсор дифференциального давления и др.</td></tr>
<tr><td>8</td><td>6</td><td>Как расшифровывается SCADA и что она означает?</td><td>SCADA (аббр. от англ. Supervisory Control And Data Acquisition — диспетчерское управление и сбор данных) — программный пакет, предназначенный для разработки или обеспечения работы в реальном времени систем сбора, обработки, отображения и архивирования информации об объекте мониторинга или управления. SCADA может являться частью АСУТП, АСКУЭ, системы экологического мониторинга, научного эксперимента, автоматизации здания и т. д. SCADA-системы используются во всех отраслях хозяйства, где требуется обеспечивать операторский контроль за технологическими процессами в реальном времени. Данное программное обеспечение устанавливается на компьютеры и, для связи с объектом, использует драйверы ввода-вывода или OPC/DDE серверы.</td></tr>
<tr><td>9</td><td>7</td><td>Функции выполняемые ПЛК</td><td>ПЛК – программируемый логический контроллер, представляют собой микропроцессорное устройство, предназначенное для сбора, преобразования, обработки, хранения информации и выработки команд управления, имеющий конечное количество входов и выходов, подключенных к ним датчиков, ключей, исполнительных механизмов к объекту управления, и предназначенный для работы в режимах реального времени.</td></tr>
<tr><td>10</td><td>7</td><td>Логические элементы и их таблицы истинности</td><td>Электрическая схема, предназначенная для выполнения какой-либо логической операции с входными данными, называется логическим элементом
Логический элемент «И» - конъюнкция, логическое умножение, AND
 

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План урока (Проект) **Дата: «___»_____2018г**

Учебный центр по эксплуатации и техобслуживанию ПГУ

«УТВЕРЖДАЮ»

Директор учебного центра

_____ Достов Ш.О.

1. *Номер и название учебного курса/ Title & Trainer*

№9 Основы газовой турбины. Эксплуатация и техобслуживание газовой турбины.
（Fundamentals of GT/ GT Operation & Maintenance）

Ответственный инструктор для данного курса
Главный: Chief: Bazarov Fakhriddin
Заместитель: Deputy: Khudoykulov Lutfullo
Другие: Others:

2. *Стандартное количество слушателей* / Number of trainee
10 слушателей. 10 Trainee
Целевые слушатели; Работники АО «НТЭС»
Персонала эксплуатации и технического обслуживания, Новые сотрудники ПГУ / O&M Staff of Navoi TPP, New employee for CCPP

3. *Продолжительность курса (часы) /* Course duration; Day(Hours)
Из дневного месяца, года; до дневного месяца, года
3 дня (21 час)

4. *Содержание курса и часы/* Course contents and hours

№	Главы	дни	часы
1	Противопожарная система CO_2. Противопожарная система CO_2 для газовой турбины и установки топливного газа и система обнаружения пожара для контрольного пакета газовой турбины	Первый	2
2	Введения к Газовой Турбине Впускное Отверстие, Система Выпуска И Фурнитура	Первый	1
3	Вспомогательное оборудование газовой турбины	Первый	1
4	Теплообменник	Первый/Второй	2
5	Техническое обслуживание газовой турбины	Второй	2
6	Запланированный останов	Второй	2
7	Планирование останова	Второй	2
8	Инструменты	Второй	1
9	Контроль за инородными материалами	Второй/Третий	2
10	План монтажа	Третий	1
11	Основные инспекции	Третий	2
12	Капитальный ремонт газовых турбин.	Третий	2
13	Анкетирование	Третий	1

5. *Необходимое оборудование для данного курса/* Equipment
Тренажер симулятор/ 3D Model of GT Vane and blade

6. *Контрольные точки данного курса*/ Milstone

№	Контрольные точки в деталях
1	Контрольные вопросы после прохождения каждой главы Question after each chapter
2	Тестирования после прохождения данного учебника Examination after the course
3	Экскурсия по складу запасных частей и инструментов для инспекции ГТ, если учебник № 5 не включен в программу обучения обучающейся группы Site visit to warehouse for spare parts and tools for GT inspection, if the course of “No5/ Hot part Maintenance” is not completed by trainee before.

7. *Вопросы и типичные ответы для заключительного экзамена курса/ Q&A for the final course exam*
Подготовить, конкретные вопросы и типичные ответы для завершения экзамена курса, чтобы подтвердить понимание курса, более 10 вопросов. Опишите конкретные вопросы и ответы на другой странице.
Preparing concrete questions and typical answers for completing the course exam to confirm understanding of the course, more than 10 questions. Please describe concrete Q&A in next page.

8. *Критерии оценки слушателей/ Criteria*

№	Параметры	Результат
1	Уровень посещаемости тренинга (%)/ attendance rate	
2	Количество заданных вопросов/ Количество вопросов, заданных каждым стажером по каждому, и его качество Number of questions asked from each trainee by each, and its quality	
3	Понимание лекции, Результаты теста завершения Understanding of the lecture, results of completion examination	

9. Specific Q&A, for course No 1 (Fundamentals of GT/ GT Operation & Maintenance)

Конкретный список вопросов и ответов, курса № 9 Основы газовой турбины. Эксплуатация и техобслуживание газовой турбины.

Q&A should be more than 10 / Вопросы и ответы должны быть более 10

No	Chapter глава	Question/ Вопрос (drawings separated/чертежи разделены)	Typical answer/ Типичный ответ (drawings separated/чертежи разделены)
1		What components can cause a fire?	1. Fuel 2. Oxygen 3. Ignition / heating
2		Which components include a fire extinguishing system with carbon dioxide (CO2)?	1. FIRE DETECTION SYSTEM 2. FIRE ALARM SYSTEM 3. CARBON DIOXIDE (CARBON) DROP SYSTEM (CO2)
3		How is fire extinguished inside protected enclosures?	1. Decrease of oxygen concentration (O2) inside the case. Thus, the reduction in support for the combustion process. 2. Providing cooling action, and hence support in eliminating fire.
4		What are the functions of the CO 2 Fire Extinguishing System (CO2)?	1. Automatic detection of a fire inside the unit (gas turbine unit and fuel gas unit). 2. Automatic and / or Manual Release of carbon dioxide (CO2) to extinguish the fire. 3. Emergency visual and audible alarm / Notification of maintenance personnel.
5		What is a thermal detector?	The thermal detector is a fire alarm device designed to operate when the temperature reaches the set value.
6		What are the functions of the local fire alarm control panel (LFACP) if the detector detects a fire?	1. Display alarms on the Display Panel. 2. Activation of the strobe and horn to prevent persons inside protected areas. 3. Activate potential open contacts to send a signal to the main fire alarm panel.
7		What is a smoke detector?	This is a detection device for detecting smoke, usually as a fire indicator inside protected enclosures. They are connected in two parallel circuits.
8		When a smoke detector detects smoke, what are the functions of the local fire alarm panel (LFAP)?	1. Display alarm messages on the Indicator Panel. 2. Activate the strobe and horn to alert the personnel inside protected enclosures. 3. Activate potentially open contacts to send a signal to the Main Fire Protection Panel
9		Why are there sound and light signals?	Sound and light signals are provided inside the enclosures to provide pre-alarm

			signaling prior to the spraying of carbon dioxide (CO2).
10		What does the CO2 mobile cargo platform include?	1. 1. Initial Release for Gas Turbine and Fuel Gas Premises. 2. 2. Extended release for a gas turbine

No	Chapter глава	Question/ Вопрос (drawings separated/чертежи разделены)	Typical answer/ Типичный ответ (drawings separated/чертежи разделены)
1		При наличие каких компонентов может возникнуть пожар?	1. Горючее 2. Кислород 3. Возгорание / нагрев
2		Какие компоненты включает в себя система пожаротушения углекислым газом (CO_2)?	1. СИСТЕМА ОБНАРУЖЕНИЯ ПОЖАРА 2. СИСТЕМА ПОЖАРНОЙ СИГНАЛИЗАЦИИ 3. СИСТЕМА СБРОСА УГЛЕКИСЛОГО ГАЗА (CO_2)
3		Каким образом осуществляется ликвидация пожара внутри защищенных корпусов?	3. Снижение концентрации кислорода (O_2) внутри корпуса. Таким образом, снижение поддержки для процесса горения. 4. Обеспечение охлаждающего действия, и следовательно поддержка в устранении пожара.
4		Какие функции выполняет СИСТЕМА ПОЖАРОТУШЕНИЯ углекислого газа (CO2)?	1. Автоматическое обнаружение пожара внутри корпусов установки (газотурбинная установка и установка топливного газа). 2. Автоматический и/или Ручной Выпуск углекислого газа(CO_2) для погашения огня. 3. Аварийная визуальная и звуковая сигнализация/Оповещение обслуживающего персонала.
5		Что такое термодетектор?	Термодетектор является противопожарным сигнальным прибором, разработанным для срабатывания при достижении температуры установленного значения.
6		Какие функции выполняет локальная панель управления пожарной сигнализации (LFACP) если детектор обнаружит возгорание?	1. Отображение тревожных сообщений на Индикаторной панели. 2. Активация строба и рычага для предупреждения лиц внутри защищенных участков. 3. Активировать потенциальные открытые контакты для отправки сигнала на Главную панель пожарной сигнализации.
7		Что такое датчик дыма?	Это-устройство обнаружения для распознания дыма, обычно в качестве индикатора пожара внутри защищенных корпусов. Они подключены в двух параллельных схемах.
8		Когда детектор дыма обнаруживает дым, какие функции выполняет	1. Отображать тревожные сообщения на Индикаторной

		локальный щит пожарной сигнализации (LFAP)?	панели. 2. Активировать Строб и Рычаг для тревожного оповещения персонала внутри защищенных корпусов. 3. Активировать потенциально открытые контакты для отправки сигнала на Главный щит пожарной безопасности
9		Для чего предусмотрены звуковые и световые сигналы?	Звуковые и световые сигналы предусмотрены внутри корпусов для обеспечения предаварийной сигнализации до распыления углекислого газа (CO_2) .
10		Что в себя включает подвижная грузовая платформа углекислого газа CO_2 ?	3. Начальный Выпуск для Газовой турбины и Помещения топливного газа. 4. Расширенный выпуск для газовой турбины

План урока (Проект) **Дата: «___»_____2018г**

Учебный центр по эксплуатации и техобслуживанию ПГУ
«УТВЕРЖДАЮ»
Директор учебного центра
_____ Достов Ш.О.

1. Номер и название учебного курса/ *Title & Trainer*

№10 Описание системы газовой турбины и технологическая схема трубопроводов и КИПиА（GT Control system、Flow diagram of pipelines and instrumentation.）

Ответственный инструктор для данного курса/Responsible Instructor for this course
Главный:Chief: Pirnazarov Nurali
Заместитель:Deputy: Bayliyev Shukhrat
Другие:Others: Musayev Alisher

2. Стандартное количество слушателей/ Number of trainee

10 слушателей.10 Trainee
Целевые слушатели: Работники АО «НТЭС»
Персонала эксплуатации и технического обслуживания / O&M Staff of Navoi TPP

3. Продолжительность курса (часы)/ Course duration; Day(Hours)

Из дневного месяца, года; до дневного месяца, года
(7 часов)

4. Содержание курса и часы/ Course contents and hours

№	Главы	дни	часы
1	Система подачи топливного газа	первый	1
2	Воздушная система и (газовыпускная) система	первый	1
3	Система защиты от обледенения	первый	1
4	Классификация опасных зон	первый	0,5
5	Обучение специалистов заказчика – Порядок эксплуатации	первый	0,5
6	Обучение специалистов заказчика общее описание блокировки установки	первый	0,5
7	Обучение специалистов заказчика Система воздушного охлаждения корпуса газовой турбины	первый	1
8	Обучение персонала заказчика процедура промывания лопастей	первый	0,5
9	Обучение персонала заказчика Сетка последнего шанса топливного газа	первый	0,5
10	Общее понятие о настройке горения	первый	0,5

5. Необходимое оборудование для данного курса/ Equipment

Не требуется / not required

6. Контрольные точки данного курса/ Milstone

№	**Контрольные точки в деталях**
1	Контрольные вопросы после прохождения каждой главы Question after each chapter
2	Тестирования после прохождения данного учебника Examination after the course
3	Экскурсия по узлам вспомогательного оборудования ГТ Site visit to the GT auxiliary equipment
4	Встреча с сотрудниками ПГУ КЦ в формате «вопрос-ответ» Meeting the staff of CCGT CC with "question-answer"

7. Вопросы и типичные ответы для заключительного экзамена курса/*Q&A for the final course exam*

Подготовить, конкретные вопросы и типичные ответы для завершения экзамена курса, чтобы подтвердить понимание курса, более 10 вопросов. Опишите конкретные вопросы и ответы на другой странице.

Preparing concretequestions and typical answers for completing the course exam to confirm understanding of the course, more than 10 questions. Please describe concreteQ&A in next page.

8. Критерии оценки слушателей/ *Criteria*

№	**Параметры**	**Результат**
1	Уровень посещаемости тренинга (%)/ attendance rate	
2	Количество заданных вопросов/ Количество вопросов, заданных каждым стажером по каждому, и его качество Number of questions asked from each trainee by each, and its quality	
3	Понимание лекции, Результаты теста завершения Understanding of the lecture, results of completion examination	

9. Specific Q&A, for course No 10 (GT Control system、Flow diagram of pipelines and instrumentation.)

Конкретный список вопросов и ответов, курса № 10 Описание системы газовой турбины и технологическая схема трубопроводов и КИПиА

Q&A should be more than 10 / Вопросы и ответы должны быть более 10

No	Chapter глава	Question/ Вопрос (drawings separated/чертежи разделены)	Typical answer/ Типичный ответ (drawings separated/чертежи разделены)
1	10.3	Purpose of the air bearing seal system.	The supply of sealing air to the bearings to prevent the oil from leaking into the air system, or the hot gas entering the bearing.
2	10.9	Purpose of the gas turbine casing cooling system.	The difference in the temperature of the GT body (the upper side and the lower side) will increase after stopping the GT. The top side of the GT is difficult to cool and the lower side of the GT housing will cool easily. Then, the body of the GT will turn like a curve of the cat's back. We call this phenomenon "cat's back". In this position the GT can not be started. The cooling system of the GT housing is designed to facilitate the effect of the "cat's back" of the GT body. The air supplied by the air cooling fan of the GT body flows into the GT body and cools the upper side of the GT body.
3	10.2	Low fuel delivery pressure	Low delivery pressure signal set: 34 bar. Runback => 150MW load set to 34 bar. Trip (2 of 3) set pressure: 33 bar.
4	10.2	Maximum temperature of fuel gas	Alarm ≥240 ° C Runback ≥250 ° C
5	10.2	Maximum pressure of the fuel gas supply system	Emergency stop ≥ pressure. Installations x 1,2
6	10.2	Lower limit of fuel gas temperature	Alarm ≤ Settings. - 30 ° C Runback ≤ Settings. 50 ° C
7	10.2	Purpose of the fuel gas system	Controlling the flow of fuel gas by the fuel gas control valves in accordance with the fuel consumption of the unit and control of the gas turbine plant. Accurate control of the distribution of fuel gas for a combustion basket type with low nitrogen oxides and moisture.
8	10.3	Purpose of the cooling air system of the turbine.	The supply of cooling sealing air to the elements of the path of the heated gas (such as the cavity of the turbine of the outlet IGV) that are exposed to the heated gas.
9	10.3	Purpose of the system compressor bleed air	Prevention of vibrations of the gas turbine compressor during acceleration and braking.
10	10.3	Internal pressure of the inlet air filter	Alarm ≤ -14,7 mbar Runback ≤ -20,6 mbar Trip ≤ -22.5 mbar (2 of 3)

No	Chapter глава	Question/ Вопрос (drawings separated/чертежи разделены)	Typical answer/ Типичный ответ (drawings separated/чертежи разделены)
1	10.3	Назначение воздушной системы уплотнения подшипника.	Подача уплотняющего воздуха в подшипники для предотвращения утечки масла для подшипников в воздушную систему, или попадания нагретого газа в подшипник.
2	10.9	Назначение системы охлаждения корпуса газовой турбины.	Разность температуры корпуса ГТ(верхняя сторона и нижняя сторона) будет нарастать после остановки ГТ. Верхняя сторона ГТ трудно поддаётся охлаждению и нижняя сторона корпуса ГТ будет охлаждается легко. Тогда, корпус ГТ повернётся подобно изгибу спины кошки. Мы называем данное явление «кошачья спина». В этом положение ГТ не может быть запущена. Система охлаждения корпуса ГТ предусмотрена для облегчения эффекта «кошачьей спины» корпуса ГТ. Воздух подводимый воздушным вентилятором охлаждения корпуса ГТ вытекает в корпус ГТ и охлаждает верхнюю сторону корпуса ГТ.
3	10.2	Низкое нагнетающее давление подачи топлива	Сигнал низкого давления подачи установленное:34 бар.изб. Разгрузка =>150MW нагрузка установленное 34 бар.изб Останов(2 из 3) установленное давление: 33 бар.изб
4	10.2	Максимальная температура топливного газа	Сигнал ≥240°C Разгрузка ≥250°C
5	10.2	Максимальное давление системы подачи топливного газа	Аварийная остановка ≥ давление. Установки x 1,2
6	10.2	Нижний предел температуры топливного газа	Сигнал ≤ Установки. - 30°C Разгрузка ≤ Установки. 50°C
7	10.2	Назначение системы топливного газа	Управление потока топливного газа регулирующими клапанами топливного газа в соответствие с расходом топлива блока и управления газотурбинной установки. Точной управление распределением топливного газа для типа камеры сгорания с низким содержанием оксидов азота и влаги.
8	10.3	Назначение системы охлаждающего воздуха турбины.	Подача охлаждающего уплотняющего воздуха в элементы траектории нагретого газа (такие как полость турбины выходной направляющей заслонки), которые подвержены воздействию, в нагретый толочный газ.
9	10.3	Назначение системы отбираемого от компрессора воздуха	Предотвращения вибраций компрессора газовой турбины во время ускорения и торможения.
10	10.3	Внутреннее давление фильтра входного воздуха	Сигнализатор ≤ -14,7 mbar Разгрузка ≤ -20,6 mbar Остановка ≤ -22,5 mbar (2 из 3)

План урока (Проект) **Дата: «___»_____2018г**

Учебный центр по эксплуатации и техобслуживанию ПГУ
«УТВЕРЖДАЮ»
Директор учебного центра
_____ Достов Ш.О.

1. Номер и название учебного курса/ *Title & Trainer*
   №11 Система электрического управления ГТ（GT Electrical Control System）
   Ответственный инструктор для данного курса/Responsible Instructor for this course
   Главный: Пармонов Азим Chief: Parmanov Azim
   Заместитель: Пирназаров Нурали Deputy: Pirnazarov Nurali
   Другие: Тошов СанжарOthers: Toshov Sanjar
2. стандартное количество слушателей / Number of trainee
   10 слушателей.10 Trainee
   Целевые слушатели,Работники АО «НТЭС»
   Персонала эксплуатации и технического обслуживания/ O&M Staff of Navoi TPP
3. Продолжительность курса (часы) / Course duration; Day(Hours)
   Из дневного месяца, года ; до дневного месяца, года
   Один день (7 часов)
4. Содержаниекурсаичасы/ Course contents and hours

№	Главы	дни	часы
1	Центр управления двигателями(MCC), распределительная панель переменного тока, система постоянного тока, и стартерная панель постоянного тока	первый	4
2	Управление газовой турбины	первый	3
3			

5. Необходимое оборудование для данного курса/ Equipment
   Не требуется / not required
6. Контрольные точки данного курса/ Milstone

№	Контрольные точки в деталях
1	Контрольные вопросы после прохождения каждой главы Question after each chapter
2	Тестирования после прохождения данного курса Examination after the course
3	Проводить Экскурсию по MCC и блочный щит управления Site Visit Motor Control Center and Control Panel
4	Встреча с операторами ПГУ КЦ в формате «вопрос-ответ» Meeting the staff of CCGT CC with "question-answer"

7. Вопросы и типичные ответы для заключительного экзамена курса/*Q&Aforthefinalcourseexam*
   Подготовить, конкретные вопросы и типичные ответы для завершения экзамена курса, чтобы подтвердить понимание курса, более 10 вопросов. Опишите конкретные вопросы и ответы на другой странице.
   Preparing concretequestions and typical answers for completing the course exam to confirm understanding of the course, more than 10 questions. Please describe concreteQ&A in next page.

8. Критерии оценки слушателей/ *Criteria*

№	Параметры	Результат
1	Уровеньпосещаемоститренинга (%)/ attendancerate	
2	Количество заданных вопросов/ Количествовопросов, заданных каждым стажером по каждому, и его качество Number of questions asked from each trainee by each, and its quality	
3	Пониманиелекции, Результатытестазавершения Understanding of the lecture, results of completion examination	

9. Specific Q&A, for course No 11 (GT Electrical Control System)

Конкретный список вопросов и ответов, курса № 11 (Система электрического управления ГТ)

Q&A should be more than 10 / Вопросы и ответы должны быть более 10

No	Chapter глава	Question/ Вопрос (drawings separated/чертежи разделены)	Typical answer/ Типичный ответ (drawings separated/чертежи разделены)
1		Electrical equipment used in the motor control center (MCC)	ABB,GE
2		Electric distribution diagram of the consumers of the engine control center (MCC)	The Motor Control Center (MCC) for GT is divided into two sections, consumers are powered from two sections. The load between the two sections is divided equally.
3		System of direct current principle of operation and purpose	The DC system is designed to control the consumers of GT, the direct current is obtained from the batteries.
4		DC starter panel operating principle and function	The DC starter panel is designed to power and control DC motors.
5		About the locaion of motor control center	The motor control center (MCC) is equipped with air conditioners and door heaters, and the battery room is equipped with air heaters and exhaust fans.
6		Safety when operating the motor control center (MCC)	When the motor control center (MCC) is operating, it is necessary to follow the rules when operating with a voltage of 0.4 kV and the rules when operating with a DC voltage ...
7		Composition of the gas turbine	Parts and parts of GT ... (air compressor, gas turbine, row blades, burners, etc.)
8		The principle of the automatic fuel management system for GT	General idea of the fuel gas control system for GT
9		Which control modes are applied to the gas turbine	Turbine speed control (control mode of the speed regulator (GVC) Load regulation (LDC mode) Adjusting the blade path temperature (BPTC mode) Exhaust gas temperature control (EGTC mode) Temperature control by fuel limitation (FL mode) Fuel regulation system for self-regulation (self-regulation mode)
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No	Chapter глава	Question/ Вопрос (drawings separated/чертежи разделены)	Typical answer/ Типичный ответ (drawings separated/чертежи разделены)
1		Электрооборудование исползуемие в центре управления двигателями (MCC)	ABB,GE
2		Электрические схема распределения потрибителей центра управления двигателями (MCC)	Центр управления двигателями (MCC) для ГТ разделено на два секции, потребители питаются от двух секций. Нагрузка между двум секциям разделена по равно.
3		Система постоянного тока принцип работы и назначение	Система постоянного тока предназначен для управления потребителями ГТ, постоянный ток получается от аккумуляторных батарей.
4		Стартерная панель постоянного тока принцип работы и назначение	Стартерная панель постоянного тока предназначен для питания и управления двигателей постоянного тока.
5		Об компановке центра управления двигателями	Центр управления двигателями (MCC) снабжено кондиционерами и обогревателями дверей, а также комната аккумуляторных батарей снабжена обогревателями воздуха и вытяжными вентиляторами.
6		Безопасность при работе центре управления двигателями (MCC)	При работе центре управления двигателями (MCC), надо соблюдать правила при работе напряжением 0.4 кВ и правила при работе напряжением постоянного тока…
7		Составние части газовой турбины	Детали и части ГТ… (воздушный компрессор,газовая турбына,лопатки ступеней,горелки и т.д.)
8		Принцип работы автоматической системы регулирования топлива для ГТ	Общее представление об системы регулирования топливним газом для ГТ
9		Какие режимы управление применяются на газовой турбине	Регулирование скорости турбины (режим управления регулятора оборотов (GVC) Регулирование нагрузки (режим LDC) Регулирование температуры траектории лопасти (режим BPTC) Регулирование температуры выхлопного газа (режим EGTC) Регулирование температуры ограничением топлива (режим FL) Система регулирования топлива для саморегулирования (режим саморегулирования)
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План урока (Проект) **Дата: «___»_____2018г**

Учебный центр по эксплуатации и техобслуживанию ПГУ
«УТВЕРЖДАЮ»
Директор учебного центра
_____ Достов Ш.О.

1. *Номер и название учебного курса/ Title & Trainer*

№12. Лекция по ЭиТО Газовой турбины /

Ответственный инструктор для данного курса/Responsible Instructor for this course

Главный: Мусаев А. Chief: Musaev Alisher

Заместитель: Худойкулов Л. Deputy: Khudoykulov Lutfillo

Другие: Исламов И. Others: Islamov Ismail

2. *Стандартное количество слушателей/*Number of trainee

10 слушателей.10 Trainee

Целевые слушатели:Работники АО «НТЭС»

Персонала эксплуатации и технического обслуживания/ O&M Staff of Navoi TPP

3. *Продолжительностькурса (часы)* / Course duration; Day(Hours)

Из дневного месяца, года; до дневного месяца, года

1 день (7 часов)

4. *Содержаниекурсаичасы*/ Course contents and hours

№	Главы	дни	часы
1	Принципы организации и проведения технического обслуживания газовой турбины	первый	4
2	Ввод в эксплуатацию теплоэлектростанции с газовой турбиной	первый	3
3	Анкетирование	первый	

5. *Необходимое оборудование для данного курса/* Equipment

Контрольные точки данного курса/ Milstone

№	Контрольные точки в деталях
1	Контрольные вопросы после прохождения каждой главы Question after each chapter
2	Экскурсия по складу запасных частей и инструментов для инспекции ГТ On-site tour to the warehouse of spare parts and tools for inspection of GT
3	Проводить Экскурсию если график обучения совпадает графиком тех. обслуживания ГТ Conduct on-site training if the training schedule coincides with the maintenance schedule of GT
4	Пусть стажер представляет пример аварий или неисправностей собственной электростанции, произошедших за последние два года, и обсудите контрмеры. Let the trainee present the example for the accidents or malfunctions of own power station, occurred in last two years, and discuss the countermeasures.

6. *Вопросы и типичные ответы для заключительного экзамена курса*

Подготовить, конкретные вопросы и типичные ответы для завершения экзамена курса, чтобы подтвердить понимание курса, более 10 вопросов. Опишите конкретные вопросы и ответы на другой странице.

Preparing concretequestions and typical answers for completing the course exam to confirm understanding of the course, more than 10 questions. Please describe concreteQ&A in next page.

7. *Критерии оценки слушателей/ Criteria*

№	Параметры	Результат
1	Уровеньпосещаемоститренинга (%)/ attendance rate	
2	Количество заданных вопросов/ Количествовопросов, заданных каждым стажером по каждому, и его качество Number of questions asked from each trainee by each, and its quality	
3	Пониманиелекции, Результатытестазавершения Understanding of the lecture, results of completion examination	

9. Specific Q&A, for course No 12 (GT O&M Lecture)

Конкретный список вопросов и ответов, курса № 12. Лекция по ЭиТО Газовой турбины Q&A should be more than 10 / Вопросы и ответы должны быть более 10

No	Chapter глава	Question/ Вопрос (drawings separated/чертежи разделены)	Typical answer/ Типичный ответ (drawings separated/чертежи разделены)
1	12-1	Principles of maintenance of a gas turbine	- The parts of the hot path (hereinafter HGPPs) consist of parts of the turbine and the combustion chamber operating at high temperatures. These parts interact with a high-temperature combustion gas for long periods of time. The combustion gas can degrade the state of HGPPs. - Requirements for proper maintenance. - Gas turbine characteristics - Maintenance concept
2	12-1	Scheduled maintenance	Scheduled maintenance Combustion basket: Combustion basket parts Turbine: Combustion chamber parts, Turbines Overhaul: combustion chamber, turbine, compressor parts and rotor surface additional inspection Other units are checked during scheduled maintenance.
3	12-1	Factors affecting maintenance	Combustion temperature: - Metal temperature, thermal stress Environment: - Erosion and corrosion Fuel: - Metal temperature (due to more intense radiation) - Erosion and corrosion (metal traces, such as sodium and potassium) Steam / water injection: - Metal temperature (due to higher coefficient of thermal expansion) The order of maintenance content - Quality of parts, duration of the unprepared condition, and maintenance costs
4	12-1	Performance degradation	- The performance of the gas turbine decreases with aging and with the operating hours. Maintenance is the reason to clean the parts and adjust the settings. - Scheduled maintenance can save performance and reduce operating costs.
5	12-1	The elimination formula of EOH	EOH = (AOH + 20 × Eo) EOH: Equivalent operating hours (hours) AOH: Actual hours of operation (burning) (hours) Eo: Equivalent number of starts, runbacks, emergency stops and sudden load surges (Standard start / stop: Eo = 1)
6	12-1	Active Scheduling of planned Maintenance	Engineering and technical schedule Planning Preparation Stopping Report
7	12-1	Possible risks when extending the	The inspection interval every 12,000 EOH

		inspection interval from 12,000 EOH	is assumed as a fundamental maintenance according manuals It is based on experience and is formulated to achieve optimal planned maintenance from a position of deterioration of parts and repair-recovery for the next periodic inspection There is a certain risk of consequential damage downstream.
8	12-1	Standard deterioration mode of HGPPs	- Creep damage - Low-cycle fatigue damage - Oxidation at high temperature
9	12-1	Advantage of the roll in / roll out procedure;	- Lower inspection duration = reduced shutdown time of unit = increased availability of the unit. - Optimized control of parts working at high temperatures. - Maximizing the life of the HGPP
10	12-2	Measures before commissioning	Power supply for switchgear and MCC Sequence check - Engine check - Arrangement of each system in a line - Test run of the pump / fan Filling (oil for lubrication, control oil, sealing oil, etc.) - Cyclic check - Adjustment of control valves - Signal and interlock check Modeling tests - Tests for turning Centrifuge operation / centrifuge purging, etc.
11	12-2	Test gas turbine rotation	Describe the procedure using the inspection schedule 1. Start of rotation for checking for grazing 2. Stop rotation at 200 rpm using the shut-off button 3. At 3 rpm 4. At 300 rpm 5. Achievement of 700 rpm 6. Ignition Speed
12	12-2	The purpose of the tests: the initial burner ignition of the gas turbine and the test at maximum rotations without load	During the initial ignition, special attention must be paid to safety and some adjustment may be necessary to ensure successful ignition. If the ignition succeeds, the gas turbine starts to accelerate to the rated speed in accordance with the acceleration schedule. During acceleration, carefully monitor the operating state. At the rated speed, keep the speed for some time and check the condition of the gas turbine. If the rated speed is not reached, adjust the combustion parameters or take the necessary measures and try again.
13	12-2	Which tests are performed before synchronization and after synchronization of the GT	Before the initial synchronization (during unloaded operation) - Dynamic tests of AVR, Test of ASS functionality, etc. - Model tests of synchronization - Combustion tuning After synchronization (during operation with load)

			- Working check and Burning setting (25%, 50%, · · · 100%) - Electrical tests (25%, 50%, · · · 100%) - Control check (gas temperature, IGV, BV, etc.)
14	12-2	The basic schedule for tuning the combustion of a gas turbine for fuel gas	Describe the schedule
15	12-2	The purpose of gas turbine load test tests	These tests are necessary to confirm the characteristics of the control device when a voltage drop occurs. Open the CB generator (52G) while the gas turbine is in steady state and make sure that the speed of the gas turbine is increased once by inertia and the fuel in the discharge line and the manifold is collected and then stabilized by the control device without excessive speed increase and loss of flame level. These tests should be performed for work under the regulated load and can be performed at a specified load (50%, 75%) as required. Acceptance criteria 1) There is no speeding. 2) No loss of ignition. 3) There is no indication of a signal significant malfunction
16	12-2	Planning activities prior to commissioning for a common system	1. Cooling water system (CCCW or in some cases a circulating water system) The filling must be carried out before the first ignition timing is initiated before commissioning. The plant configuration must be checked for planning. (Flow chart of pipelines and instrumentation) 2. I&C Air system (control) The main pipeline must be purged before the first required adjustment of the gas turbine's ignition timing for the adjustment of the control valves. 3. Fuel gas system The purging of the common pipeline must be carried out before the start of the first steps before putting the plant into operation. (If the situation has not changed, the first gas turbine should be stopped for the remaining purging for other gas turbines) 4. Other common systems Technological diagrams of pipelines and instrumentation should be checked and construction plans must be drawn up accordingly.
17	12-3	Balancing procedure on site	1. It is very important to collect data on vibration and to study vibration characteristics in order to see whether vibration is caused by imbalance or not. If vibration is caused for other reasons, such as discarding oil, rubbing, etc., appropriate measures should be taken. 2. Confirm the following. (1) Confirm that the dominant frequency is a synchronized component. Using the appropriate vibration analyzer, obtain

			filtered vibration data. (amplitude and phase angle) If the amplitude of the filtered vibration is close to the total vibration, it is considered that the dominant frequency is a synchronized component. If not, further study of the vibration frequency is necessary when using a spectral analyzer. (2) Confirm that the amplitude / angle of the vibration phase is stable. Some changes in transient vibration can generally be observed during the startup and loading of the gas turbine 3. Study the modal reaction cycles carefully and find out the location, magnitude and direction of the imbalance. As for balancing a gas turbine, three modes (1st, 2nd and 3rd) must be taken into account 4. Decide which balancing area should be balanced. In general, you should use the zone of imbalance closest to the location. You can use three zones for balancing in the area. BZ-A: Compressor side BZ-D: Coupling shaft BZ-E: Turbine side 5. Decide the amount and direction of the balancing weight. Forecast the remaining vibration using the appropriate weighting effect vector. (real or simulated data) - The vector of the weight effect is proportional to the volume of the weight. - The phase angle between the direction of weight and the vector of the weight effect is constant - To reduce the set vibration mode, an effective combination of balancing weights is effective. (The weight of the dynamic pair to reduce the 2nd is critical)
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1	12-1	Принципы технического обслуживания газовой турбины	- Детали горячего тракта (здесь и далее HGPPs) состоят из деталей турбины и камеры сгорания, работающих при высоких температурах. Данные детали взаимодействуют с газом сгорания высокой температуры на протяжение длительных периодов времени. Газ сгорания может ухудшить состояние HGPPs. - Требования к надлежащему техническому обслуживанию. - Характеристики газовой турбины - Концепция технического обслуживания
2	12-1	Плановое техническое обслуживание	Плановое техническое обслуживание Камера сгорания: Детали Камеры сгорания Турбина: Детали камеры сгорания, Турбины Полная переборка: камера сгорания, турбина, детали компрессора и поверхность ротора Дополнительная проверка Прочие единицы проверяются во время планового технического обслуживания.
3	12-1	Факторы влияющие на проведение технического обслуживания	Температура горения: - Температура металла, термическое напряжение Среда: - Эрозия и коррозия Топливо:- Температура металла(по причине более интенсивного излучения) - Эрозия и коррозия(следы металла, такие как натрий и калий) Впрыск пара/воды: - Температура металла(по причине более высокого коэффициента теплового расширения) Порядок содержания технического обслуживания - Качество деталей, продолжительность неготового к эксплуатации состояния, изатраты на техническое обслуживание
4	12-1	Снижение производительности	- Производительность газовой турбины снижается со старением и с течением часов эксплуатации. Техническое обслуживание является поводом произвести очистку частей и настройку установок. - Плановое техническое обслуживание может сохранить производительность и сократить эксплуатационные затраты.
5	12-1	Формула выведения EOH	EOH = (AOH + 20×Eo) EOH: Эквивалентные часы эксплуатации (часы) AOH:Действительные часы эксплуатации (горения) (часы) Eo: Эквивалентное количество запусков, сбросов нагрузки, аварийных остановов и резких скачков нагрузки (Стандартный запуск/останов : Eo = 1)

6	12-1	Активный цикл планового технического обслуживания	Инженерно-технический график Планирование Подготовка Простой Отчет
7	12-1	Возможные риски при продлении интервала проверки с 12,000 EOH	Интервал проверки каждые 12,000 EOH предполагается в качестве фундаментального обслуживания по руководству Он основан на опыте и формулируется для достижения оптимального планового обслуживания с позиции ухудшения состояния деталей и ремонта-восстановления для следующей периодической проверки Существует определенный риск косвенного ущерба ниже по потоку.
8	12-1	Стандартный режим ухудшения состояния HGPPs	- Повреждение при ползучести - Низкочастотные усталостные повреждения - Окисление при высокой температуре
9	12-1	Преимущество процедуры загрузки/выгрузки;	- Более низкая продолжительность проверки=снижениепродолжительности простоя установки = увеличение доступности установки. - Оптимизированное управление деталями, работающими при высоких температурах. - Максимизация срока эксплуатации HGPP
10	12-2	Мероприятия перед вводом в эксплуатацию	Подача питания на распределительные устройства и MCC Проверка последовательности - Проверка двигателя - Расположение каждой системы в линию - Пробный запуск насоса/вентилятора Заполнение (масло для смазки, контрольное масло, масло для уплотнения и т.д.) - Циклическая проверка - Настройка регулирующих клапанов - Проверка сигнала и блокировки Испытания методом моделирования - Испытания на поворот Работа центрифуги / продувка центрифуги и т.д.
11	12-2	Испытание газовой турбины вращением	Описать процедуру используя график испытания 1. Начало вращения для проверки на задевание 2. Остановка вращения при 200 об/мин при помощи кнопки отключения 3. При 3 об/мин 4. При 300 об/мин 5. Достижение 700 об/мин 6. Скорость воспламенения
12	12-2	Цель испытаний: первоначальный розжик запала газовой турбины и испытания на максимальных оборотах без нагрузки	Во время первоначального зажигания, следует обратить особое внимание на безопасность и может потребоваться некоторая настройка для обеспечения успешного зажигания. При успешном

			зажигании, газовая турбина начинает ускоряться к номинальной скорости в соответствии с графиком ускорения. Во время ускорения, тщательно наблюдайте за рабочим состоянием При достижении номинальной скорости, сохраняйте скорость на протяжении некоторого времени и проверяйте состояние газовой турбины. Если номинальная скорость не достигнута, настройте параметры сгорания или примите необходимые меры и попробуйте снова.
13	12-2	Какие испытании проводятся перед синхронизацией и после синхронизации ГТ	Перед первоначальной синхронизацией (во время работы без нагрузки) - Динамические испытания AVR, Проверка функциональности ASS и т.д. - Модельные испытания синхронизации - Настройка сгорания После синхронизации (во время работы при нагрузке) - Рабочая проверка и Настройка горения (25%, 50%, ··· 100%) - Электроиспытания (25%, 50%, ··· 100%) - Контрольная проверка (температура газа, IGV, BV и т.д.)
14	12-2	Базовый график настройки сгорания газовой турбины для топливного газа	Описать график
15	12-2	Цель испытаний испытания сброса нагрузки газовой турбины	Данные испытания необходимы для подтверждения характеристик управляющего устройства при возникновении падения напряжения. Откройте генератор CB (52G) во время работы газовой турбины в стационарном режиме и убедитесь, что скорость газовой турбины увеличилась один раз по инерции и собралось топливо в отводящем трубопроводе и манифольде и затем стабилизируется управляющим устройством без избыточного повышения скорости и потерей уровня пламени. Данные испытания должны выполняться для работы при регламентируемой нагрузке и могут выполняться при заданной нагрузке (50%,75%) по мере необходимости. Критерии приемки 1) Нет превышения скорости. 2) Нет потери воспламенения. 3) Нет индикации о сигнале о значительной неисправности
16	12-2	Планирование мероприятий перед вводом в эксплуатацию для общей системы	1. Система воды для охлаждения (CCCW или в некоторых случаях система циркуляционной воды) Заполнение должно выполняться перед началом первого регулирования момента зажигания перед вводом в эксплуатацию. Конфигурация станции должна быть проверена для планирования. (Технологическая схема трубопроводов

			и КИП) 2. Воздушная система КИП (регулирования) Продувка основного трубопровода должна осуществляться перед началом первого требуемого регулирования момента зажигания газовой турбины для настройки регулирующих клапанов. 3. Система топливного газа Продувка общего трубопровода должна выполняться перед началом первых мероприятий перед вводом установки в эксплуатацию. (Если ситуация не изменилась, первая газовая турбина должна быть остановлена для оставшейся продувки для других газовых турбин) 4. Прочие общие системы Технологические схемы трубопроводов и КИП должны проверяться и строительные планы долны составляться соответствующим образом.
17	12-3	Процедура балансировки на участке	1. Очень важно собрать данные о вибрации и изучить вибрационные характеристики для того, чтобы увидеть вызвана ли вибрация дисбалансом или нет. Если вибрация вызвана по другим причинам, таки как выбрасывание масла, трением и т.д., следует выполнить соответствующие мероприятия. 2. Подтвердите следующее. (1) Подтвердите, что доминирующая частота является синхронизированным компонентом. Используя соответствующий анализатор вибрации, получите отфильтрованные данные о вибрации. (амплитуда и угол фазы) Если амплитуда отфильтрованной вибрации близка к общей вибрации, считается, что доминантная частота является синхронизированным компонентом. Если нет, дальнейшее изучение частоты вибрации необходимо при использовании спектрального анализатора. (2) Подтвердите, что амплитуда/угол фазы вибрации стабильна Некоторые изменение переходной вибрации могут в общих случаях наблюдаться во время запуска и загрузки газовой турбины 3. Тщательно изучите модальные циклы реакции и выясните расположение, магнитуду и направление дисбаланса. Как для балансировки газовой турбины, следует принять во внимание три режима (1ый, 2ой и 3ий) 4. Решите, какую зону балансировки следует сбалансировать. В основном, следует использовать ближайшую к расположению зону дисбаланса Можно использовать три зоны для балансировки

			на участке. BZ-A : Сторона компрессора BZ-D : Связывающий вал BZ-E : Сторона турбины 5. Решите количество и направление балансировочного веса Прогнозируйте оставшуюся вибрацию с использованием соответствующего вектора весового эффекта. (реальные или моделированные данные) - Вектор весового эффекта пропорционален объему веса. - Угол фазы между направлением веса и вектора весового эффекта постоянен - Для снижения заданного режима вибрации, эффективным является комбинация балансировочных весов. (Вес динамической пары для снижения 2го критический)
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