The Islamic Republic of Pakistan
Ministry of Economic Affairs

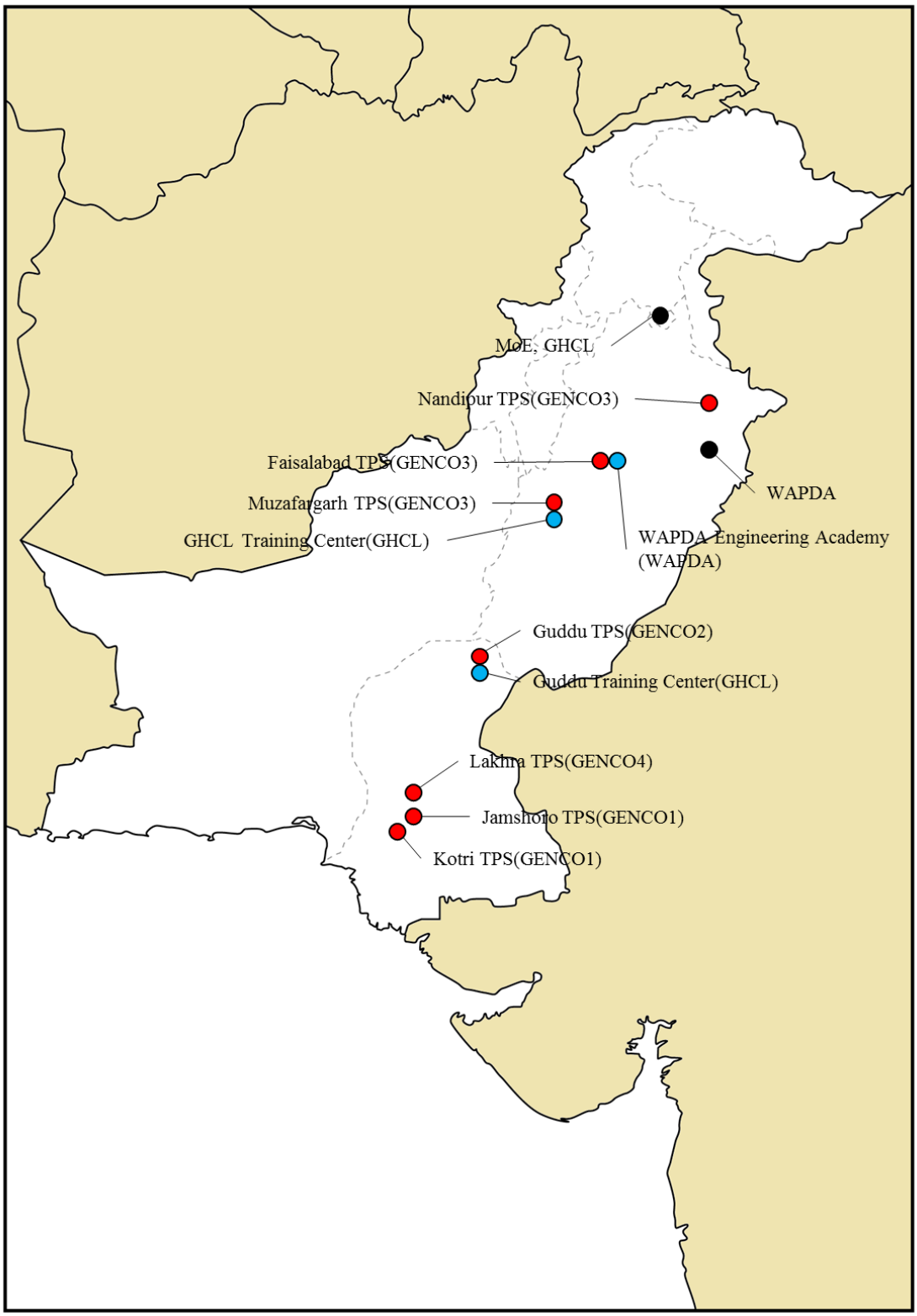
The Project for Capacity Building & Strengthening of Thermal Power Generation Operation & Maintenance in the Islamic Republic of Pakistan

Project Completion Report

February 2022

Japan International Cooperation Agency (JICA)
The Kansai Electric Power Co., Inc.

IM
JR
22-038



Source: Prepared by JICA Expert Team based on the white map released on (http://www.freemap.jp/)

Location Map of Target Areas for the Project

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List of Abbreviations

Abbreviation	Formal Name of Abbreviation
CMMS	Computerized Maintenance Management System
C/P	Counterpart
DCS	Distributed Control System
EPC	Engineering, Procurement and Construction
FTA	Fault Tree Analysis
GE	General Electric
GENCO	Generation Company
GENCOs	Generation Companies
GHCL	GENCO Holding Company Limited
GT	Gas Turbine
GTCC	Gas Turbine Combined Cycle
HRD	Human Resource Development
HRM	Human Resource Management
HRSG	Heat Recovery Steam Generator
HSE	Health, Safety, Environment
IHI	Ishikawajima-harima Heavy Industries
IPP	Independent Power Producer
JCC	Joint Coordination Committee
JET	JICA Expert Team
JICA	Japan International Cooperation Agency
KAPCO	Kot Addu Power Company
KEPCO	Kansai Electric Power Co., Inc.
KPI	Key Performance Indicator
LNG	Liquefied Natural Gas
MELCO	Mitsubishi Electric Corporation
MHPS	Mitsubishi Hitachi Power Systems
MoE	Ministry of Energy
MoM	Minutes of Meeting
MoWP	Ministry of Water and Power
MT	Magnetic Particle Testing
MW	Megawatt
NDI	Non Destructive Inspection
O&M	Operation and Maintenance
OEM	Original Equipment Manufacturer
Off-JT	Off the Job Training
OJT	On the Job Training
PCM	Project Cycle Management
PDCA	Plan-Do-Check-Act
PDM	Project Design Matrix
PET	Power Engineering and Training Services, Incorporated
PT	Penetrant Testing
RBM	Risk Based Maintenance
R/D	Record of Discussions
RMC	Remote Monitoring Center
RT	Radiographic Testing
ST	Steam Turbine
SUMP	Suzuki's Universal Micro Printing Method
TBM	Tool Box Meeting
TC	Training Center
TPP	Thermal Power Plant
TPS	Thermal Power Station
TQM	Total Quality Management

UT	Ultrasonic Testing
USC	Ultra Super Critical
WAPDA	Water and Power Development Authority
WAPDA SCI	WAPDA Staff College Islamabad
WEA	WAPDA Engineering Academy

Chapter 1 Outline of the Project

1.1 Background

In the Islamic Republic of Pakistan (hereinafter referred to as “Pakistan”), unstable power supply due to power shortage has been a serious problem, and in particularly, the power supply-demand gap in recent years has reached as high as 4,500 to 5,500 MW. A major cause of the supply-demand gap is that the fuel purchase cost becomes short due to the circulation debt caused by the high power generation cost and the low collection rate of fees and the availability factor of the existing power stations has been thus lowered. Due to chronic power shortage, the development of the industry, as well as the lives of the people, is greatly hindered, and the economic loss because of power outage or inefficient operation of power stations, etc., is recognized as the biggest problem in economic activities. Therefore, it is expected that the government of Pakistan promotes the expansion and renewal of thermal power stations in the future through importing LNG, importing natural gas through pipelines, development of imported coal and domestic coal, etc. For stable power supply, enhancement of the capacity of the operation and maintenance (O&M) technicians, as well as the enhancement of thermal power station facilities, has become an urgent issue.

The issue of the electric power field that Pakistan is currently facing lies in the fact that the limitation of the gap between the supply and demand of electric power described above relies on the construction and introduction of new plants that lead to a temporal and economic burden, due to the aging degradation of thermal power station (TPS), decrease in the output of generator and efficiency caused by a failure in the appropriate O&M, and decrease in the utilization ratio due to frequent troubles of the equipment. To solve the issue, the maintenance of the base power generation capacity of Pakistan by the improvement in the maintenance and management of the existing power stations is thought to be the urgent need.

Therefore, this project intends to enhance the capacity of O&M in TPS by continuously providing technical supports to GENCO Holding Co., Ltd. (hereinafter referred to as “GHCL”). To achieve this goal, the business operator that is excelled in the maintenance and management of TPS and the fostering of personnel handling the works is required.

From this background, the Pakistan government had required our country for technical cooperation in connection with the “Project for Capacity Building and Strengthening of Thermal Power Generation Operation and Maintenance”. Accordingly, the Japan International Cooperation Agency (JICA) confirmed the necessity and adequacy of the Project, conducted a detailed plan formulation survey in April 2016 to examine the content of cooperation, and concluded Record of Discussions (R/D) with the government on the framework of the project on May 22, 2017 based on the results of the survey.

In October 2020, approximately 3 years after the start of this project, the initial R/D was changed as shown in Table 1-1 in order to change the role of counterparts and to specify and expand the scope of the project.

Table 1-1: R/D Changes (October 2020)

<table>
<tr><td colspan="2">1. Overall</td></tr>
<tr><td>Before</td><td>Amended Version</td></tr>
<tr><td>WAPDA Engineering Academy (hereinafter referred to as “WEA”) and GENCO Holdings Company Ltd (hereinafter referred to as “GHCL”), the counterpart to JICA, will be responsible for the implementation of the Project in cooperation with JICA</td><td>GENCO Holding Company Limited (hereinafter referred to as “GHCL”), the counterpart to JICA, will be responsible for the implementation of the Project in cooperation with JICA</td></tr>
<tr><td colspan="2">Reason: Due to continuing development of GENCOs’ Training Centers, sufficient capacity has been established to carry out trainings related to thermal power plants at these Training Centers. Consequently, trainings of thermal power plants’ personnel from WEA Faisalabad has been seized/discontinued by GENCOs.</td></tr>
<tr><td colspan="2">2. Duration of the Project</td></tr>
<tr><td>Before</td><td>Amended Version</td></tr>
<tr><td>Three (3) years from the first arrival of JICA expert(s)</td><td>Four (4) years and four (4) month from the first arrival of JICA expert(s)</td></tr>
<tr><td colspan="2">Reason: In order to secure sufficient time to develop GENCOs’ training abilities by using the equipment (Vibration analysis demonstrator, Non-destructive inspection demonstrator) to be provided under this project, the duration need to be extended by above period.</td></tr>
</table>

1.2 Objective and Goal of the Project

By implementing this Project based on the R/D, achievement of the Project's purpose "Training Capacity on Operation and Maintenance (O&M) of WEA and GENCOs is strengthened." is expected. Table 1-2 shows "Overall Goal", "Project Purpose", "Outputs", and "Activities".

Table 1-2: Summary of Overall Goal, Project Purpose, Outputs and Activities

Overall Goal	Technology and technical skills obtained by the project are utilized in actual O&M at GENCOs power stations.
Project Purpose	Training capacity on O&M of WEA and GENCOs is strengthened.

Outputs	Activities
Output 1: Current situation of O&M of thermal power stations is analyzed and training needs are identified.	1-1. To analyze the current situation of O&M at thermal power stations. 1-2. To review the training system of thermal power generation, and analyze the current situation and issues of O&M personnel. 1-3. To specify the training needs.
Output 2: Capacity of WEA and GENCOs' instructors is enhanced.	2-1. To set the target O&M skills that instructors & potential instructors should obtain. 2-2. To formulate the program of training in Japan. 2-3. To set selection criteria for the training in Japan. 2-4. To conduct trainings in Japan. 2-5. To modify the contents of training in Japan at WEA and GENCOs' thremal power stations (OJTs) in Pakistan.
Output 3: Training as well as OJT at WEA and GENCOs are improved.	3-1. To develop action plans of trainings (OJTs) for O&M of thermal power 3-2. To disseminate obtained knowledge and technical skills to O&M personnel based on the action plans. 3-3. To verify the skilled up level based on the OJT checklist to check the progress of the action plan. 3-4. To review the results of action plans to improve the training at WEA and GENCOs' thermal power stations (OJTs) in Pakistan. *The OJT checklist is prepared according to the action plan items of Activity 3 -1.

1.3 Implementing Agency

1.3.1 Implementing Agency of the Project

Supervising agencies:	Ministry of Water and Power (MoWP),
	Ministry of Energy Power Division (MoE Power Division)
Implementing agencies:	WAPDA Engineering Academy (WEA),
	GENCO Holding Company Limited (GHCL)

1.3.2 Implementation Structure of the Project

The implementation structure of the Project is shown in Figure 1-1.
The MoE Power Division, which is fully delegated by the MoWP at the start of this project, monitor the overall activities of the project and coordinate the overall activities to achieve the project objectives.
The representatives of the Water and Power Development Authority (hereinafter referred to as "WAPDA") and the GHCL worked as project members in collaboration with the JICA Expert Team (hereinafter referred to as "JET").
The Joint Coordination Committee (hereinafter referred to as "JCC") is chaired by the Joint Secretary of MoE Power Division, who is responsible for the Project. The JCC is to be held basically once in a year to discuss and approve matters, check the progress and achievements, and deliberate important matters in relation to the plans of the Project. The JCC members are shown in Table 1-3.

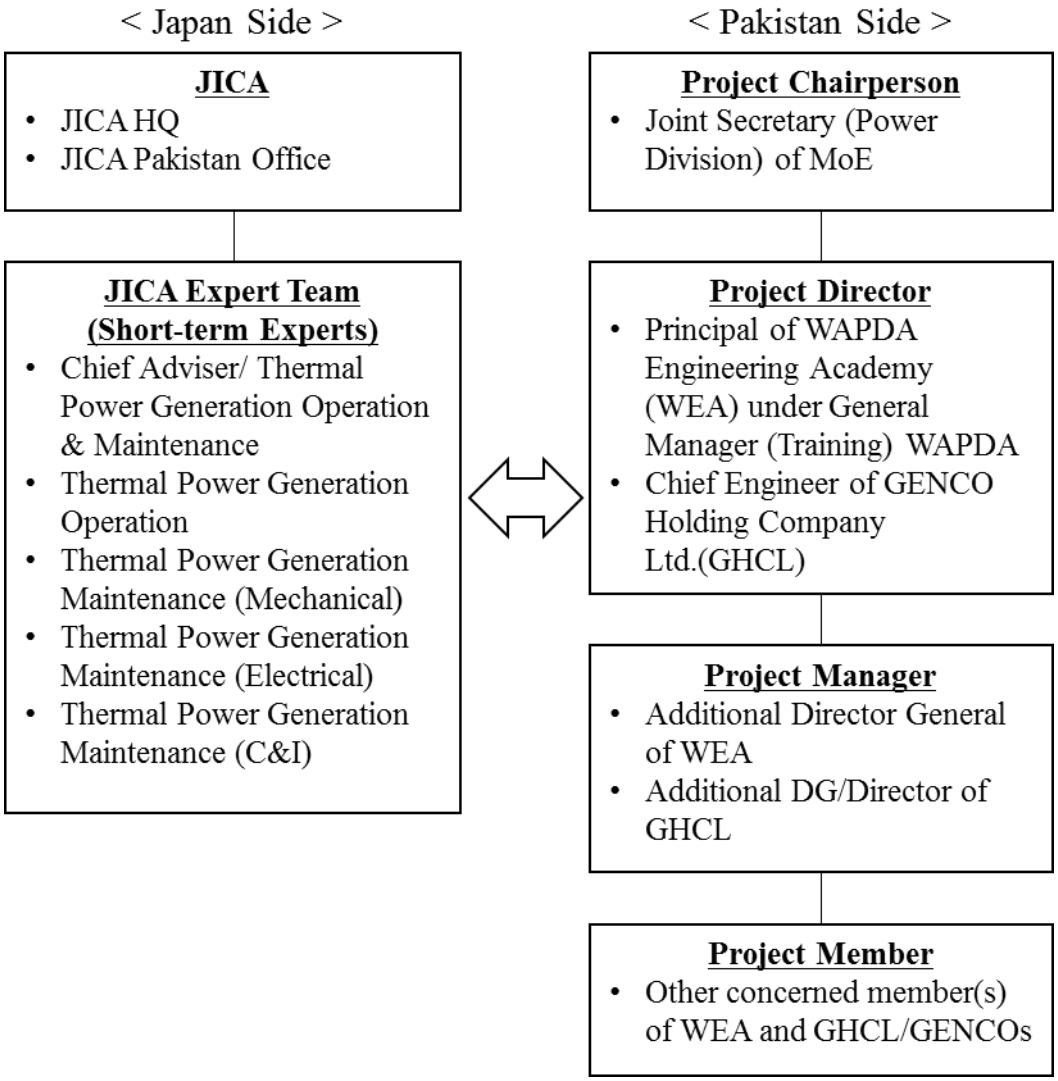


Figure 1-1: Implementation Structure of the Project

Table 1-3: JCC Members

Committee members	Relation with the Project
Joint Secretary of MoE	Project Chairperson
Principal of WEA, Chief Engineer of GHCL	Project Director
Additional Director (General) of WEA, Additional DG/Director of GHCL	Project Manager
Representatives of WEA, Representatives of GHCL and Generation Companies (hereinafter referred to as “GENCOs”)	Project members (Pakistan side)
JICA Expert Team	Project members (Japan side)

1.4 Target Areas and Scope for the Project

(1) Target Area

WEA in Faisalabad and TPSs of GENCOs in Jamshoro, Guddu, Muzaffargarh, and Lakhra

(2) Target Scope

The target scope is O&M of thermal power stations, including environmental measures, and covers combined cycle power generation. However, based on the situation and needs of Pakistan, training on steam power generation (gas-fired, oil-fired, and coal-fired) and gas turbine power generation will be added to the training items as necessary.

1.5 Beneficiaries of the Project

(1) Direct beneficiaries

Instructors of WEA and GENCOs involved in the O&M of TPSs (approximately 60 people)

(2) Final beneficiaries

O&M personnel of GENCOs TPSs (approximately 4,000 people)

1.6 Duration of the Project

The project duration was scheduled to be from November 2017 to October 2020 (3 years). However, as the provision of training equipment for training thermal power station personnel in Pakistan from Japan to Pakistan (GHCL) was added to this project, an agreement was reached with the Pakistani government in October 2020 on the modification of the R/D concerning the extension of the project duration required for the provision of the equipment, and the duration was extended from the initial 3 years to 4 years and 4 months(November 2017 – March 2022).

1.7 Project Design Matrix (PDM)

The Project Design Matrix (PDM) shown in Table 1-4 shows the framework of the project and is the tool for project management including monitoring and evaluation of the Project. In the 1st JCC held in the primary on-site work period, both in Japanese side and Pakistan sides exchanged opinions about the necessity for corrections to the PDM agreed in the R/D. Both sides confirmed that the counterparts discuss on the alterations needed for the PDM, if any, with utilizing the opportunities including JCC.

Table 1-4: Project Design Matrix (PDM)

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
Overall Goal			
Technology and technical skills obtained by the project are utilized in actual O&M at GENCOs power stations.	- Number of GENCOs power stations which utilize obtained technology and technical skills.	- Questionnaire to WEA and GENCOs including regular training reports at WEA & GENCOs provided by trained instructors.	
Project Purpose			
Training capacity on O&M of WEA and GENCOs is strengthened.	- 100% of GENCOs power stations where participants come from, implement trainings (OJTs) based on the Action Plan prepared by trained instructors. - Improvement of WEA training contents based on the Action Plan developed by trained instructors.	- Project Monitoring Sheet, including regular training reports at WEA and GENCOs provided by trained instructors.	- Trained instructors will not resign and/or transfer outside of WEA and GENCOs.
Outputs			
1. Current situation of O&M of thermal power stations is analyzed and training needs are identified.	- Training needs are compiled based on the current situation.	- Project Monitoring Sheet	- Trained instructors continue to work for WEA and GENCOs during the project period.
2. Capacity of WEA and GENCOs' instructors is enhanced.	- Training program is formulated based on the training needs. - Total number of trained instructors. - Total number of training in Japan.	- Project Monitoring Sheet	- Trained instructors continue to work for WEA and GENCOs during the project period.
3. Training as well as OJT at WEA and GENCOs are improved.	- Achievement level of Action Plans developed by trained instructors. - The results of checklists.	- Project Monitoring Sheet, including regular training reports at WEA and GENCOs provided by trained instructors. - Progress report of each Action Plan. - Checklist.	

Activities	Inputs		Important Assumption
	The Japanese Side	The Pakistan Side	
1-1 To analyze the current situation of O&M at thermal power stations. 1-2 To review the training system of thermal power generation, and analyze the current situation and issues of O&M personnel. 1-3 To specify the training needs.	a. Dispatch of Experts - Chief Advisor / Thermal Power Generation Operation & Maintenance - Thermal Power Generation Operation - Thermal Power Generation Maintenance (Mechanical) - Thermal Power Generation Maintenance (Electrical) - Thermal Power Generation Maintenance (C&I) b. Training in Japan c. Training equipment if necessary	a. Assignment of Counterpart personnel - Project Chairperson - Project Director - Project Manager - Project Coordinator - Counterpart members b. Office space and necessary facilities for Japanese experts c. Other operational cost	
2-1 To set the target O&M skills that instructors & potential instructors should obtain. 2-2 To formulate the program of training in Japan. 2-3 To set selection criteria for the training in Japan. 2-4 To conduct trainings in Japan. 2-5 To modify the contents of training in Japan at WEA and GENCOs' thremal power stations (OJTs) in Pakistan.			Pre-Conditions
3-1 To develop action plans of trainings (OJTs) for O&M of thermal power stations. 3-2 To disseminate obtained knowledge and technical skills to O&M personnel based on the action plans and verify the skilled up level by checklist developed at the above 2-4. 3-3 To review the results of action plans to improve the training at WEA and GENCOs' thermal power stations (OJTs) in Pakistan.			<Issues and countermeasures>

Chapter 2 Activities in the Project

2.1 Project Personnel and Duration

The following table lists the personnel involved in this project during the reporting target period.

Table 2-1: List of project personnel

No	Name	Responsibility	Target period	Affiliated Organization in Japan
1	Hiroki Hirahata	Chief Adviser/Thermal power generation (Operation & Maintenance)	November 2017 to June 2020	Kansai Electric Power Co., Inc. (KEPCO)
2	Hidefumi Habara		July 2020 to June 2021	
3	Hidenobu Okuda		July 2021 to March 2022	
4	Tooru Kawai	Thermal power generation (Operation & Maintenance)	November 2017 to September 2018	
5	Akira Kozakai		October 2018 to March2022	
6	Shigeru Yoshitake	Thermal power generation (Mechanical Maintenance)	November 2017 to November 2020	
7	Takashi Horita		November 2020 to June 2021	
8	Naga Fukuda		July 2021 to March 2022	
9	Yoshihiro Doi		November 2017 to March 2022	
10	Hidenobu Ichioka	Thermal power generation (Electrical Maintenance)	November 2017 to March 2022	
11	Haruaki Furukawa		November 2017 to June 2019	
12	Takeo Fujii	Thermal power generation (Control & Instrumentation Maintenance)	November 2017 to June 2018	
13	Kazuyo Kitagawa		July 2018 to June 2019	
14	Yuuki Obe		November 2017 to March 2022	

The subject period of work report was 52 months, started from November 2017 and ended in March 2022. In this period, the 1st on-site work (14 days), the 2nd on-site work (14 days), the 3rd on-site work (13 days), the 4th on-site work and an online remote survey were conducted in stead of 5th on-site work (final on-site survey). In Japan, the 1st training (engineer: 38 days, technician: 21 days, management: 11 days), the 2nd training (engineer: 35 days, technician: 21 days, management: 7 days), the 3rd training (engineer: 24 days, technician: 20 days) and the 4th online-training (instructor: 7 days) were conducted.

Regarding the JCC, the 1st JCC was held in November 2017 during the 1st on-site work, the 2nd JCC was held in September 2018 during the 2nd on-site work and the 3rd JCC was held in October 2019 during the 3rd on-site work. The 4th JCC was originally scheduled to be held in June 2020 during the 4th local operation. However, as it became impossible to carry out the on-site work due to the global spread of the COVID-19, the 4th JCC was held online in November 2020. The 5th JCC(the final JCC) was scheduled to be held during the 5th on-site survey(the final on-site survey), but the spread of the COVID-19 could not be expected to end. We decided to cancel the final on-site operations and held the 5th JCC online in February 2022.

Figure 2-1 shows the work schedule for the project period.

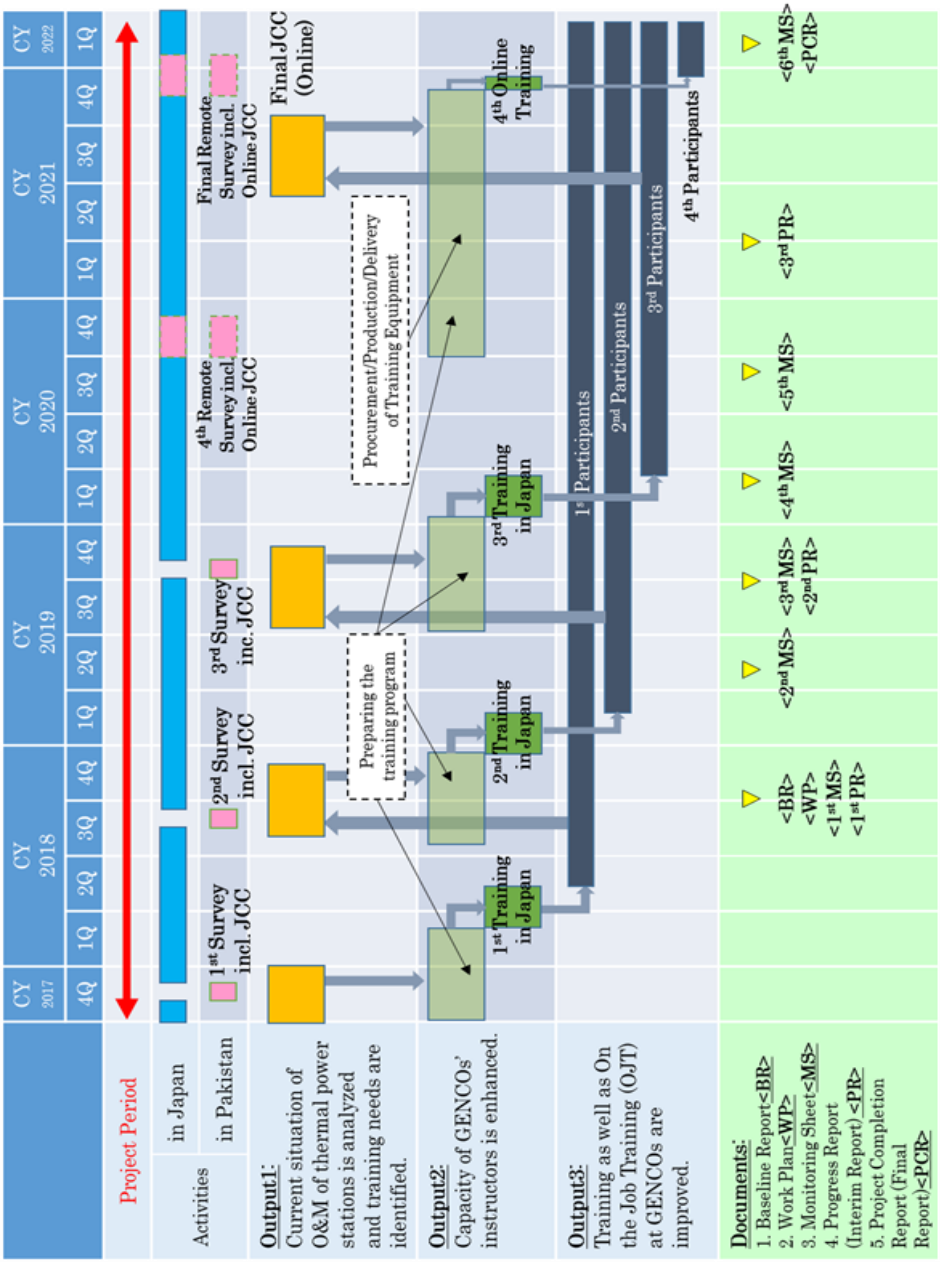


Figure 2-1: Actual work schedule list

2.2 1st On-site Work

2.2.1 Overview of On-site Work

(1) Purpose

As the kick-off of this project, the 1st on-site work was carried out in accordance with the following objectives.

- Project overview sharing with each C/P
- Confirmation of training needs
- On-site survey of TPS and TC (Muzaffargarh TPS, Jamshoro TPS, Lakhra TPS, Kot Addu TPS and WEA)
- Survey of current situation of O&M at TPSs in Pakistan

(2) Result

- Project overview sharing with each C/P

  As the kick-off of the project, the organization and roles of both side (Japan side and Pakistan side), as well as the outline related to the whole project such as work flow and input/output, were shared with the C/P along with the work plan.
- Confirmation of training needs

  Through hearings based on the answers to the questionnaire sent to each C/P to grasp the training needs of this project prior to the commencement of on-site work, and through the on-site survey current situation of O&M at each TPS, the training needs contributing to the improvement of O&M capabilities at TPSs in Pakistan were summarized and reflected in the formulation of the training in Japan curriculum.
- On-site survey of TPS and TC (Muzaffargarh TPS, Jamshoro TPS, Lakhra TPS, Kot Addu TPS and WEA)

  Through on-site survey and hearing of TPS and training center (TC), the current situation of O&M at TPS in Pakistan was analyzed.
- Survey of current situation of O&M at TPSs in Pakistan

  Based on the field study of TPSs and TC in the 1st on-site work and the analysis of collected data, the current situation of O&M at TPSs in Pakistan was summarized in "Baseline survey report (Pakistan) ".

(3) Issue

For the following reasons, the same troubles occur frequently and the power generation capacity is reduced at TPSs in Pakistan.

- Deviation from an appropriate maintenance cycle to meet strong power demand
- Prevention of recurrence of equipment troubles and permanent measures are not properly taken

- Since the repair materials are long-delivery products from overseas, maintenance is performed on an ad hoc basis.

In order to follow up on these issues within this project, the curriculum of the training in Japan was reflected as much as possible.

2.2.2 On-site Work Schedule

From November 12 (departure) to November 25 (return), 2017: 13 nights and 14 days

2.2.3 Personnel involved in On-site Work

Table 2-2: 1st on-site work participants list

No	Name	Responsibility	Affiliated organization in Japan
1	Hiroki Hirahata	Chief Adviser/Thermal power generation (Operation & Maintenance)	KEPCO
2	Tooru Kawai	Thermal power generation (Operation & Maintenance)	
3	Yoshihiro Doi	Thermal power generation (Mechanical Maintenance)	
4	Haruaki Furukawa	Thermal power generation (Electrical Maintenance)	
5	Yuuki Obe	Thermal power generation (Control & Instrumentation Maintenance)	

2.2.4 Implemented Work and Schedule

Table 2-3: Summary list of implemented work and schedule in the 1st on-site work

Date	Visiting place, work, etc	Counterpart
November 12 (Sunday)	Entrance into Pakistan	-
November 13 (Monday)	WAPDA House ➢ Kickoff meeting with counterparts ➢ Explanation of project overview	・JICA ・GHCL ・WAPDA
	WAPDA House ➢ Courtesy call	・WAPDA(Member)
November 14 (Tuesday)	WAPDA House ➢ Inquiry	・GHCL ・WAPDA ・WEA
November 15 (Wednesday)	WEA ➢ Investigation of training facilities, equipment, and materials ➢ Inquiry	・WEA
November 16 (Thursday)	Muzaffargarh Thermal Power Station ➢ Explanation of project overview ➢ Investigation of equipment and O&M status	・GENCO-III

	➢ Inquiry	
November 17 (Friday)	Kot Addu Thermal Power Station (KAPCO) ➢ Explanation of project overview ➢ Investigation of equipment and O&M status ➢ Inquiry	-
November 18 (Saturday)	Holiday	-
November 19 (Sunday)	Holiday	-
November 20 (Monday)	Jamshoro Thermal Power Station ➢ Explanation of project overview ➢ Investigation of equipment and O&M status ➢ Inquiry	・GENCO-I
	Lakhra Thermal Power Station ➢ Explanation of project overview ➢ Investigation of equipment and O&M status ➢ Inquiry	・GENCO-IV
November 21 (Tuesday)	Documentation	-
November 22 (Wednesday)	JICA Pakistan Office ➢ Report of on-site survey result ➢ Discussion about contents in wrap-up meeting ➢ Discussion about MoM	・GHCL
	JICA Pakistan Office ➢ Report of on-site survey result ➢ Discussion about contents in wrap-up meeting ➢ Discussion about MoM	・JICA
	JICA Pakistan Office ➢ Report of on-site survey result ➢ Discussion about contents in wrap-up meeting ➢ Discussion about MoM	・WEA
November 23 (Thursday)	Documentation	-
November 24 (Friday)	GHCL Office ➢ JCC ➢ Preparation of MoM, signature	・MoE (ex-post) ・GHCL ・WAPDA/WEA ・JICA
November 25 (Saturday)	Return to Japan	-


Figure 2-2: The 1st on-site work

(Left: Muzaffargarh TPS, Right: Jamshoro TPS)

2.3 The 1st Joint Coordination Committee (JCC)

The 1st JCC was held on November 24, 2017 during the 1st on-site work period and discussed and agreed on the following items.

(Refer to Annex 3-(1))

(1) Project Organization

- Delegation of Authority
- Formation of JCC
- Functions of JCC

(2) Project outline

- Work Plan
- Project Activities
- Roles and Duties of Human Resource Development

(3) Result of the First Mission

- Outline of the Mission
- Major Facing Issues

(4) Action Plan

- Purpose of Action Plan
- Roles and Duties on Action Plan

(5) First Counterpart Training in Japan

- Schedule
- Goal
- Overall Contents
- Participants
- Nomination date

(6) Participation in the Training by Management/Supervising Officers

(7) Request from JICA Expert Team

Figure 2-3: The 1st JCC meeting

2.4 1st Training in Japan

2.4.1 Overview of Training

(1) Purpose

In the 1st training in Japan, training curriculum was established to follow up on technologies that require capacity building based on the current situation of O&M at TPSs in GENCOs and training needs from Pakistan, which were investigated through the 1st on-site work.

In addition, by setting the ideal of autonomous power plant O&M in IPP of Pakistan (KAPCO), which was additionally investigated in the 1st on-site work, and by incorporating common matters such as labor safety, quality improvement, and human resource development, which are considered to be necessary to fill the gap with the current situation of O&M at GENCOs' TPSs, in this training in a balanced manner, not only the improvement of individual technical ability, but also the improvement of the organizational ability of GENCOs was attempted.

(2) Outcome

Engineers and Technicians trained in Japan answered that the purpose of the training was largely achieved.

(3) Difficulty

In the training for engineers and technicians, discussions were often diverged in the problem analysis using the PCM method, which is the basis for the preparation of the Action Plan, and improvement seemed to be necessary.

In the specialized training, there were some opinions that the training period was short due to the relocation of training sites and the responses to poor physical condition of trainees, etc. Therefore, it was decided to reflect as much as possible in the planning of the 2nd training in Japan, taking into consideration the acceptance systems of JICA and JET and the effects of training.

2.4.2 Training Schedule

(1) Engineer training: March 21 to April 27, 2018 [Training period: 38 days]

(2) Technician training: March 4 to March 24, 2018 [Training period: 21 days]

(3) Management training: March 14 to March 24, 2018 [Training period: 11 days]

2.4.3 Participants of Training in Japan

(1) Engineer training (8 people)

Table 2-4: List of participants of the 1st training in Japan (Engineer)

Participant name	Organization and Designation at the time of participation	Assigned responsibility
Mr. ABBASI Gul Munir	GENCO-II Guddu TPS Deputy Manager	Maintenance
Mr. NAZEER Nazeer Ahmed	GENCO-I Jamshoro TPS Senior Engineer	Maintenance
Mr. BABAR Asadullah	GENCO-II Guddu TPS Mechanical Engineer	Maintenance
Mr. KHWAJA Shahbaz Illahi	GENCO-II Guddu TPS Deputy Manager	Maintenance
Mr. KHAN Asif Hasan	GENCO-II Guddu TPS Assistant Manager	Operation
Mr. MUHAMMAD Aslam Motlani	GENCO-III Faisalabad TPS XEN (IT&R)	Maintenance
Mr. MUHAMMAD Muddasir	GENCO-III Muzaffargarh TPS Assistant Manager	Maintenance
Mr. RAJPER Muhib Ali	GENCO-I Jamshoro TPS Assistant Mechanical Engineer	Maintenance

(2) Technician training (8 people)

Table 2-5: List of participants of the 1st training in Japan (Technician)

Participant name	Organization and Designation at the time of participation	Assigned responsibility
Mr. MEMON Nadeem	GENCO-I Jamshoro TPS Foreman	Maintenance
Mr. KHAN Muhammad Toheed	GENCO-I Jamshoro TPS Operator	Operation
Mr. KHAN Nasim	GENCO-II Guddu TPS Mechanical Foreman	Maintenance
Mr. KALWAR Muhammad Moosa	GENCO-II Guddu TPS Mechanical Foreman	Maintenance
Mr. AHMED Ijaz	GENCO-II Guddu TPS Mechanical Assistant Foreman	Maintenance
Mr. SHAIKH Abdul Hameed	GENCO-II Guddu TPS Mechanical Fitter	Maintenance
Mr. ARIF Muhammad	GENCO-III Muzaffargarh TPS Fitter	Maintenance
Mr. IQBAL Pervaiz	GENCO-III Muzaffargarh TPS Fitter	Maintenance

(3) Management training (2 people)

Table 2-6: List of participants of the 1st training in Japan (Management)

Participant name	Organization and Designation at the time of participation	Assigned responsibility
Mr. BASHIR Shahzad	WAPDA Engineering Academy Chief Engineer / Principal	-
Mr. IQBAL Zafar	WAPDA Engineering Academy Additional Director General	-

2.4.4 Contents of Training

(1) Engineer training

Table 2-7: Contents of the 1st training in Japan (Engineer)

Item	Details
Training contents	➢ Common to JICA training Program orientation / Course orientation / Job report presentation / Instruction for preparing Action Plan (PCM method) / Preparation and presentation of Action Plan ➢ Common to TPSs Fuel of TPSs / Overview of GTCC / Overview of coal fired power station / Overview of USC / Boiler water quality control / Environmental protection / Experiential safety training / Lessons through major accidents / Quality control / Thermal efficiency control / Human resource development (HRD) / Human error ➢ Mechanical Maintenance GTCC (GT/ST/Hot parts/Maintenance of GTCC/Generator/Control) / Nondestructive inspection (Lecture/Practice) / Feed water treatment / Basic training of vibration (Lecture/Practice) ➢ TPS tour Chugoku Electric Power Yanai Thermal Power Station ➢ Manufacturer's factory tour Mitsubishi Hitachi Power Systems (MHPS), Kure Works / MHPS Hitachi Works ➢ Japanese culture experience Visit to Hiroshima Peace Memorial Museum / Japanese-language seminars
Training site	JICA Chugoku Center / Power Engineering and Training Services, Incorporated (PET) / TPS/Manufacturer's factory

As for the detailed schedule of the engineer training, refer to Annex 4-(1).

(2) Technician training

Table 2-8: Contents of the 1st training in Japan (Technician)

Item	Details
Training contents	➢ Common to JICA training Program orientation / Course orientation / Job report presentation / Instruction for preparing Action Plan (PCM method) / Preparation and presentation of Action Plan ➢ Common to TPSs Overview of KEPCO / Fuel of TPSs / Overview of GTCC / Overview of coal fired power station /Experiential safety training / Experiential quality training / Prevention of accidents and disasters ➢ Mechanical Maintenance Handling metal materials / Welding procedure management / Maintenance for high-temperature and high-pressure piping / Valve overhaul (Lecture/Practice) / Pump overhaul (Lecture/Practice) / Nondestructive testing (Lecture/Practice) / Maintenance of instruments ➢ TPS tour KEPCO Himeji No. 2 Thermal Power Station ➢ Manufacturer's factory tour Ishikawajima-harima Heavy Industries (IHI), Aioi Works / MHPS, Takasago Works ➢ Japanese culture experience Japanese-language seminars
Training site	JICA Kansai Center / Kanden Plant Technocenter / TPS / Manufacturer's factory

As for the detailed schedule of the technician training, refer to Annex 4-(1).

(3) Management training

Table 2-9: Contents of the 1st training in Japan (Management)

Item	Details
Training contents	➢ Common to JICA training Program orientation / Course orientation / Problem and Objective analysis using PCM method ➢ Common to TPSs Overview of KEPCO / HRD ➢ Mechanical Maintenance Nondestructive testing (tour) ➢ TPS tour KEPCO Himeji No. 2 Thermal Power Station/ ➢ Training Center (TC) tour KEPCO TC / Kanden Plant Technocenter ➢ Manufacturer's factory tour IHI, Aioi Works / MHPS, Takasago Works
Training site	JICA Kansai Center / KEPCO TC / Kanden Plant Technocenter / TPS / Manufacturer's factory

As for the detailed schedule of the technician training, refer to Annex 4-(1).

2.5 2nd On-site Work

2.5.1 Overview of On-site Work

(1) Purpose

The 2nd on-site work was carried out in accordance with the following objectives.

- Sharing project progress with each C/P
- Interviews with engineers and technicians trained in Japan on the implementation of the action plan
- Discussion on the provision of training equipment
- On-site survey of TPS and TC (Kotri TPS, Faisalabad TPS, Nandipur TPS and WAPDA SCI)

(2) Result

- Sharing project progress with each C/P

  JET shared the following items with each counterpart to ensure the smooth implementation of this project.
  - Project summary
  - Outline of the 1st training in Japan
  - Outline of the 2nd on-site work
  - Issues identified during on-site work and training in Japan, and proposals from JET
  - Plan for the 2nd training in Japan
  - Next steps in the project
- Interviews with engineers and technicians trained in Japan on the implementation of the action plan

  Interviews were held at each TPS with participants trained in Japan regarding the implementation status of the action plan, and the results were summarized.

  In addition, the status of the implementation of the action plan and the issues identified through the hearing results were shared with the management of each C/P through visits to each TPS and at the JCC to encourage further cooperation in the systematic implementation of the action plans.
- Discussion on the provision of training equipment

  Based on the needs for training equipment from the Pakistan side and JET surveys and analyses at TPSs and TC, JET prepared and proposed introduction cases for equipment deemed necessary ("Power Plant Operation Simulator" "Vibration Analysis Demonstrator" "NDI Demonstrator").

- On-site survey of TPS and TC (Kotri TPS, Faisalabad TPS, Nandipur TPS and WAPDA SCI)

  JET surveyed the current situation of O&M at the TPS and the actual status of maintenance of electrical equipment, which was the theme of the 2nd training in Japan.
  JET reviewed the facilities and operation of WAPDA SCI, one of WAPDA's training centers.

(3) Issue

In the interviews on the status of the implementation of the action plan by the engineers and technicians, issues such as the busy workload and lack of training materials and equipment were raised.
Therefore, JET urged the management of each C/P to follow up with the participants trained in Japan to adjust their workload and prepare materials and equipment necessary for the training, so that the action plans could be implemented effectively and systematically.

2.5.2 On-site Work Schedule

From September 2 (departure) to September 15 (return), 2018: 13 nights and 14 days

2.5.3 Personnel involved in On-site Work

Table 2-10: 2nd on-site work participants list

No	Name	Responsibility	Affiliated organization in Japan
1	Hiroki Hirahata	Chief Adviser/Thermal power generation (Operation & Maintenance)	KEPCO
2	Shigeru Yoshitake	Thermal power generation (Mechanical Maintenance)	
3	Yoshihiro Doi	Thermal power generation (Mechanical Maintenance)	
4	Haruaki Furukawa	Thermal power generation (Electrical Maintenance)	
5	Yuuki Obe	Thermal power generation (Control & Instrumentation Maintenance)	

2.5.4 Implemented Work and Schedule

Table 2-11: Summary list of implemented work and schedule in the 2nd on-site work

Date	Visiting place, work, etc	Counterpart
September 2 (Sunday)	Entrance into Pakistan	-
September 3 (Monday)	JICA Pakistan Office ➢ Sharing of the 2nd on-site survey overview	・JICA
	GHCL Office ➢ Project interim report ➢ Sharing of the 2nd on-site work overview ➢ Sharing the contents of the 2nd training in Japan	・GHCL ・WAPDA ・JICA
September 4 (Tuesday)	Nandipur Thermal Power Station ➢ Explanation of project overview ➢ Project interim report ➢ Investigation of equipment and O&M status ➢ Sharing of the 2nd on-site work overview ➢ Sharing the contents of the 2nd training in Japan	・GHCL ・GENCO-IV
	WEA ➢ Discussion about the supply of training materials and equipment	・GHCL ・WAPDA ・WEA
September 5 (Wednesday)	Faisalabad Thermal Power Station ➢ Explanation of project overview ➢ Project interim report ➢ Investigation of equipment and O&M status ➢ Sharing of the 2nd on-site work overview ➢ Sharing the contents of the 2nd training in Japan	・GHCL ・GENCO-III
	Central Gas Turbine Maintenance Workshop Faisalabad ➢ Explanation of project overview ➢ Project interim report ➢ Investigation of equipment	・GHCL
September 6 (Thursday)	Conference room in the staying hotel (for Guddu Power Station) ➢ Explanation of project overview ➢ Project interim report ➢ Sharing of the 2nd on-site work overview ➢ Sharing the contents of the 2nd training in Japan ➢ Interview of action plan implementation status to the participants who attended the 1st training in Japan	・GHCL ・GENCO-II
September 7 (Friday)	Muzaffargarh Thermal Power Station ➢ Project interim report ➢ Sharing of the 2nd on-site work overview ➢ Sharing the contents of the 2nd training in Japan ➢ Interview of action plan implementation status to the participants who attended the 1st training in Japan	・GHCL ・GENCO-III
September 8 (Saturday)	Holiday	-
September 9 (Sunday)	Holiday	-
September 10 (Monday)	Jamshoro Thermal Power Station ➢ Project interim report	・GHCL ・GENCO-I

	➢ Sharing of the 2nd on-site work overview ➢ Sharing the contents of the 2nd training in Japan ➢ Interview of action plan implementation status to the participants who attended the 1st training in Japan	・GENCO-II
	Kotri Thermal Power Station ➢ Explanation of project overview ➢ Project interim report ➢ Investigation of equipment and O&M status ➢ Sharing of the 2nd on-site work overview ➢ Sharing the contents of the 2nd training in Japan	・GHCL ・GENCO-I
September 11 (Tuesday)	Documentation	-
September 12 (Wednesday)	WAPDA Staff College Islamabad (WAPDA SCI) ➢ Explanation of project overview ➢ Project interim report ➢ Investigation of actual status of training facility ➢ Sharing of the 2nd on-site work overview	・WAPDA
	JICA Pakistan Office ➢ Report of the 2nd on-site work result ➢ Arrangement of JCC discussion contents ➢ Arrangement of MoM description	・JICA
September 13 (Thursday)	JICA Pakistan Office ➢ Report of the 2nd on-site work result ➢ Arrangement of JCC discussion contents ➢ Arrangement of MoM description	・GHCL ・WAPDA ・JICA
September 14 (Friday)	GHCL Office ➢ JCC ➢ MoM signature	・MoE ・GHCL ・WAPDA ・JICA
September 15 (Saturday)	Return to Japan	-


Figure 2-4: The 2nd on-site work

(Left: Faisalabad TPS, Right: Nandipur TPS)

2.6 The 2nd Joint Coordination Committee (JCC)

The 2nd JCC was held on September 14, 2018 during the 2nd on-site work period and discussed and agreed on the following items.

(Refer to Annex 3-(2))

(1) Progress of the Project

(2) Result of the Second Mission

- Outline of the Mission
- Result of the review of Action Plan Implementation
- Current situation of O&M and Training needs
- Recommendation on Future Steps for HRD Enhancement

(3) Action Plan

- Purpose of Action Plan
- Roles and Duties on Action Plan

(4) Second Counterpart Training in Japan

- Schedule
- Overall Contents
- Participants
- Nomination date

(5) Provision of O&M training equipment

(6) Participation in the Training by Management and Supervising Officers

(7) Project Monitoring Sheet

(8) Monitoring Indicator

(9) Request from JICA Expert Team

Figure 2-5: The 2nd JCC meeting

2.7 2nd Training in Japan

2.7.1 Overview of Training

(1) Purpose

The basic objectives of the 2nd training in Japan are the same as those of the 1st training in Japan.

In the kickoff meeting with the counterpart at 2nd on-site work, with regard to the specialty dealt with in the training, the CEO of GHCL strongly requested for the field of electrical maintenance as the item in the 2nd training in Japan. In response to the request, JET formulated the training program again with the specialized training focused on the field of electrical maintenance, while the common items such as the safety and quality training are based on the contents of the 1st training in Japan.

JET surveyed the actual situation of electrical equipment maintenance and training needs at GENCOs TPSs that JET visited through the 1st and 2nd on-site work, and conducted a balanced combination of lectures and practical training after improving the training found in the above-mentioned 1st training in Japan for technologies that require capacity building.

In the 2nd management training held in Japan, participants discussed the necessary mechanisms for improving the O&M capabilities of TPSs in Pakistan (Human resources development methods, training programs, training facilities, etc.), referring to human resource development methods in Japan.

(2) Outcome

Regarding training in Japan for engineers and technicians, by switching from the PCM method to JET's original issue analysis method in the preparation of the Action Plan, participants were able to analyze the actual situations of O&M at own TPS more concretely, and to create an image of activities to be taken after returning to Pakistan.

With regard to training for management, the action plan of GHCL/GENCOs is made to incorporate the use of participants trained in Japan as instructors and the improvement of training facilities, leading to improved O&M capabilities as an organization.

(3) Difficulty

As there was a high demand for more practical training in engineer and technician training, it was decided to reflect this in the 3rd training in Japan plan.

2.7.2 Training Schedule

(1) Engineer training: January 6 to February 9, 2019 [Training period: 35 days]

(2) Technician training: January 6 to January 26, 2019 [Training period: 21 days]

(3) Management training: February 3 to February 9, 2019 [Training period: 7 days]

2.7.3 Participants of Training in Japan

(1) Engineer training (8 people)

Table 2-12: List of participants of the 2nd training in Japan (Engineer)

Participant name	Organization and Designation at the time of participation	Assigned responsibility
Mr. ANSARI Sajid Hussain	GENCO-I Jamshoro TPS Additional Manager	Maintenance
Mr. BHATTI Muhammad Ahmad	GHCL Additional Manager	Design and Development
Mr. GHAFFAR Abdul	GENCO-II Guddu TPS Additional Manager	Maintenance
Mr. KHAN Mughees Ul Muneer	GENCO-II Guddu TPS Deputy Manager	Maintenance
Mr. Mahmood Ul Hasan	GENCO-II Guddu TPS Assistant Manager	Fuel
Mr. LAL Nand	GENCO-IV Lakhra TPS Assistant Manager	Maintenance
Mr. CHOUDHRY Irfan Bashir	GENCO-III Muzaffargarh TPS Additional Manager	Performance
Mr. ALI Zahid	GENCO-III Muzaffargarh TPS Manager	Maintenance

(2) Technician training (8 people)

Table 2-13: List of participants of the 2nd training in Japan (Technician)

Participant name	Organization and Designation at the time of participation	Assigned responsibility
Mr. MEMON Ali Akbar	GENCO-IV Lakhra TPS -	Operation
Mr. CHACHAR Imdad Hussain	GENCO-IV Lakhra TPS -	Maintenance
Mr. HASHMI Muhammad Ishaq	GENCO-II Guddu TPS Foreman	Maintenance
Mr. ARAIN Muhammad Saleem	GENCO-II Guddu TPS Fitter	Maintenance
Mr. GOLATO Moula Bux	GENCO-II Guddu TPS Foreman	Maintenance
Mr. ALLAH Nawaz Malik	GENCO-III Muzaffargarh TPS -	Maintenance
Mr. SEELRO Naseer Ahmed	GENCO-I Jamshoro TPS Foreman	Maintenance
Mr. KHAN Muhammad Azeem	GENCO-I Jamshoro TPS -	Operation

(3) Management training (4 people)

Table 2-14: List of participants of the 2nd training in Japan (Management)

Participant name	Organization and Designation at the time of participation	Assigned responsibility
Mr. AHMAD Mushtaq	GHCL Chief HR and Admin Officer	Human Resource Management
Mr. SINDHU Zafar Ahmad	GENCO-I Jamshoro TPS Resident Engineer (Operation)	-
Mr. HASHMAT Waseem	WAPDA Engineering Academy Additional Director/Sr. Instructor	-
Mr. AHMED Khalil	WAPDA Engineering Academy Deputy. Director/Sr. Instructor	-

2.7.4 Contents of Training

(1) Engineer training

Table 2-15: Contents of the 2nd training in Japan (Engineer)

Item	Details
Training contents	➢ Common to JICA training Program orientation / Course orientation / Job report presentation / Instruction for preparing Action Plan (Issue analysis) / Preparation and presentation of Action Plan ➢ Common to TPSs Overview of KEPCO / Fuel of TPSs / Overview of GTCC / Overview of coal fired power station / Experiential safety training / Lessons through major accidents / Quality control / Thermal efficiency control / HRD / Optimal maintenance planning / Risk prediction meeting ➢ Electrical Maintenance Nondestructive inspection (Lecture/Practice) / Basic training of vibration (Lecture/Practice) / Circuit breakers / Generators / Motors / Electrical cables / Outline of insulation / Fire prevention measures of electrical equipment / Protection systems of main electrical equipment ➢ TPS tour KEPCO Himeji No. 2 Thermal Power Station / KEPCO Maizuru Thermal Power Station / Central load dispatching center / Remote Monitoring Center (RMC) ➢ Manufacturer's factory tour Nihon Denken Industrial Co., Ltd / MHPS, Takasago Works / Mitsubishi Electric Corporation (MELCO), Kobe Works / MELCO, Itami Works ➢ Japanese culture experience Guide to famous historic remains in Kyoto / Home visit / Japanese-language seminars

Training site	JICA Kansai Center / KEPCO Headquarters /KEPCO TC / TPS / Manufacturer's factory

As for the detailed schedule of the engineer training, refer to Annex 4-(2).

(2) Technician training

Table 2-16: Contents of the 2nd training in Japan (Technician)

Item	Details
Training contents	➢ Common to JICA training Program orientation / Course orientation / Job report presentation / Instruction for preparing Action Plan (Issue analysis) / Preparation and presentation of Action Plan ➢ Common to TPSs Overview of KEPCO / Fuel of TPSs / Overview of GTCC / Overview of coal fired power station/ Experiential safety training / Experiential quality training / Prevention of accidents and disasters / Occupational safety / Risk prediction meeting ➢ Electrical Maintenance Generators / Motors (Lecture/Practice) / Transformers / Electrical cables / Outline of insulation / Fire prevention measures of electrical equipment / Protection systems of main electrical equipment ➢ TPS tour KEPCO Maizuru Thermal Power Station / Central load dispatching center / Remote Monitoring Center (RMC) ➢ Japanese culture experience Guide to famous historic remains in Kyoto / Japanese-language seminars
Training site	JICA Kansai Center / KEPCO Headquarters / Kanden Plant Technocenter / TPS

As for the detailed schedule of the technician training, refer to Annex 4-(2).

(3) Management training

Table 2-17: Contents of the 2nd training in Japan (Management)

Item	Details
Training contents	➢ Common to JICA training Program orientation/Course orientation/Job report presentation/ Stakeholder Analysis/Issue Analysis Preparation and presentation of Action Plan ➢ Common to TPSs HRD / Experiential safety training (tour) ➢ TPS tour Remote Monitoring Center (RMC) / KEPCO Sakaikou Thermal Power Station / KEPCO Nankou Thermal Power Station / Sakai LNG Receiving Terminal ➢ TC tour KEPCO TC
Training site	JICA Kansai Center / KEPCO Headquarters / KEPCO TC / TPS / LNG Receiving Terminal

As for the detailed schedule of the technician training, refer to Annex 4-(2).

2.8 3rd On-site Work

2.8.1 Overview of On-site Work

(1) Purpose

The 3rd on-site work was carried out in accordance with the following objectives.

- Sharing project progress with each C/P
- Interviews with engineers and technicians trained in Japan on the implementation of the action plan
- Discussion on the provision of training equipment
- On-site survey of TPS and TC (Guddu TPS, Guddu TC and Muzaffargarh TC)

(2) Result

- Sharing project progress with each C/P

  JET shared the following items with each counterpart to ensure the smooth implementation of this project.
  - Project summary
  - Outline of the 2nd training in Japan
  - Outline of the 3rd on-site work
  - Issues identified during on-site work and training in Japan, and proposals from JET
  - Plan for the 3rd training in Japan
  - Next steps in the project
- Interviews with engineers and technicians trained in Japan on the implementation of the action plan

  Interviews were held at each TPS with participants trained in Japan regarding the implementation status of the action plan, and the results were summarized.

  In addition, the status of the implementation of the action plan and the issues identified through the hearing results were shared with the management of each C/P through visits to each TPS and at the JCC to encourage further cooperation in the systematic implementation of the action plans.

  The issue analysis that had been conducted since the 2nd training in Japan, including the 1st participants trained in Japan, was explained again, and the issue analysis tree was reviewed.
- Discussion on the provision of training equipment

  Regarding the training equipment to be provided from Japan to Pakistan, discussions were held with C/P regarding the specifications of each equipment and the effects of its introduction into training, and a consensus was reached on the cases where “NDI Demonstrator” and “Vibration Analysis Demonstrator” would be introduced.

- On-site survey of TPS and TC (Guddu TPS, Guddu TC and Muzaffargarh TC)

  JET surveyed the current situation of O&M at the TPS and the actual status of maintenance of control and instrumentation equipment, which was the theme of the 3rd training in Japan. Simultaneously, the research was carried out on training actual condition in Guddu TC established jointly.

  In addition, a potential survey was conducted on the training facilities attached to the Muzaffargarh TPS where GHCL is considering renovation of the training facilities.

(3) Issue

Until now, training of engineers among the thermal power generation personnel required at GENCOs was based on the use of the WEA. However, GHCL now has a policy to training, regardless of engineer or technician, using its own training facilities and training curriculum. As a result, the effect of the involvement of WAPDA and WEA in this project has become limited.

2.8.2 On-site Work Schedule

From September 30 (departure) to October 12 (return), 2019: 12 nights and 13 days

2.8.3 Personnel involved in On-site Work

Table 2-18: 3rd on-site work participants list

No	Name	Responsibility	Affiliated organization in Japan
1	Hiroki Hirahata	Chief Adviser/Thermal power generation (Operation & Maintenance)	KEPCO
2	Akira Kozakai	Thermal power generation (Mechanical Maintenance)	
3	Yoshihiro Doi	Thermal power generation (Mechanical Maintenance)	
4	Hidenobu Ichioka	Thermal power generation (Electrical Maintenance)	
5	Yuuki Obe	Thermal power generation (Control & Instrumentation Maintenance)	

2.8.4 Implemented Work and Schedule

Table 2-19: Summary list of implemented work and schedule in the 3rd on-site work

Date	Visiting place, work, etc.	Counterpart
September 30 (Monday)	Entrance into Pakistan	-
October 1 (Tuesday)	JICA Pakistan Office ➢ Project interim report ➢ Sharing of the 3rd on-site work overview ➢ Sharing the contents of the 3rd training in Japan ➢ Discussion on the provision of training equipment	・GHCL ・JICA
October 2 (Wednesday)	Muzaffargarh Thermal Power Station ➢ Project interim report ➢ Sharing of the 3rd on-site work overview ➢ Sharing the contents of the 3rd training in Japan ➢ Interview of action plan implementation status to the participants who attended the 1st and 2nd training in Japan ➢ Investigation of actual status of training facility	・GHCL ・GENCO-III
October 3 (Thursday)	Guddu Thermal Power Station ➢ Project interim report ➢ Sharing of the 3rd on-site work overview ➢ Sharing the contents of the 3rd training in Japan ➢ Interview of action plan implementation status to the participants who attended the 1st and 2nd training in Japan ➢ Investigation of equipment and O&M status	・GHCL ・GENCO-II
October 4 (Friday)	Guddu Training Center ➢ Investigation of actual status of training facility ➢ Discussion on the provision of training equipment	・GHCL ・GENCO-II
October 5 (Saturday)	Holiday	-
October 6 (Sunday)	Holiday	-
October 7 (Monday)	Jamshoro Thermal Power Station ➢ Project interim report ➢ Sharing of the 3rd on-site work overview ➢ Sharing the contents of the 3rd training in Japan ➢ Interview of action plan implementation status to the participants who attended the 1st and 2nd training in Japan	・GHCL ・GENCO-I
October 8 (Tuesday)	Documentation	-
October 9 (Wednesday)	JICA Pakistan Office ➢ Report of the 3rd on-site work result ➢ Arrangement of JCC discussion contents ➢ Arrangement of MoM description	・JICA
	GHCL Office ➢ Report of the 3rd on-site work result ➢ Arrangement of JCC discussion contents ➢ Arrangement of MoM description	・GHCL
October 10 (Thursday)	Documentation	-

October 10 (Friday)	GHCL Office ➢ JCC ➢ MoM signature	・MoE ・GHCL ・WAPDA ・JICA
October 11 (Saturday)	Return to Japan	-

Figure 2-6: The 3rd on-site work

(Left: Guddu Training Center, Right: Guddu Thermal Power Station)

2.9 The 3rd Joint Coordination Committee (JCC)

The 3rd JCC was held on October 10, 2019 during the 3rd on-site work period and discussed and agreed on the following items.

(Refer to Annex 3-(3))

(1) Progress of the Project

(2) Result of the Third Mission

- Outline of the Mission
- Result of the review of Action Plan Implementation
- Current situation of O&M
- Suggestion of Training target

(3) Third Counterpart Training in Japan

- Schedule
- Overall Contents
- Participants
- Nomination date
- Observance of the application deadline

(4) Provision of O&M training equipment

(5) Project Monitoring Sheet

Figure 2-7: The 3rd JCC meeting

2.10 3rd Training in Japan

2.10.1 Overview of Training

(1) Purpose

The basic objectives of the 3rd training in Japan are the same as those of the 1st and 2nd training in Japan.

In the 3rd training in Japan for engineers and technicians, GHCL had strongly requested implementation in the field of control and instrumentation maintenance in advance, so it was decided to implement it in the field of control and instrumentation maintenance.

JET surveyed the actual situation of control and instrumentation equipment maintenance and training needs at GENCOs TPSs that JET visited through the 1st to 3rd on-site work, and conducted a balanced combination of lectures and practical training after improving the training found in the above-mentioned 1st and 2nd training in Japan for technologies that require capacity building.

In the 3rd training in Japan for management, the curriculum was set up so that training programs using "NDI Demonstrator" and "Vibration Analysis Demonstrator", which were decided to be provided from Japan to the Pakistan, could be formulated, along with training on human resource development methods that contribute to the improvement of O&M capabilities of TPSs.

(2) Outcome

As for the training in Japan for engineers and technicians, participants first learned the theory through lectures, and then went on to further deepen their understanding through practical training and tours of actual facilities. As a result, the 3rd training in Japan received even higher evaluations from the participants.

(3) Difficulty

Due to insufficient coordination, the 3rd management training was cancelled, and the 3rd engineer training was shortened by two weeks.

2.10.2 Training Schedule

(1) Engineer training: January 23 to February 15, 2020 [Training period: 24 days]

(2) Technician training: January 13 to February 1, 2020 [Training period: 20 days]

2.10.3 Participants of Training in Japan

(1) Engineer training (8 people)

Table 2-20: List of participants of the 3rd training in Japan (Engineer)

Participant name	Organization and Designation at the time of participation	Assigned responsibility
Mr. SAEED Ahmed Shaikh	GENCO-II Guddu TPS Additional Manager	Maintenance
Mr. MUHAMMAD Adnan Bashir	GENCO-II Guddu TPS Assistant Manager	Maintenance
Mr. MUHAMMAD Asif Siddiqui	GHCL Deputy Manager	-
Mr. FAISAL Naeem	GENCO-III Muzaffargarh TPS Assistant Manager	Maintenance
Mr. FARRUKH Riaz	GENCO-III Nandipur TPS Assistant Manager	Maintenance
Mr. KHALIL Ahmed Shaikh	GENCO-I Jamshoro TPS Assistant Manager	Maintenance
Mr. NAIMAT Ullah Khan	GENCO-II Guddu TPS Assistant Manager	Maintenance
Mr. SUHAIL Ahmed Qureshi	GENCO-II Guddu TPS Assistant Manager	Maintenance

(2) Technician training (8 people)

Table 2-21: List of participants of the 3rd training in Japan (Technician)

Participant name	Organization and Designation at the time of participation	Assigned responsibility
Mr. Muhammad Zahid Akhtar	GENCO-I Kotri TPS Test Inspector	Maintenance
Mr. Muhammad Usman Khan	GENCO-I Kotri TPS Test Inspector	Maintenance
Mr. Anwar Ali	GENCO-II Guddu TPS Foreman	Maintenance
Mr. Abdul Toheed	GENCO-II Guddu TPS Fitter	Maintenance
Mr. Shahid Masood	GENCO-III Muzaffargarh TPS Foreman	Maintenance
Mr. Muhammad Ijaz	GENCO-III Muzaffargarh TPS Fitter	Maintenance
Mr. Asad Ullah	GENCO-III Muzaffargarh TPS Assistant Station Attendant	Maintenance
Mr. Noor Hussain	GENCO-IV Lakhra TPS Test Inspector	Maintenance

2.10.4 Contents of Training

(1) Engineer training

Table 2-22: Contents of the 3rd training in Japan (Engineer)

Item	Details
Training contents	➢ Common to JICA training Program orientation / Course orientation / Job report presentation / Instruction for preparing Action Plan (Issue analysis) / Preparation and presentation of Action Plan ➢ Common to TPSs Overview of GTCC / Experiential safety training / Lessons through major accidents / Quality control / HRD / Optimal maintenance planning / Quality of electric power infrastructure / Tool Box Meeting (TBM) ➢ Control & Instrumentation Maintenance GTCC (GT/ST/HRSG/Control/Simulator) / Turbine supervisory instrument (Lecture/Practice) / Measuring and Monitoring Device (Lecture/Practice) / Control Valve and Accessories (Lecture/Practice) / Basic Control Theory (PID Control) / Optimal Tuning (Lecture/Practice) ➢ TPS tour KEPCO Himeji No. 2 Thermal Power Station ➢ Manufacturer's factory tour Shimadzu Corporation, Sanjo Works / Shimadzu System Solutions, Sanjo Works ➢ Japanese culture experience Guide to famous historic remains in Kyoto
Training site	JICA Kansai Center / KEPCO TC / Kanden Plant Technocenter / TPS / Manufacturer's factory

As for the detailed schedule of the engineer training, refer to Annex 4-(3).

(2) Technician training

Table 2-23: Contents of the 3rd training in Japan (Technician)

Item	Details
Training contents	➢ Common to JICA training Program orientation / Course orientation / Job report presentation / Instruction for preparing Action Plan (Issue analysis) / Preparation and presentation of Action Plan ➢ Common to TPSs Overview of KEPCO / Overview of GTCC / Experiential safety training / Experiential quality training / Prevention of accidents and disasters / Occupational safety / TBM ➢ Control & Instrumentation Maintenance Measuring and Monitoring Device (Lecture/Practice) / Copper Pipe Flaring and Seal Taping (Lecture/Practice) / Control Cable and Terminal Treatment (Lecture/Practice) / Control Valve and Accessories (Lecture/Practice) / Basic Control Theory (PID Control) / Optimal Tuning (Lecture/Practice) ➢ TPS tour KEPCO Himeji No. 2 Thermal Power Station / Central load dispatching center / Remote Monitoring Center (RMC) ➢ Manufacturer's factory tour MELCO, Kobe Works / ➢ Japanese culture experience Guide to famous historic remains in Nara / Home visit / Japanese-language seminars
Training site	JICA Kansai Center / KEPCO Headquarters / Kanden Plant Technocenter / TPS / Manufacturer's factory

As for the detailed schedule of the technician training, refer to Annex 4-(3).

2.11 The 4th Joint Coordination Committee (JCC)

The 4th JCC was scheduled to be held in the 4th on-site work period, which was scheduled to be carried out by October 2020, which is the originally planned end time of the Project. Since it became impossible to carry out the on-site work due to the global spread of the COVID-19, the 4th JCC was held online on November19, 2020 and discussed and agreed on the following items. (Refer to Annex 3-(4))

(1) Progress of the Project

(2) Review of Action Plan Implementation

- Actual Conditions
- Request from the Project Members

(3) Analysis of current situation of O&M through Issue Analysis

(4) Delivery of Training Equipment

(5) Amendment of Project Design Matrix (PDM) and Plan of Operation

(6) Next Phase of the Project

(7) Conclusion

Figure 2-8: The 4th JCC meeting

2.12 The 4th Online Training

2.12.1 Overview of Training

(1) Purpose

At the 4th JCC held in November 2020, it was agreed as additional projects that training materials and equipment (vibration model rotor, non-destructive inspection kit) will be provided from the Japanese side to the Pakistan side, and instructors will be trained early in order to incorporate the training course with such training materials and equipment into the thermal power training in Pakistan.

Training of instructors was planned to be carried out during the period of the 5th on-site survey planned in 2021, but since the spread of CVID-19 could not be expected to end, online training in stead of on-site training was conducted.

In the 4th online training, training equipment (vibration model rotor, non-destructive inspection kit) were used to carry out more practical training sustainably in Pakistan. The training equipment were selected based on the field surveys, discussions with the management of GHCL / GENCOs, and opinions from participants in the training in Japan. Specifically, we made a curriculum in which instructors can understand the basic theory in the technical training curriculum using each equipment, learn how to install, use, and maintain each equipment, and learn the method of teaching trainees by themselves as an instructor. The training was conducted by online using a web conferencing system.

(2) Outcome

The instructors of each training center who participated in the training answered that they were able to achieve the purpose of this online training, which is the acquisition of practical training methods using the training materials and equipment provided by the Japanese side. In addition, action plans were formulated to carry out training using materials and equipment at each training center continuously in the future.

We believe that the understanding of the trainee was promoted as we assigned Urdu interpreter to activate reciprocal communication in online training. It is proved by looking the trainees worked diligently in each training session and actively asked questions to resolve their doubts.

In addition, as a feature of this online training, the training materials and equipment provided from the Japanese side to the Pakistan side were actually used by the training participants. The Japanese side prepared the same equipment and used it as a model so that the trainees who handle the materials and equipment for the first time can easily understand it. In consideration of detailed support and unforeseen trouble with the equipment, manufacturer staff were also involved in the remote training. By doing so, it was an effective and efficient

training.

(3) Difficulty

Although there were small problems such as power outages and communication equipment malfunctions at the training center on the Pakistan side during this online training, both country side considered counter measures to continue the training and overcome flexibly. By doing so, we completed all the curriculum as planned.

2.12.2 Schedule of Training

The training of instructor was held from 29th November 2021 to 8th December 2021 (7days)

2.12.3 Participants of Training

The 8 instructors participated in the training.

Table 2-24 The 4th Online Training Participants

Name of Trainee	Organization / Title	Area
Mr. Memon Ayaz Ahmed	GENCO-Ⅲ NPGCL GHCL Trainin Center Dy. Director	-
Mr. Rauf Abdul	GENCO-Ⅲ NPGCL Muzaffargarh Power Plant Junior Engineer (I&C)	Maintenance
Mr. Pervaiz Iqbal	GENCO-Ⅲ NPGCL Muzaffargarh Phase- Ⅰ Mechanical Forman	Maintenance
Mr. Muhammad Arif	GENCO-Ⅲ NPGCL Muzaffargarh Phase- Ⅰ Mechanical Fitter	Maintenance
Mr. Khalil Ahmad	GENCO-Ⅱ CPGCL Guddu Power Plant Assistant Manager / Junior Engineer	Maintenance
Mr. Shahrukh Ali	GENCO-Ⅱ CPGCL Guddu Power Pant Assistant Manager / Junior Engineer	Operation / Maintenance
Mr. Muhammad Mohsin	GENCO-Ⅱ CPGCL Guddu Power Pant -	Operation
Mr. Basharat Ali	GENCO-Ⅱ CPGCL Guddu Power Pant ASA / Assistant Manager (F&C)	Fuel & Contracts (F&C)

2.12.4 Contents of Training

The contents of the trainig is shown in the below table.

. **Table 2-25: Contents of the 4th Online Training (Instructor)**

Item	Details
Training contents	➢ Common to JICA training Program orientation / Course orientation / Instruction for preparing Action Plan (Issue analysis) / Making Action Plan ➢ Training of Vibration Model Rotor Unpacking / Checking the number of staff / Installation / Connection / Starting up / Function confirmation (bearing scratches, bearing replacement, rotor scattering, rotor scattering, unbalanced troubleshooting) /Vibration foundation / unbalance calculation (influence effect method, 3-point method) /Training demonstration ➢ Training of Non-Destructive kit Unpacking / Checking the number of members / Outline of non-destructive inspection / PT (lecture / practice) /MT (Lecture / Practice) / UT (Lecture / Practice) /Training demonstration
Training site	Zoom Online Conference system(Japan, Pakistan)

As for the detailed schedule of the technician training, refer to Annex 4-(4).

2.13 The 5th JCC

The 5th JCC was scheduled to be held during the 5th on-site survey, which is the final on-site survey, but the final on-site survey was canceled because the spread of COVID-19 could not be expected to end. The final JCC, the 5th JCC, was held online on February 17, 2022.
In the 5th JCC, JET gave a presentation on the results of the project and recommendations for the future, and the Pakistani side expressed the effectiveness and usefulness of the project.
Annex 3-(5) shows the minutes of the meeting and presentation materials of the 5th JCC. The main points of agreement are as follows.

(1) Status of Project Achievement
Considering the number of training courses conducted by the trainees in Pakistan and the number of trainers (instructors) trained which are the monitoring index of the project, both the Japanese side and the Pakistani side agreed that the project goal of "strengthening the training capacity related to O&M of thermal power plants" was achieved.. In addition, both side also concluded that this project contributed to the improvement of the O&M capacity of the thermal power plant and was practical and effective.

(2) Importance of continuous action plan implementation by GHCL management
The implementation of the human resources development action plan by the management is almost completed, but the participants share the recognition that the continuous implementation of the human resources development action plan by the management is indispensable for enhancing the sustainability of this project.

(3) Continuous support after the project completion
JET requested further support from the Pakistani side for the implementation and monitoring of action plans by trainees even after the project was completed. The JCC Chair requested the management of each GENCO for further support to the implementation of the action plan from the viewpoint of the efficiency and sustainability of this project, and the Paticipants from Pakistan side agreed.

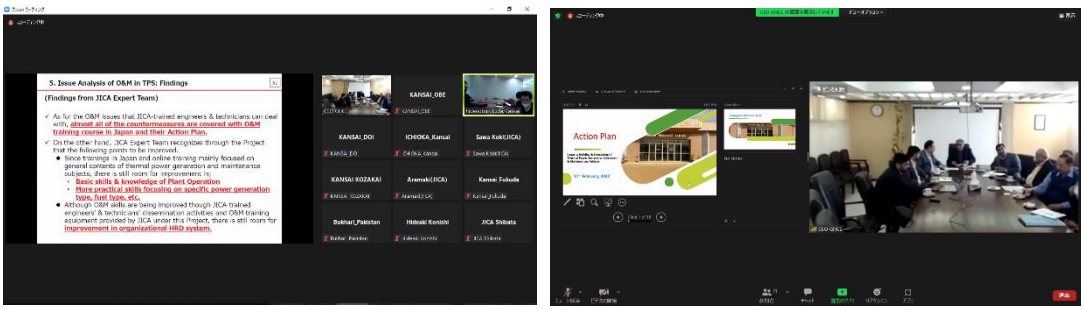


Figure 2-9: The 5th JCC meeting

Chapter 3 Results of Activities for the Project

3.1 Results of Activities for Output 1

3.1.1 Analyzing and Summarizing the Current Situation and Issues of O&M for TPSs

(1) 1st analysis and summarize

The JET organized the current situation analysis related to O&M for TPSs in Pakistan as described in "Baseline survey report (Pakistan)" by referring to various documents and published information for common electric power circumstances and the results of the 1st on-site work in this project for TPSs. Table 3-1 shows the analysis targets for the 1st on-site work.

Table 3-1: List of analysis targets and analytical methods (1st on-site work)

Target		Analytical method
Public utility	GHCL	QA answers / Questions
TPS	GENCO-I Jamshoro TPS	Site visit / Questions
TPS	GENCO-II Guddu TPS	QA answers
TPS	GENCO-III Muzaffargarh TPS	Site visit / Questions
TPS	GENCO-IV Lakhra TPS	Site visit / Questions
TPS (IPP)	KAPCO Kot Addu TPS	Site visit / Questions
Training facility	GENCO-II Guddu Training Center	QA answers
Training facility	WAPDA WAPDA Engineering Academy	Site visit / Questions

(2) 2nd analysis and summarize

Table 3-2 shows the additional analysis target about the current situation related to the O&M of TPS for the TPS and relevant training facilities that we will visit for the first time in the 2nd on-site work.

In the kickoff meeting in the 2nd on-site work, the CEO of GHCL strongly requested the implementation of the 2nd training in Japan in the electrical maintenance filed. In response to the request, the 2nd training items in Japan were summarized to improve the skills in the electrical maintenance field that seems to be necessary, according to the actual situation of the maintenance to electrical equipment in respective power stations that were visited in the 2nd on-site work as the JET and the result of the interview with the staffs in the power station.

Table 3-2: List of analysis targets and analytical methods (2nd on-site work)

Target		Analytical method
TPS	GENCO-I Kotri TPS	Site visit / Questions
TPS	GENCO-III Faisalabad TPS	Site visit / Questions
TPS	GENCO-III Nandipur TPS	Site visit / Questions
TPS	GENCO-IV Lakhra TPS	Site visit / Questions
TPS (IPP)	KAPCO Kot Addu TPS	Site visit / Questions
Repair plant	GENCO-III Central Gas Turbine Maintenance Workshop Faisalabad	Site visit / Questions
Training facility	WAPDA WAPDA Staff College Islamabad	Site visit / Questions

The following is a list of special remarks from the results of the survey on the current status of O&M at the targets JET visited in the 2nd on-site work.

- Kotri TPS
  - Operation
    - ✓ The operation of the power plant was not digitized and automated, and it appeared that the main operating parameters were recorded by hand every four hours. The operator who was recording the data did not understand the meaning of the value and did not seem to understand the warning value.
  - Maintenance
    - ✓ Because the electrical maintenance field is requested for the 2nd training in Japan, the main electrical facility that had been introduced in this power station was investigated. Consequently, the protective relay of the GT generator, the directional relay, ground relay, and frequency relay were found to be the analogue type. Similarly, the protection relays of the ST generator were analog type for the overcurrent relay, under voltage relay, directional relay, and frequency relay.
    - ✓ The slip ring was rusted, and instead of the use of connector for the terminal box of the motor, taping was used. From these facts, it seemed that appropriate maintenance was not conducted there.
    - ✓ The significance of maintenance for precision equipment did not seem to be recognized well, because many dusts were accumulated on the card portion due to use for a long period, although the well air-conditioned HRSG/ST calculator room had a good environment.

- Faisalabad TPS
  - Operation
    - ✓ While an approach to cost reduction and improvement in the power generation efficiency is needed, damages due to the peel-off of thermal insulation material and aging degradation were found on the actual equipment on site.
    - ✓ There was a paper-based daily report on HRSG and ST by the operator, and although the main parameters were recorded every two hours. However, operators did not understand the meaning of the values and did not seem to understand the warning values.
    - ✓ Although we pointed out that the fire alarm system was stopped, the worksite was embarrassed about the lack of budget for it.
  - Maintenance
    - ✓ Although the control calculator room besides the HRSG/ST control room was well air-conditioned, the poorer installation environment including traces of inundation was found on the ceiling, compared to Japan.
    - ✓ Cards in the control panel were used without any spare including the items that was discontinued with production. Many dusts were accumulated on the card portion in the respective panels, and the insulating section in the upper part of the card inside was degraded and damaged. From these facts, it seemed that not only the equipment on site but also the controllers were not maintained well.
    - ✓ Concerning the input/output panel, failure in the basic part of instrumentation work was found. For example, some cables did not have a cable number, and a bare cable without termination was connected.
- Nandipur TPS
  - Operation
    - ✓ The status of plant including power generation efficiency was recorded in the form of report. The central control room has the engineering room to analyze the past data.
    - ✓ The O&M of this plant has been outsourced to HEPSEC (Chinese companies) since March 2018. As a result, the operation system is different from that of other GENCOs power plants.
    - ✓ Workers in the yard wore safety protectors including helmets, and the worksite was kept clean and tidy. Taking into consideration the superiority in the environment due to the new equipment, it seemed that things were in a good order there, compared to other power stations of GENCOs.
  - Maintenance
    - ✓ Since the facilities were new compared with other GENCOs power plants, no major problems due to various facility abnormalities were found at the time of the survey.

- Others
  - ✓ The O&M work was subcontracted to Chinese corporation (HEPSEC). HEPSEC provided 75% of the personnel, while NPGCL provided remaining 25%. It is supposed that 25% of the personnel will have mastered the O&M method after ten and several years have passed and the O&M contract is terminated, and they will be able to perform O&M by themselves together with the additional personnel dispatched from other power stations.
  - ✓ Among 75% of the personnel of HEPSEC, approximately 20% were Chinese, and the remaining approximately 55% were Pakistanis employed by HEPSEC (employees of the subcontractor). The human resources development of the Pakistanis of HEPSEC is supposed to be implemented in accordance with the policy unique to HEPSEC, focusing on OJT.

➢ Central Gas Turbine Maintenance Workshop Faisalabad

- Overview of Facility
  - ✓ It is the repair plant of large equipment attached to Faisalabad TPS that was established in 1983.

    This plant receives large equipment that is used for the power generating facilities throughout Pakistan at the time of overhaul for inspection and repair. The equipment to be received include not only equipment in Faisalabad TPS, but also equipment related to gas turbine in Guddu TPS and IPP, blades of air compressor and gas turbine and combustor, steam turbine and large fan motors of conventional-related equipment in Jamshoro TPS and Muzaffargarh TPS, and steam turbines in nuclear power plants besides TPSs.
  - ✓ This repair plant roughly consists of two divisions of machinery and welding. The machinery division covers a wide range of fields, such as the machinery field including machining/non-destructive inspection/rotor balancing and the electrical/measurement fields.
  - ✓ Although JET investigated only the machinery system equipment in the plant, it seemed that the required equipment was provided completely. From the non-destructive inspection equipment to the balancing adjuster for large rotating machines, the plant had equipment that is used by manufacturers in Japan.
  - ✓ The workshop of Faisalabad TPS seemed to be used for the repair to large rotating machines (turbine rotor, generator, and motor) from not only TPSs of GENCOs (Guddu, Jamshoro, etc.), but also nuclear power plants and IPP. The introduction of the workshop is as shown in the collected documents.
- Relationship with the thermal power station O&M capacity of GENCOs
  - ✓ According to the result of the interview, some staffs in the maintenance division in each power station of GENCOs were dispatched to this repair plant at the time of periodic inspection and assigned to repair work.

- ✓ Concerning the information on the use of this workshop in the training of WEA, the day of visit to this workshop is only a day, and no trainee uses the materials or machines actually.
- ✓ Safety awareness is considered to be as low as at the GENCOs power station, as workers did not wear protective equipment.

- Others
  - ✓ Many GT vane put for repair were damaged (with cracks, flaws, and holes). They seemed to be damaged constantly in the normal operation. No repair criteria were established, and it was told that the repairer decided the appropriate repair method at the discretion.

➢ WAPDA Staff College Islamabad

- Overview of Facility
  - ✓ This training facility, established in 1999 with the four educational organizations merged, is not the technical training facility such as a power station, but the facility to implement the training of business skills and management know-how required for management, intended for the management education from the junior to the senior level.
  - ✓ Besides lecture rooms, it has a library and computer room. Technical facilities are integrated in WEA located in Faisalabad. In this college, education of the leadership/PC and IT skills/finance/project management needed for the management class is implemented. Training related to HRM is followed up in the leadership training.
- Outline of Training
  - ✓ Varied educational methods including Lecture, Case study, and Research work are available.
  - ✓ From GENCOs, about 25 trainees in total (together with Junior, Middle and Senior) participate lectures a year. Some trainees from IPP also seem to participate in the lectures.
  - ✓ The training course and the period are set up as shown in Table 3-3. All lectures are held for a fee.

Table 3-3: List of training courses in WAPDA Staff College Islamabad

Class	Period	Tuition fee
Elementary	4 weeks	3,188 USD
Junior	9 weeks	7,172 USD
Middle	9 weeks	7,172 USD
Senior	11 weeks	8,766 USD

(3) 3rd analysis and summarize

Table 3-4 shows the additional analysis target about the current situation related to the O&M of TPS for the TPS and relevant training facilities that we will visit for the first time in the 3rd on-site work.

As in the 2nd on-site work, the GHCL strongly requested that the 3rd training be conducted in the field of control and instrumentation maintenance, which was different from the field of mechanical and electrical maintenance that had been conducted so far. In response to the request, the 3rd training items in Japan were summarized to improve the skills in the control & instrumentation maintenance field that seems to be necessary, according to the actual situation of the maintenance to control & instrumentation equipment in respective power stations that were visited in the 3rd on-site work as the JET and the result of the interview with the staffs in the power station.

Table 3-4: List of analysis targets and analytical methods (3rd on-site work)

Target		Analytical method
TPS	GENCO-II Guddu TPS	Site visit / Questions
Training facility	GENCO-II Guddu TC	Site visit / Questions
Training facility	GHCL GHCL Training Center	Site visit

The following is a list of special remarks from the results of the survey on the current status of O&M at the targets JET visited in the 3rd on-site work.

- Guddu TPS
  - Operation
    - ✓ It is a GTCC power station with high utilization rate among thermal power stations of GENCOs. Distributed Control System (DCS) is used for this plant control.
    - ✓ The person in charge who recorded the indicator at the site did not understand the meaning of the indication value or the warning point.
  - Maintenance
    - ✓ As with other GENCOs power plants, the control cards did not seem to have been cleaned despite the accumulation of dust.
    - ✓ The caulking was not properly done in the cable penetration part under the control panel, and a puddle was formed by the inflow of outside air containing moisture.

- ✓ In the terminal portion of the control cable, there were some portions where the control cable was attached to the terminal box without being cured, or where sockets of different sizes were attached. Also, some of the removed cables were left as they were and were not cured or fixed.
- ✓ Some cables were left unmarked for identification.

➢ Guddu TC

- Overview of Facility
  - ✓ This training center is attached to the Guddu power station and is mainly used for training of technicians.
  - ✓ Lecture rooms and workshops are provided, but training facilities such as driving simulators and large equipment are not provided
  - ✓ The lecturers will be staffed by seven full-time staff and, if necessary, by veteran O&M staff from the nearby Guddu power station.
- Outline of Training
  - ✓ There are training courses in the fields of operation and maintenance and chemistry.
  - ✓ During the training period, in cooperation with the neighboring Guddu power station, training is conducted through actual facilities and field trips.
  - ✓ The training course and the period are set up as shown in Table 3-5.

Table 3-5: List of training courses in Guddu Training Center

Class	Period	Maximum Number of People
Advance Operator	7 weeks	20
Basic Operator	7 weeks	20
Basic Craftsmen Electrical	13 weeks	10
Basic Craftsmen Mechanical	13 weeks	10
Basic Craftsmen Instrumental	13 weeks	6
Basic Chemical	8 weeks	10
Advance Chemical	8 weeks	10

➢ GHCL Training Center

- Overview of Facility
  - ✓ It is a training facility attached to the Muzaffargarh Power Station, and this training facility was not in operation when JET conducted the 3rd on-site work.
  - ✓ There are only a few training rooms, and a conventional power generation type operation simulator is installed in the central large room, but it cannot be operated due to a failure.

- ✓ According to the action plan of HRD management of GHCL, which participated in the 2nd training in Japan, replacement and enhancement activities of this facility are progressing. In the training for engineers of thermal power plant workers who belong to GENCOs, it is planned to shift from WEA to this facility.

(4) Summary

Following are the issues that are related to O&M of TPS and are revealed by the analysis of the current situation in the 1st to 3rd on-site works.

- ➢ As for the maintenance of each power plant, inspection intervals are determined in accordance with the OEM manual, and the OEM manual is used for operation as it is. This shows that maintenance is strongly dependent on the OEM, and it is considered that efficient maintenance is not possible after understanding and taking into account the current condition of the facilities and operation.
- ➢ According to the hearing with GENCOs, when a plant trouble occurs, the root cause is investigated, and measures are taken based on past experience and OEM recommendations to prevent the recurrence of the trouble. However, the PDCA cycle for preventing the recurrence of trouble is not working well, as the fact that similar troubles are repeated from the list of stops received shows.
- ➢ Safety awareness was not high at some thermal power plants because they were not equipped with safety protectors (Helmet, etc.) and cleaning was insufficient.
- ➢ Concerning the maintenance plan, since the work may not be performed as scheduled if the supply and demand situation is severe, the systematic maintenance may not be able to be performed at an appropriate timing. If periodic inspection is not performed as scheduled, especially, the hot parts of the gas turbine, the part to be replaced regularly cannot be replaced at an appropriate timing, and the gas turbine has to be operated with its output decreased to protect the equipment, and this may be lower the capacity factor.
- ➢ In the plant under public utilities, the tendency of lower output of the aged CCPP was recognized. To improve the output decrease rate, measures for the problem have to be reviewed and implemented after the output decrease factors are identified, and the cost performance is considered.
- ➢ It was confirmed that the output of thermal power stations which have been aging remarkably decreased. To improve the output decrease rate, measures for the problem have to be reviewed and implemented after the output decrease factors are identified, and the cost performance is considered.

3.1.2 Reviewing the Training System of TPS Staff, and Analyzing and Organizing the Current Situation and Issues of O&M staff of TPS

Concerning the training system of TPS staff, hearing investigation was performed during the 1st on-site work with TPSs shown in Table 3-1 referred to as a subject. Taking into consideration the analysis result of data collected on site, the training system for TPS staff was reviewed as shown in "Baseline survey report (Pakistan)".

- There is a Guddu Training Center as a training facility for GENCOs, but this facility is used only for technician training (practical training type), and training for engineers is provided only by WEA.

  As a result of the investigation of WEA in the 1st on-site work, it is supposed that the training was insufficient to improve the capacity of engineers who are working for TPS, since many of the training facilities in WEA are intended for the training of electrical system, and many of the training equipment and materials are also used for academic purpose, not for maintenance. Consequently, the capacity of GENCOs' engineers in the maintenance and management of power stations is supposed to be hindered from being improved.
- The repair plant in Faisalabad has enough equipment, from large repair equipment to non-destructive inspection equipment. However, it is not the training facility for the development of maintenance personnel of TPS, but the facility for the inspection and repair of large auxiliary equipment in periodic inspections.

  Even though this plant is reviewed from the viewpoint of learning technology, it is supposed that the skills at a certain level are not transferred, because the contents of duties of workers at the foreman level are learned by watching the experienced, or they are taught orally.

  As described in the details of review on the plant shown in 3.1.1. (2), in one example in the non-destructive inspection process of hot parts, inspectors have to decide either repair to or replacement of part depending on the damage status of part based on the experience of inspectors, since no criteria for the judgment of repair or replacement of part have been established, although inspectors understand the inspection method. From these facts, the knowledge to decide appropriate response according to the result of inspection is assumed to be required, not only the knowledge of inspection method.
- In the education in the power stations of GENCOs, technology is succeeded by rules of thumb and OJT, and technical skills backed up by knowledge are lacked. In addition, since the demand and supply of electric power are imminent on site, stopped plants are required to be restored early there after accidents occur, and manpower needed for maintenance is insufficient. In these circumstances, the safety is apt to be undervalued, and knowledge of safety measures and skills in maintenance work are also insufficient, due to continuous request for more speedy work, rather than the safety of workers.

3.1.3 Confirming the Needs for Training

(1) Confirmation of needs for training in Japan

Table 3-6 shows the current issues and needs for this project of the O&M of TPS that are heard from the each TPS in the 1st on-site survey.

Table 3-6: Current issues and needs for this project

GENCO-I Jamshoro TPS	GENCO-II Guddu TPS	GENCO-III Muzaffargarh TPS	GENCO-IV Lakhra TPS
Human resources Equipment Promotion Organization External support Knowledge	Knowledge Budget Organization Human resources Equipment Promotion	Knowledge Budget Organization Human resources Equipment Promotion	Human resources Organization

Source: Prepared by JICA Expert Team based on questionnaire reply

Human resources, organizations, knowledge, and equipment are cited as the most important needs for each power station (GENCOs), and training systems that provide knowledge and skills related to the operation, maintenance, and management of thermal power stations are considered insufficient. This fact shows that the training system to provide knowledge and skills of the O&M of TPS is incomplete.

Concerning the items for which specific knowledge and skills are required, respective power stations designated the O&M training. Especially, needs for the remaining life assessment and TQM training were presented. "Baseline survey report (Pakistan)" summarizes the manifest needs obtained based on the direct answers and the potential needs that are reviewed as a result of the survey and interview in the power station on site in the 1st on-site work.

In the kickoff meeting in the 2nd on-site work, the CEO of GHCL strongly requested the implementation of the 2nd training in Japan in the electrical maintenance filed. The common training needs were based on those of the 1st on-site work and the 1st training in Japan, and the training needs in the specialized field of electrical maintenance were investigated during the 2nd on-site work and used as a reference for formulating the 2nd training menu in Japan.

In the 3rd training in Japan, the specialized field was planned in the control & instrumentation maintenance field, which had not been implemented until then, in advance. Based on the results of the past two on-site work and the results of the maintenance status survey of control and instrumentation at Guddu TPS, which we visited during the 3rd on-site work, JET developed the 3rd training menu in Japan.

(2) Confirmation of needs for training materials and equipment in Pakistan

JET confirmed the needs for training materials and equipment that contribute to improving the O&M capacity of thermal power plants in Pakistan through survey results of power plants and training facilities in Pakistan in every on-site survey, discussions with management of GHCL / GENCOs, human resource development training for management in Japan, tours to training facilities that contribute to improving thermal power O&M capacity, introduction of human resource development methods in Japan, and opinions from action plan implementation by engineers and technicians who participated in the training in Japan.

As a result, it is decided that the equipment shown in Table 3-7 will be provided to the Muzaffargarh Training Center and Guddu Training Center, which are the thermal power training facilities in Pakistan.

Table 3-7: Training Materials and Equipment provided from Japan

Destination	Items	Quantity	Target	Learning objectives
Muzaffargarh Training Center	Vibration Analysis Demonstrator	1 set	Engineer	• Vibration analysis of rotory machines • Balancing of rotors
	NDI Demonstrator (PT/MT/UT)	DVD: 2 sets PT: 6 sets MT: 6 sets UT: 6 sets		• Penetrant testing (PT) technique • Magnetic partical testing (MT) technique • Ultrasonic testing (UT) technique
Guddu Training Center	NDI Demonstrator (PT/MT/UT)	DVD: 2 sets PT: 6 sets MT: 6sets UT: 6 sets	Technician	• Penetrant testing (PT) technique • Magnetic partical testing (MT) technique • Ultrasonic testing (UT) technique

3.2 Results of Activities for Output 2

3.2.1 Organizing targets of O&M skills to be obtained by instructors and potential instructors

According to the 1st on-site work in the project, in the power stations of GENCOs, it cannot be said that the power stations are performing autonomous O&M, compared with IPP power stations in Pakistan (supposing Kot Addu TPS of KAPCO), and it is considered that recognizing and improving not only the manifest human resource development needs, which were mentioned in the responses from the respective power stations of GENCOs, but the potential needs are required. For this reason, the ideal state for the management of autonomous power stations (mainly the management in IPP) is set, the gap supposed between the current situation obtained from the on-site work results and the ideal state for the O&M method of the respective power stations was set

as an issue, and the improvement measures to fill the gap and the items which can be filled through the improvement measures and the training in the project are summarized as shown in Table 3-8. In addition, as shown in Section 3.3.3 (3) and Table 3-7, the technologies that should be obtained through training using each equipment provided are summarized in line with the training materials and equipment needs confirmed in Pakistan.

Table 3-8: Summary of improvement measures for issues based on survey results

Results of field survey	Ideal state (IPP level)	Assumed GAP from ideal state	Improvement measures (*1)	Response and Training
• Financial condition is bad	• Improvement in soundness of management	• Electricity procurement cost is high • Power sales price is low	● Reduction of O&M cost ● Improvement in power generation efficiency ● Improvement in capacity factor of high efficiency units ● Efficient implementation of countermeasures against aging △ Appropriate setting of power sales cost	• GTCC Maintenance Training • TQM training • Non-destructive inspection training • Remaining life assessment training
• Drop capacity rate is high • They do not grasp plant performance	• Maintenance of design output • Periodical understanding of plant performance	• Reduction in output cannot be prevented • Plant performance is not grasped • Maintenance cost is short	● Factor of lowered output is analyzed and appropriate maintenance is performed ● Understanding and managing plant performance △ Ensuring fuel △ Ensuring maintenance costs	• TQM training • GTCC Maintenance Training
• Low level of capacity factor	• High level of capacity factor	• Forced outage rate is high • Fuel shortage	● Factor of forced outage is analyzed and appropriate maintenance is performed △ Securing fuel	• TQM training • Sharing accident cases
• Maintenance performed according to OEM • Continued use of OEM manual	• Operation of power stations independently of OEM	• Conservation according to actual situation is not performed • Maintenance of manuals according to actual situation is not performed	● Planning of maintenance method and period according to actual situation of operation ● Improvement in maintenance technology	• GTCC Maintenance Training • Non-destructive inspection training • Remaining life assessment training
• Similar type of trouble is repeated	• Thorough implementation of measures for preventing recurrence by practicing PDCA	• Problems in trouble analysis, planning and implementation of countermeasures	● Identification of cause of trouble and implementation of appropriate repair / countermeasures	• TQM training • GTCC Maintenance Training • Sharing accident cases
• Improper wearing of safety protective equipment • Insufficient organization	• Establishment of safety-first culture • Thorough implementation of 4S	• Lack of safety consciousness • Lack of 4S consciousness	● Improvement in safety consciousness ● Understanding importance of 4S	• Safety training • Power station tour
• Operation suspension period is not ensured	• Implementation of systematic maintenance	• Determination of necessity for operation suspension is not made • Forced outage rate is high	● Clearly explain necessity of operation suspension from technical point of view ● Analyze factors of forced outage and implement appropriate maintenance	• TQM training • Sharing accident cases • GTCC Maintenance Training
• Procurement of spare parts has not been completed	• Required spare parts are ensured when necessary	• Spare parts are not possessed and procured according to actual operation situation	● Systematic possession and procurement of spare parts according to state and maintenance time of equipment	• GTCC Maintenance Training • Non-destructive inspection training • Remaining life assessment training
• There is no designated training textbook • Educational quality depends on instructor	• Implementation of effective training	• Contents and quality of education is not uniform	● Unification of educational materials and curriculum and continuous reflection of technological progress and know-hows ● Grasping of skill level for each trainee	• Each training • Educational materials

*1: ● Measure which is highly likely to be covered by the Project, △: Measure which is not likely to be covered by the Project (Source: JICA Expert Team)

3.2.2 Formulation of training program in Japan for instructors

(1) Formulation of the 1st training program in Japan

With regard to the training in Japan to be implemented as the measure for improvement in the issues described in the paragraph above, the program of the first training in Japan including the contents below was formulated. Not only the technical training program for engineers/technicians but also the training program for the management personnel in Pakistan was formulated.
The summary of the finalized training subjects for engineers and technicians is shown in Table 3-9, and the summary of the training subjects for management personnel shown in Table 3-10.

1) Training for engineers

- Maintenance technology of GTCC power generating facilities (GT, ST, HRSG, Electrical equipment, Control system)
- Equipment diagnostic technology (Non-destructive inspection, Remaining life assessment, etc.)
- Quality control at thermal power stations (TQM), Efficiency control
- Human resource development method of thermal power generation
- Instruction for preparing action plan
- Tours to TPSs and manufacturers' factories

2) Training for technician

- Quality control, safety management (Experiential training)
- Equipment diagnosis technology (Non-destructive inspection etc.)
- Equipment inspection maintenance technology (Pipes, Valves, Pumps, Welding, Control equipment, etc.)
- Instruction for preparing Action Plan
- Tours to TPSs and manufacturers' factories

3) Training for management personnel

- Human resource development
- Instruction for preparing Action Plan
- Tours to TPSs, training facility and manufacturers' factories

Table 3-9: Outline of the 1st training subjects in Japan (for engineers/technicians)

Engineers (from 21st Mar. to 27th Apr., 2018)	Technicians (from 4th Mar. to 24th Mar., 2018)
■ **Develop Capacity of Instructors of TPP**	■ **Develop Capacity of Instructors of TPP**
✓ GTCC Power Generation Technology	✓ Introduction of the latest technology in TPP
✓ Overview of USC technologies	✓ **Experiential Safety Training**
✓ Human Resource Development	✓ Welding Procedure Management
✓ **Total Quality Management (TQM) Activities in Japan**	✓ **Experiential Quality Training**
✓ Basics of Vibration	✓ Metal Material
✓ Boiler Water Quality Control	✓ Valve Maintenance skills & Overhauling Motors/Pumps
✓ **Remaining Life Assessment**	✓ Maintenance Technique of Industrial Instruments
✓ **Non-Destructive Testing**	✓ **Basics of Non-Destructive Inspection Skills**
✓ Environmental Conservation Technologies	✓ Maintenance of High Temperature and High Pressure Piping
✓ **Accident Case-study**	✓ Prevention of Accidents and Disasters
✓ Site Visit on TPP and Manufacture's factory	✓ Site Visit on TPP and Manufacture's factory
■ **Conduct Trainings at each TPP by the Instructors**	■ **Conduct Trainings at each TPP by the Instructors**
✓ Job Report Presentation	✓ Job Report Presentation
✓ Methodology to Formulate Action Plan	✓ Methodology to Formulate Action Plan
✓ Presentation about Action Plan	✓ Presentation about Action Plan

Table 3-10: Outline of the 1st training subjects in Japan (for management personnel)

Managers
✓ Job Report Presentation
✓ PCM
✓ Making an Action Plan
✓ Presentation of Action Plan
✓ Human Resource Development in KEPCO
✓ Site Visit ➢ Thermal Power Station ➢ Training Center

(2) Formulation of the second training program in Japan

The 1st training in Japan was implemented focusing on the mechanical maintenance field. As a result of checking the level of the participants who received the training, engineer participants seem to be inclined to theory and do not seem to have enough skills in terms of practical work. Concerning the technicians, although they do not have any problem in the practical work, they are lack in the theoretical aspect, including the viewpoint of the reason why the work has to be done, and it is thought that the skills need to be enhanced continuously in order to make up for the weak points of both.

Therefore, the 2nd training in Japan also continues to focus on the field of mechanical maintenance from the 1st training in Japan. The training program was formulated with the improvement points obtained in the 1st training in Japan described above and the opinions from the participants who attended the training reflected, and presented in the 2nd on-site work. However, in the kickoff meeting with the counterpart, with regard to the specialty dealt with in the training, the CEO of GHCL strongly requested for the field of electrical maintenance as the item in the 2nd training in Japan. In response to the request, JET formulated the training program again with the specialized training focused on the field of electrical maintenance, while the common items such as the safety and quality training are based on the contents of the 1st training in Japan, and we reached an agreement with the Pakistan side in the 2nd JCC.

With regard to the common items other than the specialized training shown above, the contents of the training were improved, with reference to the opinions from the participants who attended the 1st training in Japan, the degree of understanding of the training by JET, and the level analysis of participants.

The summary of the finalized training subjects for engineers and technicians is shown in Table 3-11, and the summary of the training subjects for management personnel shown in Table 3-12. Items included in the green grid line in Table 3-11 are the contents that were newly implemented as the specialized training of electrical maintenance.

1) Training for engineers
- Equipment diagnostic technology (Non-destructive inspection, Vibration analyses, etc.)
- Equipment inspection maintenance technology (Generators, Motors, Electrical cables, Fire prevention measures of electrical equipment, etc.)
- Quality control at thermal power stations (TQM), Efficiency control
- Human resource development method of thermal power generation
- Instruction for preparing action plan
- Tours to TPS and manufacturers' factories

2) Training for technician
- Quality control, safety management (Experiential training)
- Equipment inspection maintenance technology (Generators, Motors, Electrical cables, Fire prevention measures of electrical equipment, etc.)
- Instruction for preparing Action Plan
- Tours to TPS and manufacturers' factories

3) Training for management personnel
- Human resource development
- Instruction for preparing Action Plan
- Tours to TPS and training facility

Table 3-11: Outline of the 2nd training subjects in Japan (for engineers/technicians)

Engineers	Technicians
✓ Introduction of the latest technology in TPP (inc. USC)	✓ Introduction of the latest technology in TPP (inc. USC)
✓ **Experience-based Safety Training**	✓ Experiential Safety Training
✓ Human Resource Development	✓ Experiential Quality Training
✓ Quality Management	✓ Basics of Non-Destructive Inspection Skills
✓ **Thermal Efficiency Management**	✓ **Overhauling Motors**
✓ Basic Training of Vibration (Balancing)	✓ **Electrical Protection Systems (inc. intro. & usage)**
✓ Non-Destructive Inspection	✓ **Modern Maintenance Techniques of Excitation Systems**
✓ **Electrical Protection Systems (inc. intro. & usage)**	✓ **Control Circuit (mainly Protection Relay)**
✓ **Modern Maintenance Techniques of Excitation Systems**	✓ **Preventive Maintenance (inc. Generator & Main Trans.)**
✓ **Control Circuit (mainly Protection Relay)**	✓ **Fire Protection for Electrical Circuit/Equipment**
✓ **Preventive Maintenance (inc. Generator & Main Trans.)**	✓ **Insulation standard for Electrical Circuit/Equipment**
✓ **Fire Protection for Electrical Circuit/Equipment**	✓ **Occupational HSE (especially Safety)**
✓ **Insulation standard for Electrical Circuit/Equipment**	✓ Site Visit on TPP and Manufacture's factory
✓ Site Visit on TPP and Manufacture's factory	✓ Prevention of Accidents and Disasters
✓ Lessons Learned from Accidents	✓ Methodology to Formulate Action Plan
✓ **Human Error Prevention**	
✓ **Effective Maintenance for Quality Electric Power Infrastructure**	
✓ Methodology to Formulate Action Plan	

Electrical Subject

Table 3-12: Outline of the 2nd training subjects in Japan (for management personnel)

Managers
✓ Job Report Presentation
✓ Issue Analysis & Stakeholder Analysis
✓ Making an Action Plan
✓ Presentation of Action Plan
✓ Human Resource Development in KEPCO
✓ Discussion on the training equipment provision and the next training theme
✓ Site Visit ➢ Thermal Power Station ➢ Training Center

(3) Formulation of the second training program in Japan

As for the training in Japan for engineers and technicians, the 1st training in Japan was conducted in the field of mechanical maintenance, and the 2nd training in Japan was conducted in the field of electrical maintenance. Therefore, it was decided to formulate the 3rd training in Japan mainly in the field of control and instrumentation maintenance, as coordinated with the counterpart in advance.

However, in the field of control and instrumentation maintenance, compared with the field of mechanical maintenance and electrical maintenance, the design concept of the manufacturer, the time of manufacture, the structure of the equipment to be controlled, the policy of the power generation company, and the rules to be observed are reflected more strongly in the instrumentation equipment and control programs, etc. Therefore, the know-how unique to each power station is often used, and in comparison with the two fields in the past years, the field of control and instrumentation is preferably taught mainly through OJT training in the power station.

Therefore, JET analyzed and organized the actual conditions of control and instrumentation maintenance at the power stations visited and surveyed by JET in the 1st to 3rd on-site works. Taking into consideration the characteristics of this project, in which GENCOs power stations with different power generation methods, ages, manufacturers, design concepts, etc. widely participate in training in Japan, the 3rd training program in Japan was formulated with the aim of acquiring basic skills that are useful for each power station.

In addition, with reference to the opinions, etc. from trainees who participated in the 1st and 2nd training in Japan, a set of lectures style training and practical training using training equipment has been made more practical. For common menus, "Issue analysis" training for creating action plans was fully incorporated. (Trial implementation at the 2nd training in Japan)

As for the training in Japan for management personnel, the training program included learning about Japan's policies for training thermal power generation personnel, "Issue analysis" of human resource development policies in their own countries, and developing effective training plans using training equipment provided by Japan.

The summary of the finalized training subjects for engineers and technicians is shown in Table 3-13, and the summary of the training subjects for management personnel shown in Table 3-14. At the 3rd JCC held on October 11, 2019 during the 3rd on-site work period, the policy of the 3rd training program in Japan was agreed with the Pakistan side.

1) Training for engineers

- Maintenance technology of GTCC power generating facilities (GT, ST, HRSG, Control system, Simulator)
- Equipment inspection maintenance technology (Measuring and monitoring device, Turbine supervisory instrument, Control valve, PID control, Optimal tuning, etc.)
- Quality control at thermal power stations (TQM), Efficiency control
- Human resource development method of thermal power generation
- Instruction for preparing action plan
- Tours to TPS and manufacturers' factories

2) Training for technician

- Quality control, safety management (Experiential training)
- Equipment inspection maintenance technology (Measuring and monitoring device, Control valve, PID control, Optimal tuning, Terminal treatment, etc.)
- Generators, Motors, Electrical cables, Fire prevention measures of electrical equipment, etc.)
- Instruction for preparing Action Plan
- Tours to TPS and manufacturers' factories

3）Training for management personnel

- Human resource development
- Instruction for preparing Action Plan
- Tours to TPS and training facility
- Develop training plan to effectively utilize training equipment

Table 3-13: Outline of the 3rd training subjects in Japan (for engineers/technicians)

	Engineers	Technicians
General	✓ Introduction of the latest technology in TPP (inc. USC)	✓ Introduction of the latest technology in TPP (inc. USC)
	✓ Experience-based Safety Training	✓ Experiential Safety Training
	✓ Human Resource Development	✓ Experiential Quality Training
	✓ Quality Management	✓ Prevention of Accidents and Disasters
	✓ Thermal Efficiency Management	✓ Occupational HSE (especially Safety)
	✓ Tool Box Meeting (for Safety)	✓ Tool Box Meeting (for Safety)
	✓ Lessons Learned from Accidents	
	✓ Human Error Prevention	
	✓ Effective Maintenance for Quality Electric Power Infrastructure	
I&C Maintenance	✓ Monitoring Device (Pressure, Temperature, Level, Flow Rate)	✓ Monitoring Device (Pressure, Temperature, Level, Flow Rate)
	✓ Pneumatic Control Valve and Accessories	✓ Pneumatic Control Valve and Accessories
	✓ Copper Tube Processing and Terminal Treatment	✓ Copper Tube Processing and Terminal Treatment
	✓ Sequence Control	✓ Sequence Control
	✓ Tuning of PID Control	✓ Tuning of PID Control
	✓ Turbine Supervisory Instrument (Vibration Meter, Eccentricity Indicator, Differential Expansion Indicator, Shaft Position Indicator, Speed Indicator)	* Subjects including practical training are shown in red.
	✓ Basic Training of Vibration (Balancing)	
	✓ GTCC Control	
Site Visit	✓ Site Visit on TPP	✓ Site Visit on TPP
	✓ Site Visit on Manufacturer's factory	✓ Site Visit on Manufacturer's factory
JICA Original	✓ Issue Analysis	✓ Issue Analysis
	✓ Methodology to Formulate Action Plan	✓ Methodology to Formulate Action Plan

Table 3-14: Outline of the 3rd training subjects in Japan (for management personnel)

Training Course	Main Purpose	Important Points
Course Orientation	To grasp outline of HRD training course.	Motivating management to participate in this HRD training course.
Job Report Presentation	To grasp actual condition of HRD in Pakistan.	Utilizing **actual condition** in Pakistan for HRD issue analysis.
Site Visit on KANSAI's Thermal Power Station	To grasp the latest condition and how to manage the latest TPP directly.	Suggesting **an example of ideal condition** (TPPs) on HRD issue analysis.
Site Visit on Training Center (For Engineer & Technician)	To grasp roles & responsibilities of T/C directly and encourage engineers and technicians during next O&M training.	Suggesting **an example of ideal condition** (T/C for technicians) on HRD issue analysis.
Develop Training Plan to effectively utilize Training Equipment	To make feasible and effective Training Plan, including how to use O&M training equipment provided by JICA.	**Maximizing the effectiveness of training equipment** considering **actual condition** in Pakistan.
HRD Issue Analysis	To analyze current issues & causes related to HRD in Pakistan	Based on each difference between **actual condition** and **ideal condition** item by item, **identifying the countermeasure.**
Action Plan Presentation	To make effective action plan to improve HRD situation in Pakistan	Implementing action plan as scheduled (inc. Training Plan on how to use O&M training equipment provided by JICA)

(4) Formulation of the 4th online training program

As we confirmed with counterparts in the 4th JCC, we decided to formulate a training program aiming to train instructors so that instructors can conduct in Pakistan using the training materials and equipment provided from Japanese side as a menu of the 4th training.
On the other hand, since the spread of COVID-19 has not yet ended, the training, which was originally planned to be conducted during the 5th on-site survey period, was changed into online and we adapted the menu of the training program to online.
Table 3-15 shows an outline of the online training courses for instructors.

1) Training for instructors

- Action plan guidance
- Training using a vibration model rotor
- Training using non-destructive inspection kit

Table 3-15: Outline of the 4th online training subjects (for instructor)

	Time PKT/[JST]	10am-12am [14pm-16pm]	13pm-15pm [17pm-19pm]	Muzaffar garh	Guddu
Day 0	10 Nov (Wed)	Web meeting connecting test with Muzaffargarh		✓	✗
	TBS	Web meeting connecting test with Guddu		✗	✓
Day1	29 Nov (Mon)	Unpacking and checking the quantity of vibration model rotor	Installing the model rotor (assembling, connecting cables, etc.)	✓	✗
Day2	30 Nov (Tue)	How to use the model rotor(1) Operating and maintenance of the model rotor	How to use the model rotor(2) Demo of the phenomenon (unbalance/Fly-loss)	✓	✗
Day3	1 Dec (Wed)	Lecture I : Basic of vibration Practical training 1 : Critical speed and changes in phase of a high-spot position during speeding up	Practical training 2 : Checking response by unbalance form Practical training 3 : Checking vibration response by cancel weight Lecture II : Vibration Diagnosis	✓	✗
Day4	2 Dec (Thu)	Lecture III : Cause of vibration Practical training 4 : Flying of a revolution body	Lecture IV : Taking countermeasures Practical training 5:Balancing by the three-point balancing method Practical training 6 : Balancing by the influence coefficient method	✓	✗
	3-5 Dec	Holiday			
Day5	6 Dec (Mon)	Unpacking and checking the quantity of NDT kit Overall the Non-destructive Test	Lecture &workshop: Penetrant Testing	✓	✓
Day6	7 Dec (Tue)	Lecture &workshop: Ultrasonic Testing	Lecture &workshop: Magnetic particle Testing	✓	✓
Day7	8 Dec (Thu)	Making Action Plan of vibration & NDT		✓	✓

3.2.3 Establishment of selection criteria for the training in Japan

(1) Establishment of criteria for the 1st training in Japan

The current situation of the O&M in respective power stations was analyzed in the 1st on-site work, and the criteria as shown in Table 3-16 were established for the training of skills required for TPSs in Pakistan.

Table 3-16: Criteria for the 1st training in Japan (for engineers/technicians)

Items	Qualification (Engineers)	Qualification (Technicians)
Number	10 persons per annual	10 persons per annual
Training Term	About 1 month	About 3 weeks
Current Duties	Be a Leading engineer working on thermal power plants or instructors of WEA, and has expertise related to **mechanical engineering (especially GTCC)*** who are capable to be instructors to train other engineers. *Training program (e.x. electrical and C&I engineering) would be under discussion on 2nd and 3rd year.	Be a Leading technician or instructors of Guddu training center working on thermal power plants, and has expertise related to **mechanical work (especially GTCC)* ,** who are capable to be instructors to train other technicians. *Training program (e.x. electrical and C&I work) would be under discussion on 2nd and 3rd year.
Experience in the relevant field	Have **more than 5 years' experience in the field O&M** of thermal power plants ideally.	
Educational Background	**Be a graduate of university**	**Be a diploma of technical high school or college**, or higher
Language	**Have a competent command of spoken and written English.**	None*1
Health	Must be in good health, both physically and mentally, to participate in the program in Japan.	

*1:Lecture will be made in Japanese and translated to English or Urdu (under consideration). Course materials will be prepared in English, and participants are expected to prepare job reports and action plans in English.

(2) Establishment of criteria for the 2nd training in Japan

The current situation of the actual electrical maintenance situation in the respective power stations was analyzed in the 2nd on-site work in accordance with the criteria for the 1st training in Japan, and the criteria as shown in Table 3-17 were established for the training of skills required for TPSs in Pakistan.

Table 3-17: Criteria for the 2nd training in Japan (for engineers/technicians)

Items	Qualification (Engineers)	Qualification (Technicians)
Number	8 persons	8 persons
Training Term	About 1 month	About 3 weeks
Required Condition	➢ An engineer in TPS or an instructor in WEA ➢ Capable of drafting effective action plan ➢ Willing to make technical contribution to HRD in GENCOs ➢ Electrical expertise	➢ An technician in TPS or an instructor in Guddu T/C ➢ Capable of drafting effective action plan ➢ Willing to make technical contribution to HRD in GENCOs ➢ Electrical expertise
Educational Background	Be a graduate of university	Be a diploma of technical high school or college, or higher
Language	Have a competent command of spoken and written English.	See footnote*
Health	Must be in good health, both physically & mentally, to participate in the program in Japan.	

*1:Lecture will be made in Japanese and translated to Urdu. Course materials will be prepared in English, and participants are expected to prepare job reports and action plans in English. Therefore participants are expected to be familiar with written English at least.

(3) Establishment of criteria for the 3rd training in Japan

In the same way as the 1st and 2nd training in Japan, the current situation of the actual control and instrumentation maintenance in the respective power stations through the 1st to 3rd on-site works was analyzed, and the criteria as shown in Table 3-18 were established for the training of skills required for TPSs in Pakistan.

Table 3-18: Criteria for the 3rd training in Japan (for engineers/technicians)

Items	Qualification (Engineers)	Qualification (Technicians)
Number	8 persons	8 persons
Training Term	About 5 weeks	About 3 weeks
Current Duties	Be a leading engineer working on thermal power plants, and has expertise related to **I&C engineering in TPPs**, who are capable to be instructors to train other engineers.	Be a leading technician working on thermal power plants, and has expertise related to **I&C work in TPPs**, who are capable to be instructors to train other technicians.
Experience in the relevant field	Middle-class* engineers and technicians in charge of O&M in TPPs. *Ideally, engineers & technicians have experience in TPPs including GTCC.	
Language	Have a competent command of spoken and written English.	None*2
Health	Must be in good health, both physically and mentally, to participate in the program in Japan.	

***1: JICA expert may refuse the application of candidates who deviate from the criteria.**

*2: Lecture will be made in Japanese and translated to English or Urdu. Course materials will be prepared in English, and participants are expected to prepare job reports and action plans in English.

(4) Establishment of criteria for the 4rd training in Japan

As for the 4th online training, the criteria were created as shown in Table 3-19 aming continuous utilization of the training materials and equipment provided by Japanese side to the Pakistani side at each training center.

Table 3-19: Criteria for the 4th online training (for instructor)

Items	Cualification
Current duties	Be a leading engineer or technical working on thermal power plants, and has expertise related to Mechanical engineering or Technicians in TPSs / training centers, who are capable to be instructors to train other engineers and technicians.
Experience in the relevant field	Middle-class engineers or technicians in charge of O&M in TPSs/training centers.
Language	Have a competent command of spoken and written English.
Gender Consideration	Japan is promoting gender equality. Women are encouraged to apply for the program.
Number of participants	Training Participants will be expected up to 4 engineers or technicians for each NDI and vibration lecture.

3.2.4 Implementation of training in Japan related to O&M of TPS

(1) Implementation of the 1st training in Japan

As a measure to solve the issue in the O&M of the respective power stations which was obtained from the results of the 1st on-site work, the 1st training in Japan (eight engineers for 38 days, eight technicians for 21 days, two management people for 11 days) was implemented as shown in 2.4. The details of the opinions of trainees who participated in the 1st training in Japan are as shown in the questionnaire conducted by JICA, which was reflected in the formulation of the 2nd training program in Japan.

The participants who participated in respective trainings answered that they had almost achieve the training objective ("Training capacity on O&M of WEA and GENCOs is strengthened."), and that the knowledge and experience they acquired can be directly applied or adaptable to their work as shown in Table 3-20 and 3-21.

Table 3-20: Achievement level of the training objective in the 1st training in Japan

	← Fully Achieved			Not Achieved →
	4	3	2	1
Engineer training (8 people)	0	7	0	0
Technician training (8 people)	0	8	0	0
Management training (2 people)	0	2	0	0

Table 3-21: Usefulness level of the training results from the 1st training in Japan

	It can be directly applied to work	It cannot be directly applied, but it can be adaptable to work	It cannot be directly applied or adapted, but it can be of reference	It was not useful at all
Engineer training (8 people)	1	1	5	0
Technician training (8 people)	2	5	1	0
Management training (2 people)	0	2	0	0

Figure 3-1: Scenes of the 1st training in Japan
(Top Left: Basic training of vibration [engineer], Top Right: Nondestructive inspection [technician], Bottom: Problem analysis using PCM method [management])

(2) Implementation of the 2nd training in Japan

The 2nd training in Japan (for eight engineers for 35 days, eight technicians for 21 days, four management people for 7 days) was held with changing to focus on the electrical maintenance field from the 1st training in Japan, in reference to the opinions from the participants who received the 1st training in Japan, as shown in 2.7.

The details of the opinions of trainees who participated in the 2nd training in Japan are as shown in the questionnaire conducted by JICA, which was reflected in the formulation of the 3rd training program in Japan.

The participants who participated in respective trainings answered that they had almost achieve the training objective ("Training capacity on O&M of WEA and GENCOs is strengthened."), and that the knowledge and experience they acquired can be directly applied or adaptable to their work as shown in Table 3-22 and 3-23.

Table 3-22: Achievement level of the training objective in the 2nd training in Japan

	← Fully Achieved			Not Achieved →
	4	3	2	1
Engineer training (8 people)	7	1	0	0
Technician training (8 people)	7	1	0	0
Management training (2 people)	3	1	0	0

Table 3-23: Usefulness level of the training results from the 2nd training in Japan

	It can be directly applied to work	It cannot be directly applied, but it can be adaptable to work	It cannot be directly applied or adapted, but it can be of reference	It was not useful at all
Engineer training (8 people)	8	0	0	0
Technician training (8 people)	6	2	0	0
Management training (2 people)	3	1	0	0

Figure 3-2: Scenes of the 2nd training in Japan
(Top Left: Experiential safety [engineer], Top Right: Risk prediction meeting [technician], Bottom: Training facility tour (Vibration analysis demonstrator) [management])

(3) Implementation of the 3rd training in Japan

The 3rd training in Japan (for eight engineers for 24 days, eight technicians for 20 days) was held with changing to focus on the control and instrumentation maintenance field from the 2nd training in Japan, in reference to the opinions from the participants who received the 2nd training in Japan, as shown in 2.10.

The five weeks training menu for engineers had been prepared, but due to the significant delay in the procedures for participation in training in Pakistan, the training period was shortened to three weeks. Similarly, the 3rd training for management in Japan was suspended due to delays in procedures for participation in training in Pakistan.

The details of the opinions of trainees who participated in the 3rd training in Japan are as shown in the questionnaire conducted by JICA, which was reflected in the formulation of training programs in Japan for this project in other countries.

The participants who participated in respective trainings answered that they had almost achieve the training objective ("Training capacity on O&M of WEA and GENCOs is strengthened."), and that the knowledge and experience they acquired can be directly applied or adaptable to their work as shown in Table 3-24 and 3-25.

Table 3-24: Achievement level of the training objective in the 3rd training in Japan

	← Fully Achieved →			Not Achieved
	4	3	2	1
Engineer training (8 people)	8	0	0	0
Technician training (8 people)	7	1	0	0

Table 3-25: Usefulness level of the training results from the 3rd training in Japan

	It can be directly applied to work	It cannot be directly applied, but it can be adaptable to work	It cannot be directly applied or adapted, but it can be of reference	It was not useful at all
Engineer training (8 people)	8	0	0	0
Technician training (8 people)	8	0	0	0

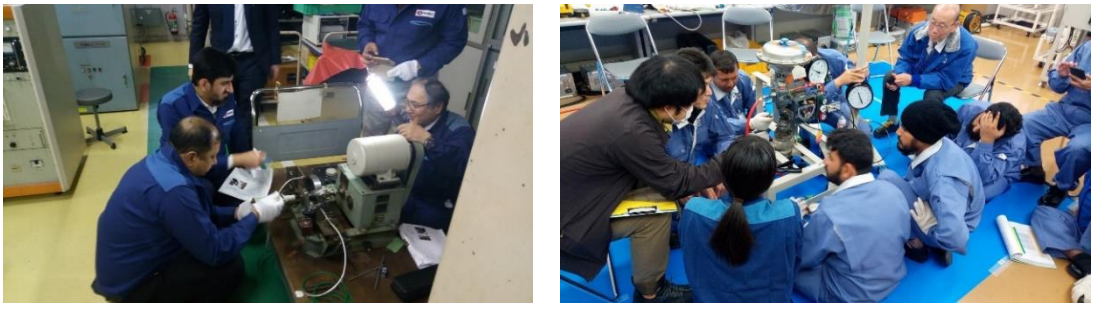


Figure 3-3: Scenes of the 3rd training in Japan

(Left: Turbine supervisory instrument [engineer], Right: Control valve [technician])

(4) Implementation of the 4th online training

Regarding the 4th online training, it is decided in the 4th JCC held in November 2020 that training materials and equipment will be provided from the Japanese side to Pakistani side, and instructors are trained so that they can conducted trainings by themselves in their own country using those materials and equipment. The 4th online training (8 instructors: 7 days) was conducted to train instructors with the goal of acquiring training skills using vibration kits and non-destructive inspection kits. The 4th online training was carried out as described in Section 2.12.

In addition, the trainees who took the 4th online training answered that they were able to learn the practical training method using the training materials and equipment provided by the Japanese side in line with the purpose of this training, and they formulated action plans so that they can continue to implement training continuously using materials and equipment at each training center in the future.

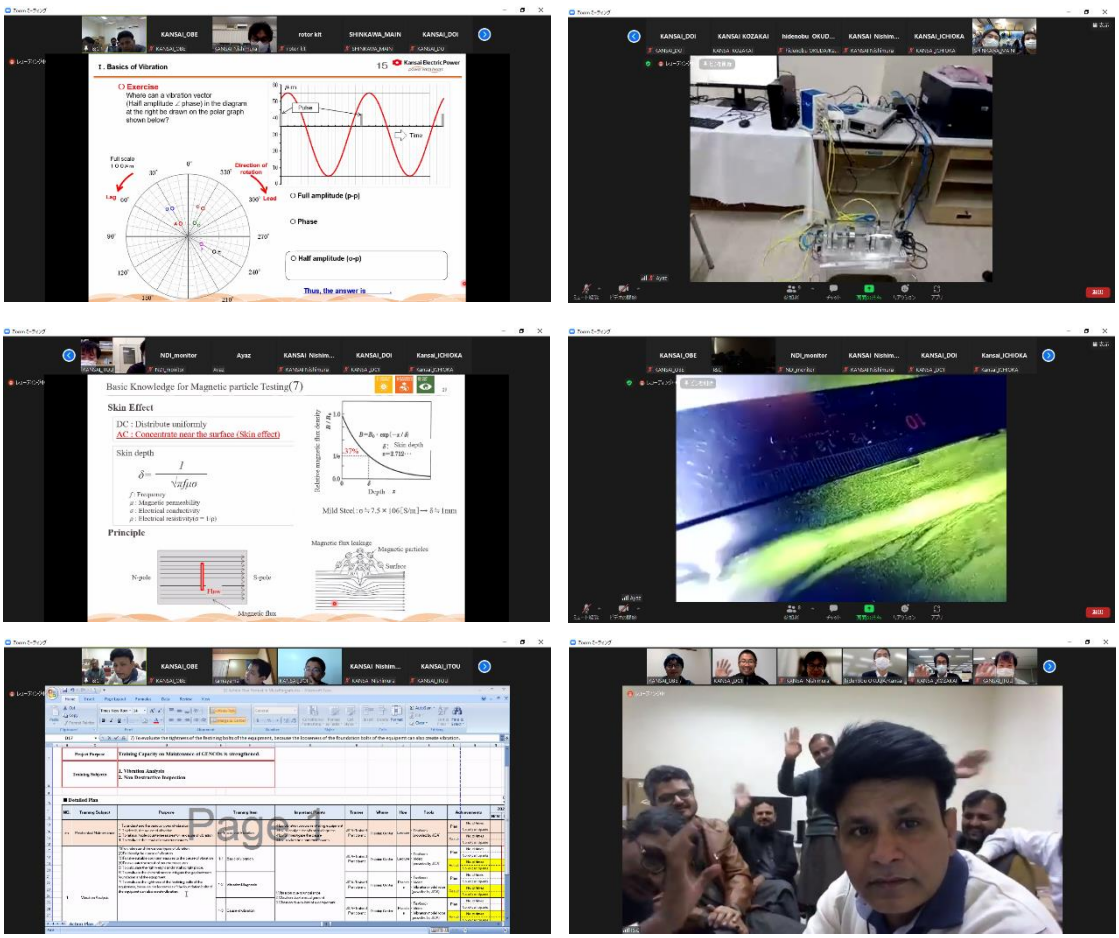


Figure 3-4: Scenes of the 4th online training

(Top: Vibration training(lecture/training), Middle:Non-destructive training(lecture/training), Bottom: Action Plan(work/closing session)

3.2.5 Improvement in the training contents in Japan based on the feedback of the on-the-job training (OJT) of WEA and GENCOs

Training in Japan was improved based on the opinions of trainees in Japan and the results of surveys and hearings conducted during each on-site work.
To allow the effective implementation of the action plan that was prepared by the participant who attended the training in Japan after returning to their own country, the training needs the understanding and the action plan prepared by the participants needs the understanding and cooperation by the management class of the respective power stations of GHCL and GENCOs. Therefore, since the 2nd training in Japan, participation of the counterpart in Pakistan to the action plan presentation of engineers and technicians by cooperating with the JICA office on site was incorporated.
In the management training of the 1st and 2nd trainings in Japan, observation of the actual situation of the training that engineers and technicians were learning and the actual experience of some of the common trainings by management staffs contributed to promote the understanding of the training contents.
In addition, the analysis of problems mainly involved in the human resource development in the management training of the 2nd training in Japan and the preparation and implementation of action plan from the management standpoint led to the effective activities for the enhancement of the O&M of TPSs in Pakistan from the respective standpoints of engineer/technician/management personnel.
Although only two staffs attended from WEA to the 1st training in Japan, two staffs from GHCL and two staffs from WEA attended to the 2nd training in Japan. Especially, in the 2nd training in Japan, persons in charge of HRD of GHCL were highly aware the problems involved in the human resource development system including the training system in TPSs of GENCOs and the improvement of them. These facts are considered to effectively act on the improvement in the development and training of personnel of power stations in Pakistan including OJT and Off-JT and to be referred to for the establishment of the criteria for the third training in Japan(for management personnel).

3.3 Results of Activities for Output 3

3.3.1 Preparation of action plan for OJT related to the O&M of TPS

(1) Action plan prepared in the 1st training in Japan

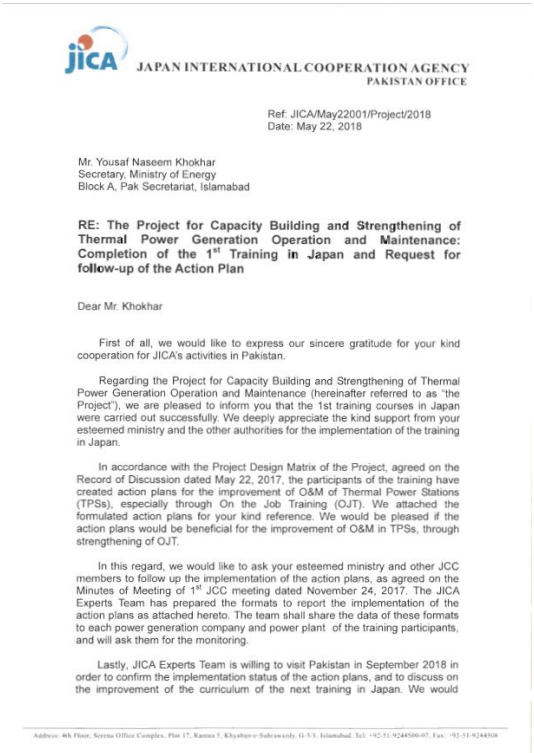
The Action Plan prepared as the result of the 1st training in Japan is as shown below. Activities of the "Implementation of training" were summarized, in which participants were instructed to communicate what they had learned in training in Japan to their colleagues and others in order to improve their maintenance ability and work safety at their thermal power stations.
(For the detailed contents, refer to Annex 5-(1).)

1) Engineer
- Implementation of the training for the improvement of O&M capacity of TPS
- Implementation of safety training

2) Technician
- Implementation of the training for the improvement of O&M capacity of TPS
- Implementation of safety training

Figure 3-5: Scenes of the presentation of action plan (1st training in Japan)
(Left: Eengineer, Right: Technician)

In order to create an environment that makes it easier to implement the Action Plan at the TPSs to which the participants belong, respective counterparts on the Pakistan side needs to follow-up the implementation of the Action Plan by the participants. Therefore, JICA issued a follow-up letter to the MoE Power Division, which is the coordinator of the counterpart on the Pakistan side. (refer to Figure 3-6)
The implementation status of the Action Plan prepared in the 1st training in Japan is shown in Section 3.3.2.



JAPAN INTERNATIONAL COOPERATION AGENCY
PAKISTAN OFFICE

Ref: JICA/May22001/Project/2018
Date: May 22, 2018

Mr. Yousaf Naseem Khokhar
Secretary, Ministry of Energy
Block A, Pak Secretariat, Islamabad

RE: The Project for Capacity Building and Strengthening of Thermal Power Generation Operation and Maintenance: Completion of the 1st Training in Japan and Request for follow-up of the Action Plan

Dear Mr. Khokhar

First of all, we would like to express our sincere gratitude for your kind cooperation for JICA's activities in Pakistan.

Regarding the Project for Capacity Building and Strengthening of Thermal Power Generation Operation and Maintenance (hereinafter referred to as "the Project"), we are pleased to inform you that the 1st training courses in Japan were carried out successfully. We deeply appreciate the kind support from your esteemed ministry and the other authorities for the implementation of the training in Japan.

In accordance with the Project Design Matrix of the Project, agreed on the Record of Discussion dated May 22, 2017, the participants of the training have created action plans for the improvement of O&M of Thermal Power Stations (TPSs), especially through On the Job Training (OJT). We attached the formulated action plans for your kind reference. We would be pleased if the action plans would be beneficial for the improvement of O&M in TPSs, through strengthening of OJT.

In this regard, we would like to ask your esteemed ministry and other JCC members to follow up the implementation of the action plans, as agreed on the Minutes of Meeting of 1st JCC meeting dated November 24, 2017. The JICA Experts Team has prepared the formats to report the implementation of the action plans as attached hereto. The team shall share the data of these formats to each power generation company and power plant of the training participants, and will ask them for the monitoring.

Lastly, JICA Experts Team is willing to visit Pakistan in September 2018 in order to confirm the implementation status of the action plans, and to discuss on the improvement of the curriculum of the next training in Japan. We would

Figure 3-6: Action Plan follow-up letter (1st training in Japan)

(2) Action plan prepared in the 2nd training in Japan

1) Action Plan for engineers and technicians

Table 3-26 shows the Action Plan prepared as the result of the 2nd training in Japan.

Activities of the "Implementation of training" were summarized, in which participants were instructed to communicate what they had learned in training in Japan to their colleagues and others in order to improve their maintenance ability and work safety at their thermal power stations, and "Workplace improvement activities" for incorporating into actual work.

The participants participated in the training while being aware of the issues and measures they had analyzed themselves in the issue analysis for creating action plans. JET thinks that this has made the actions that trainees should take after returning country more concrete and effective.

(For the detailed contents, refer to Annex 5-(2).)

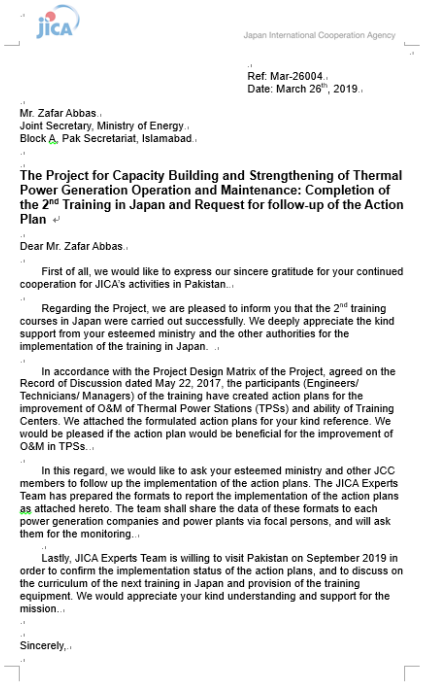
Table 3-26: Outline of Action Plan prepared by the participants of the 2nd training in Japan

Items	Engineers	Technicians
Implementation of training	➢ Preventive Maintenance of Generators ➢ Preventive Maintenance of Transformers ➢ Quality Control of TPP (including RBM) ➢ Efficiency Management ➢ Basics of Vibration ➢ Non Destructive Inspection ➢ Experienced based safety training ➢ Lessons from past accidents records	➢ Overview of the Gas turbine Combined Cycle ➢ Preventive maintenance of Generators ➢ Preventive Maintenance of High Voltage Motors ➢ Preventive Maintenance of Transformers ➢ Protection systems of Main Electrical Equipment ➢ The Outline of Insulation ➢ Experiential Quality Training ➢ Prevention of Accidents and disasters ➢ Labor Safety ➢ Experiential Safety Training
Workplace improvement activities	➢ Implementation of TBM (The following items are suggestions for improving the workplace) ➢ State-of-the-art CMMS ➢ Power plant specific simulator ➢ Vibration and NDI training equipment ➢ Establishment of HSE section	➢ Implementation of TBM

Figure 3-7: Scenes of the presentation of action plan (2nd training in Japan)

(Left: Eengineer, Right: Technician)

Among the Action Plans prepared by the respective participants as a result of the 1st training in Japan, the implementation status of activities other than the training were hard to be followed up. Thus, in the Action Plan preparation in the 2nd training in Japan, the implementation status of Action Plan was made easier to control for the respective participants by recording the implementation status of the activities for improvement in workplace into the management table to manage the implementation status of the training. It is thought that the improvement contributes to the easier management of the implementation status of the Action Plan by the JET.
In addition, after the 2nd training in Japan, JICA issued a follow-up letter to the MoE Power Division, which is the coordinator of the counterpart on the Pakistan side, so that respective counterparts on the Pakistan side follow-up the implementation of the Action Plan by the participants. (refer to Figure 3-8)
The implementation status of the Action Plan prepared in the 2nd training in Japan is shown in Section 3.3.2.



Japan International Cooperation Agency

Ref: Mar-26004
Date: March 26th, 2019

Mr. Zafar Abbas
Joint Secretary, Ministry of Energy
Block A, Pak Secretariat, Islamabad

The Project for Capacity Building and Strengthening of Thermal Power Generation Operation and Maintenance: Completion of the 2nd Training in Japan and Request for follow-up of the Action Plan

Dear Mr. Zafar Abbas

First of all, we would like to express our sincere gratitude for your continued cooperation for JICA's activities in Pakistan.

Regarding the Project, we are pleased to inform you that the 2nd training courses in Japan were carried out successfully. We deeply appreciate the kind support from your esteemed ministry and the other authorities for the implementation of the training in Japan.

In accordance with the Project Design Matrix of the Project, agreed on the Record of Discussion dated May 22, 2017, the participants (Engineers/ Technicians/ Managers) of the training have created action plans for the improvement of O&M of Thermal Power Stations (TPSs) and ability of Training Centers. We attached the formulated action plans for your kind reference. We would be pleased if the action plan would be beneficial for the improvement of O&M in TPSs.

In this regard, we would like to ask your esteemed ministry and other JCC members to follow up the implementation of the action plans. The JICA Experts Team has prepared the formats to report the implementation of the action plans as attached hereto. The team shall share the data of these formats to each power generation companies and power plants via focal persons, and will ask them for the monitoring.

Lastly, JICA Experts Team is willing to visit Pakistan on September 2019 in order to confirm the implementation status of the action plans, and to discuss on the curriculum of the next training in Japan and provision of the training equipment. We would appreciate your kind understanding and support for the mission.

Sincerely,

Figure 3-8: Action Plan follow-up letter (2nd training in Japan)

2） Action Plan for management personnel
Table 3-27 shows the Action Plan prepared by the management personnel as the result of the 2nd training in Japan. (For the detailed contents, refer to Annex 5-(2).)
In the 2nd training in Japan, the participants of the management training analyzed issues related to HRD and confirmed the actual training situation at KEPCO, thereby they were able to grasp the gap between actual condition of HRD in Pakistan and ideal condition, and identified countermeasures to be implemented. Both sides also discussed the effective utilization of training equipment planned to be provided from Japan to Pakistan through this project.
As a result, the Action Plans to be implemented by the participants after they return have been made more effective.

Table 3-27: Outline of Action Plan prepared by the management personnel of the 2nd training in Japan

1. Utilization of the Technical Skills and Expertise acquired by Engineers & Technicians in JICA	➢ The two batches of technicians & engineers received training, can be best utilized as Trainers. ➢ The cutting edge knowledge acquired in Thermal Generation by GHCL/GENCOs employees to be utilized as knowledge reservoir.
2. Introduction of proper On Job Training (OJT) in GENCOs	➢ Proper framework for On Job Training (OJT) is to be developed in GENCOs by GHCL in each Thermal Generation department where services of the Technicians & Engineers who got training at JICA can be best utilized. ➢ The resource persons selected for OJT will be properly declared and certain incentives will be given viz; ● Recognition Certificates will be awarded ● To be declared champions and will be shown on meritorious display boards. ● Financial incentives will be given in exceptional cases ● Mentoring will be adopted as part of HR policy.
3. Enhancement of Training Facilities in Regional Training Centre, Guddu	➢ Facilities in the Regional Training Centre (RTC), Guddu (GENCO-II) will be upgraded to bring at par with the present day needs. ➢ IN GENCOs job description for each category of employees will be prepared to set KPIs. ➢ Gap analysis will be made to ascertain the causes of deficiencies. ➢ Trained Engineers and Technicians from JICA will be blended with other trainers in RTC Guddu. ➢ Training aids as well as trainees residential facilities will be upgraded.
4. Establishment of exclusive Training Facility Centre for Thermal Engineers at GENCO-II, Guddu	➢ To have an exclusive training facility for Thermal Engineers, GHCL has decided to establish an independent Training Institute for all level courses at Genco-II, Guddu where infrastructure is available. ➢ Faculty will be taken from the field formations including the Engineers of Mechanical & Electrical disciplines who got training at JICA. ➢ Besides mandatory trainings required for career advancement, capacity building courses will be framed to enhance the knowledge & sharpen the existing skills. ➢ Short term courses will be introduced viz; ● Induction/beginners courses ● Refresher courses ● Sector Specific courses ● Advance Engineering Management courses

Figure 3-9: Scenes of the presentation of action plan (2nd training in Japan)
(Management personnel)

(3) Action Plan prepared in the 3rd training in Japan

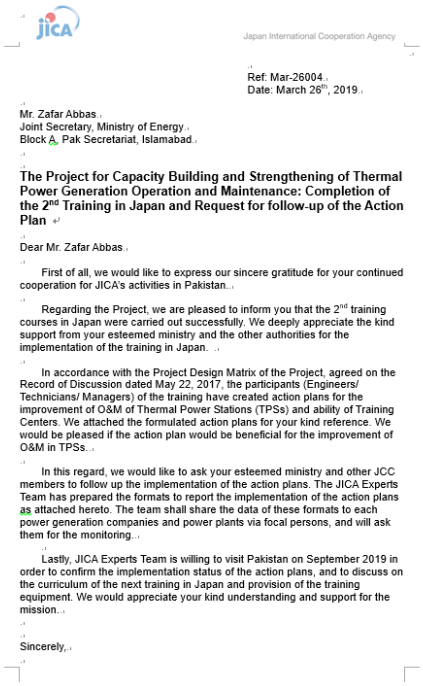
For the 3rd training in Japan, three training programs for engineers, technicians, and management had been planned and prepared, but the management training was suspended due to the delay in the procedures for participating in the training in Japan.
For this reason, the Action Plan prepared as a result of the 3rd training in Japan consisted of 2 plans (engineer and technician) as shown in Table 3-28.
Activities of the "Implementation of training" were summarized, in which participants were instructed to communicate what they had learned in training in Japan to their colleagues and others in order to improve their maintenance ability and work safety at their thermal power stations, and "Workplace improvement activities" for incorporating into actual work.
As with the action plan prepared in the 2nd training in Japan, the participants participated in the training while being aware of the issues and measures they had analyzed themselves in the issue analysis for creating action plans. JET thinks that this has made the actions that trainees should take after returning country more concrete and effective.
(For the detailed contents, refer to Annex 5-(3).)

Table 3-28: Outline of Action Plan prepared by the participants of the 3rd training in Japan

Items	Engineers	Technicians
Implementation of training	➢ Overview of Measuring and Monitoring Device (Lecture/Practice) ➢ Overview of Turbine Supervisory Instrument ➢ Overview of Gas Turbine Combined Cycle Power Generation Control System and Maintenance ➢ Tool Box Meeting (TBM) ➢ Experience-based Safety Training	➢ Overview of Measuring and Monitoring Device (Lecture/Practice) ➢ Overview of Control Valve and Accessories (Lecture/Practice) ➢ Copper Pipe Flaring and Seal Taping ➢ Control Cable and Terminal Treatment ➢ Experiential Quality Training, etc. ➢ Tool Box Meeting (TBM)
Workplace improvement activities	➢ Tool box meeting (TBM) before actual work	➢ Implementation of TBM ➢ Apply practical knowledge/maintenance skill learned in Japan to actual work


Figure 3-10: Scenes of the presentation of action plan (3rd training in Japan)
(Left: Eengineer, Right: Technician)

In addition, after the 3rd training in Japan, JICA issued a follow-up letter to the MoE Power Division, which is the coordinator of the counterpart on the Pakistan side, so that respective counterparts on the Pakistan side follow-up the implementation of the Action Plan by the participants. (refer to Figure 3-11)
The implementation status of the Action Plan prepared in the 3rd training in Japan is shown in Section 3.3.2.



JICA Japan International Cooperation Agency

Ref: Mar-26004
Date: March 26th, 2019

Mr. Zafar Abbas
Joint Secretary, Ministry of Energy
Block A, Pak Secretariat, Islamabad

The Project for Capacity Building and Strengthening of Thermal Power Generation Operation and Maintenance: Completion of the 2nd Training in Japan and Request for follow-up of the Action Plan

Dear Mr. Zafar Abbas

First of all, we would like to express our sincere gratitude for your continued cooperation for JICA's activities in Pakistan.

Regarding the Project, we are pleased to inform you that the 2nd training courses in Japan were carried out successfully. We deeply appreciate the kind support from your esteemed ministry and the other authorities for the implementation of the training in Japan.

In accordance with the Project Design Matrix of the Project, agreed on the Record of Discussion dated May 22, 2017, the participants (Engineers/ Technicians/ Managers) of the training have created action plans for the improvement of O&M of Thermal Power Stations (TPSs) and ability of Training Centers. We attached the formulated action plans for your kind reference. We would be pleased if the action plan would be beneficial for the improvement of O&M in TPSs.

In this regard, we would like to ask your esteemed ministry and other JCC members to follow up the implementation of the action plans. The JICA Experts Team has prepared the formats to report the implementation of the action plans as attached hereto. The team shall share the data of these formats to each power generation companies and power plants via focal persons, and will ask them for the monitoring.

Lastly, JICA Experts Team is willing to visit Pakistan on September 2019 in order to confirm the implementation status of the action plans, and to discuss on the curriculum of the next training in Japan and provision of the training equipment. We would appreciate your kind understanding and support for the mission.

Sincerely,

Figure 3-11: Action Plan follow-up letter (3rd training in Japan)

(4) Action Plan formulated in the 4th online training

As a result of the 4th online training, Table 3-29 shows the action plans formulated by the instructors of each training center who participated in the training.

Regarding the subjects learned in the online training, the activities for "thermal power plant O&M training" using the training materials and equipment provided by the Japanese side were summarized.

(For the detailed contents, refer to Annex 5-(4).)

The implementation status of the Action Plan prepared in the 4th online training is shown in Section 3.3.2.

Table 3-29: Outline of Action Plan prepared by the participants of the 4th online training

Action Plan Item	Muzaffargarh	Guddu
Implementation of Training	➢ Training with Vibration Model Rotor ➢ Training with Non-destructive Inspection kit	➢ Training with Non-destructive Inspection kit

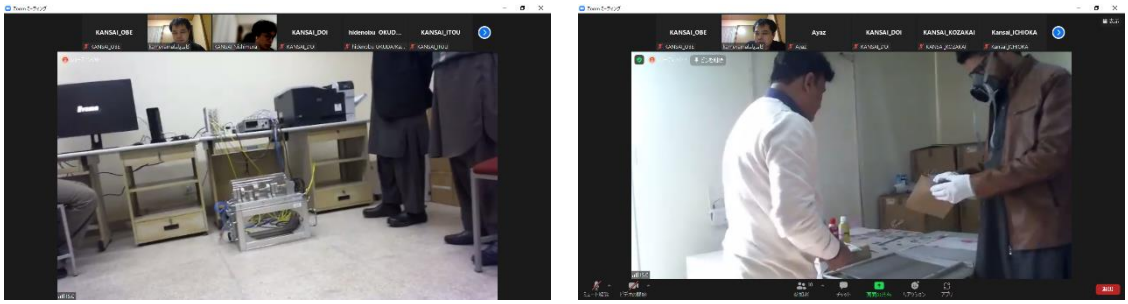


Figure 3-12: Scenes of training demonstration among trainees based on action plan (4th online training)
(Left: Vibration training, Right: Non-destructive Inspection training)

3.3.2 Dissemination of knowledge and skills to O&M personnel based on the action plan

Table 3-30 shows the implementation status of the Action Plan that was prepared in the 1st, 2nd and 3rd trainings in Japan.
As of the end of December 2021, the participants of engineers who participated in the training in Japan conducted 385 trainings as instructors and trained 3,521 O&M personnel at TPSs. On the other hand, the participants of technicians who participated in the training in Japan conducted 437 trainings as instructors and trained 2,808 O&M personnel at TPSs.
In addition, regarding workplace improvement activities, activities such as TBM and wearing of safety protective equipment were implemented at each workplace.

Table 3-30: Table of Action Plan implementation status by participants in the 1st , 2nd and 3rd trainings in Japan (as of the end of December 2021)

		Number of Participants in Japan	Number of Training Activity at each TPS	Number of Trainees at each TPS	Reference
Jamshoro	Engineers	4	26	332	
	Technicians	4	94	398	
Kotri	Technicians	2	11	98	
Guddu	Engineers	11	261	2,745	
	Technicians	9	255	1,824	One technician has left the project.
Muzaffargarh	Engineers	4	45	204	
	Technicians	6	44	259	
Nandipur	Engineers	1	6	30	
Lakhra	Engineers	1	43	197	
	Technicians	3	33	229	
Faisalabad	Engineers	1	0	0	One engineer has left the project.
GHCL	Engineers	2	4	13	
Cumulative Total	Engineers	24	385	3,521	
	Technicians	24	437	2,808	
	Total	**48**	**822**	**6,329**	

Regarding the implementation of the Action Plan, according to the results of the questionnaire survey to each participant, about 46% of the trained instructors were able to implement the Action Plan as planned. The remaining about 54% of instructors were able to implement only partial Action Plans due to the global spread of the COVID-19 as shown in Figure 3-13.

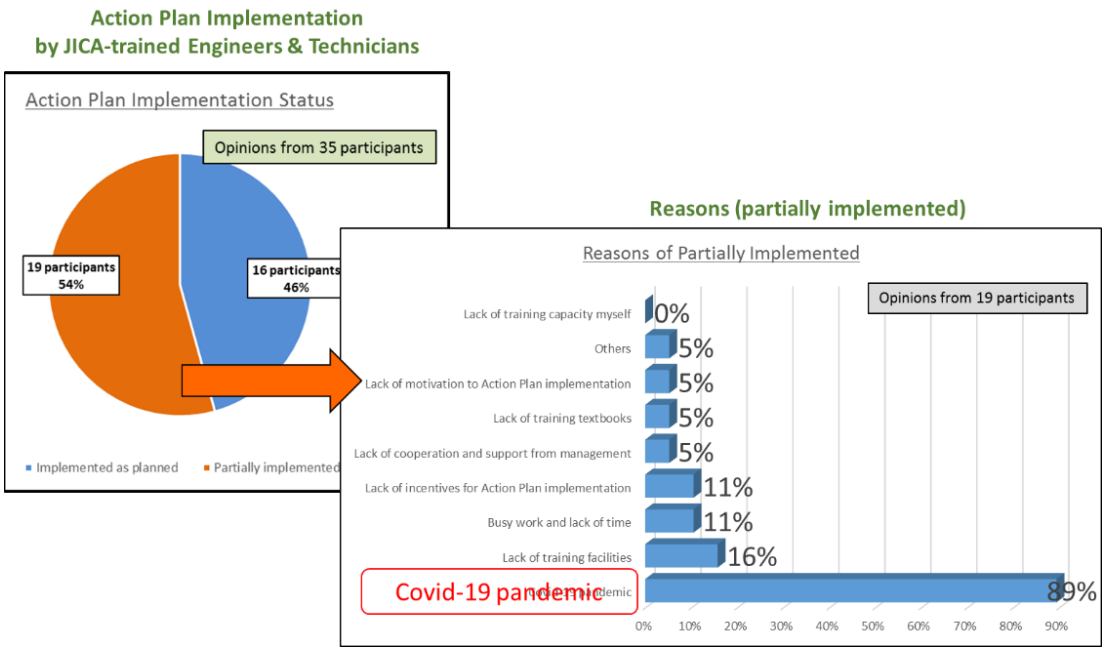


Figure 3-13: Action Plan Implementation Status (based on questionnaire surveys)

In the 4th and 5th JCC, JET made recommendations on these statistical results and asked management to follow up on them.

Table 3-31 shows the implementation status of the action plan by the instructor formulated during the 4th online training. As of the end of December 2021, 13 training sessions have been conducted, and a total of 85 people have been trained.

Table 3-31: Table of Action Plan implementation status by participants in the 4th online trainings (as of the end of December 2021)

	Training Centers (Instructor)	Muzaffargarh (4)	Guddu (4)	Total (8)
Vibration Analysis Demonstrator	No of Training	5	-	5
	No of participants	25	-	25
NDI Demonstrator [PT/MT/UT]	No of Training	4	4	8
	No of participants	28	32	60
Total	No of Training	9	4	13
	No of participants	53	32	85

3.3.3 Verification of skilled up level based on the OJT checklist

Dissemination of knowledge and skills to O&M personnel in Pakistan is required, while maintaining the level of knowledge and skills acquired through training in Japan.
For this reason, in order to use them as checklists for OJT implementation, such as "Purpose" "Training Items" and "Important Points" for each training course that they have set, they are included in the implementation record form of the action plan shown in Figure 3-14.
Regarding the confirmation of the quality of the training conducted by the participants as an instructor in Pakistan, the JET grasped the numerical values from the evaluation questionnaire in the training report submitted by the instructor who conducted the training and the local O&M personnel who took the training.
Regarding the evaluation of training by instructors, 3 items of "Achievement of the training in Pakistan" "Usefulness of training in Japan" and "Responsiveness to requests from trainees" were evaluated on a scale of 5 (highest evaluation = 5, lowest evaluation = 1).
Regarding the evaluation of training by trainees, 4 items of "Improvement of knowledge and skills" "Improvement of maintenance skills" "Utilization for actual work" "Satisfaction with training materials" were evaluated on a scale of 5 (highest evaluation = 5, lowest evaluation = 1).
Figure 3-15 shows the statistical results of the questionnaire collected by both instructors and trainees.

Figure 3-14: Example of Action Plan Implementation Record Format

■ **Basic information**

Country	**Pakistan**
Target TPP	**GHCL, Jamshoro TPS (JPCL), Guddu TPS (CPGCL), Muzaffargarh TPS (NPGCL), Nandipur TPS (NPGCL)**
Name of the Trainers (JICA-trained participants)	**Mr. Saeed Ahmed Shaikh, Mr. Asif Siddiui, Mr. Suhail Ahmed Qureshi, Mr. Naimat Ullah Khan, Mr. Adnan Bashir, Mr. Khalil Ahmed Shaikh, Mr. Faisal Naeem, Mr. Farrukh Riaz**
Overall goal	**Technology and technical skills obtained by the project are utilized in actual O&M at GENCOs power stations.**
Project goal	**Training Capacity on Maintenance of WEA and GENCOs is strengthened.**
Subjects	**[Training]** **(I&C Maintenance)** **1-1. Overview of Measuring and Monitoring Device (Lecture)** **1-2. Maintenance of Measuring and Monitoring Device (Practice)** **1-3. Overview of Turbine Supervisory Instrument** **1-4. Overview of Gas Turbine Combined Cycle Power Generation Control System and Maintenance** **(General)** **1. Tool Box Meeting (TBM)** **2. Exerience-based Safety Training** **[Activity]** **1. Tool box meeting (TBM) before actual work**

■ **Training**

Survey ▼

NO.	Subject		Training course	Purpose	Training Item	Important Points	Trainer	Where	How	Tools	Achievements		2020 Feb	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Remarks
(ex.)	I&C Maintenance	ex.	Overview of Measuring and Monitoring Device (Pressure, Temperature, Level, Flow Rate)	To understand the techniques to measure process variables such as pressure, temperature, level and flow	1. Pressure measuring equipment 2. Temperature measuring equipment 3. Level measuring equipment 4. Flow rate measuring equipment	•Principle and structure of measuring devices •How to remove and install measuring devices •How to ensure quality and safty during maintenance work •How to maintain and calibrate	JICA trained Participant	TPP	Lacture and OJT	Manufacturer's Manuals and Text books provided by JICA	Plan	No. of times		1				1					Photograph when training Training report Attendance list
												No. of participants		10				10						
											Result	No. of times		1				1				1		
												No. of participants		10				5				10		
1	I&C Maintenance	1-1	Overview of Measuring and Monitoring Device (Pressure, Temperature, Level, Flow Rate)	To understand the techniques to measure process variables such as pressure, temperature, level and flow	1. Pressure measuring equipment 2. Temperature measuring equipment 3. Level measuring equipment 4. Flow rate measuring equipment	・Principle and structure of measuring devices ・How to remove and install measuring devices ・How to ensure quality and safty during maintenance work ・How to maintain and calibrate	JICA trained Participant	TPP	Lecture and OJT	Text books provided by JICA	Plan	No. of times			1									
												No. of participants			8									
											Result	No. of times												
												No. of participants												
		1-2	Maintenance of Measuring and Monitoring Device (Pressure, Temperature)	(1)To understand the method to maintenance and calibration to measurement equipment (2)To understand the importance to use of proper measuring equipment and proper recording	1. Pressure Gauge 2. Pressure Switch 3. Thermocouple 4. Resistance Thermometer Detector		JICA trained Participant	TPP	Lecture and OJT	Text books provided by JICA	Plan	No. of times					1							
												No. of participants					8							
											Result	No. of times												
												No. of participants												
		1-3	Overview of Gas Turbine Combined Cycle Power Generation Control System and maintenance.	(1)To understand the overview of GTCC control system (2)To be able to find out the control-related troubles and to take proper countermeasure	1. Shaft Vibration 2. Shaft Eccentricity 3. Turbine Speed 4. Shaft Position 5. Difference Expansion	・Function of GTCC control ・How to control start-up and load operation ・Troubleshooting for plant operation	JICA trained Participant	TPP	Lecture	Text books provided by JICA	Plan	No. of times								1				
												No. of participants								8				
											Result	No. of times												
												No. of participants												
		1-4	Overview of Turbine Supervisory Instrument (Lecture Only)	To understand the techniques to monitor critical parameters of turbine for its safe and smooth operation such as shaft vibration, position, turbine speed, difference expansion	1. GTCC control during start-up operation 2. GTCC control during load operation 3. Introduction of troubleshooting	・Principle and structure of TSI ・How to disassembly and assembly of TSI ・How to ensure quality and safty during maintenance work ・How to maintain and calibrate	JICA trained Participant	TPP	Lecture	Text books provided by JICA	Plan	No. of times											1	
												No. of participants										8		
											Result	No. of times												
												No. of participants												

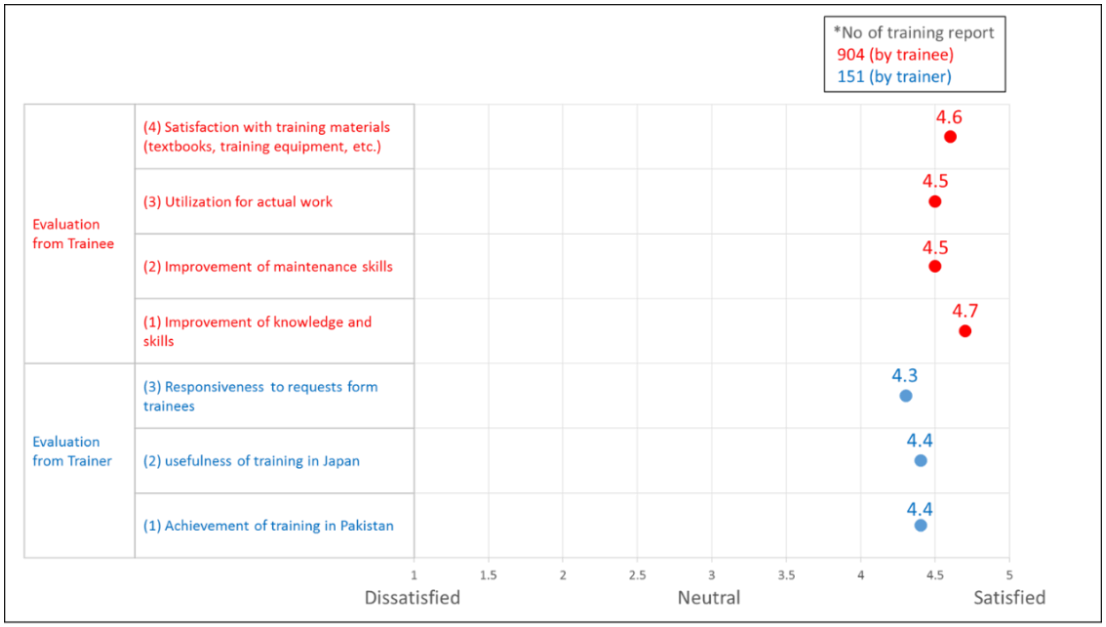


Figure 3-15: Evaluation of On-site Training

Both instructors and trainees received over 4.0 high ratings in each category, indicating that training activities in Pakistan have been disseminated at a high level.

3.3.4 Review of action plan results and improvement of the on-site training (OJT)

Review of the results of the action plan is described in the previous sections.
Based on these results, regarding the improvement of OJT in Pakistan, it is considered to improve by "(1) Implementation of action plans prepared by participant trained in Japan", "(2) Improvement of educational textbooks", and "(3) Effective use of training facilities in Pakistan and materials and equipment provided from Japan".

(1) Implementation of action plans prepared by participant trained in Japan

In order to effectively implement the action plan prepared by engineers and technicians in the training in Japan as planned, the following activities were carried out.

- Management of GHCL and GENCOs participated remotely in the presentation of the action plan held in Japan to foster understanding of the action plan and to support their activities after their return to Pakistan.
- After the training in Japan, JICA issued a follow-up letter to the MoE Power Division, so that respective counterparts on the Pakistan side follow-up the implementation of the Action Plan by the participants.
- Through various reports and direct interviews with the participants trained in Japan at the time of each on-site work, issues deemed necessary for the sustainability and development of the action plan were summarized and proposed together with improvement proposals.
- Management training was conducted in Japan, and efforts were made to raise awareness of issues in the training environment in Pakistan through tours of the engineer/technician training in Japan, introduction of personnel training methods at KEPCO, and tours of training facilities.

Through these activities, it can be confirmed that OJT at power stations has been steadily improved.

Figure 3-16: Scenes of the OJT in Pakistan

(2) Improvement of educational textbooks

The textbooks used in the engineer training and technician training in Japan were distributed to each participant in five copies, along with a set of electronic data, so that they could be used for training activities after returning to Pakistan. At the same time, the checklist that were actually used during the practical training in Japan were distributed to all participants so that they could be taught based on their own experiences during the training in Japan.

As a result of these activities, participants trained in Japan used the textbooks distributed by JET for OJT in Pakistan, and redistributed the textbooks to other GENCOs power stations. It is thought that the quality of training using textbooks has improved from oral OJT based on experienced personal memos and experience conducted in Pakistan to stable OJT.

Figure 3-17: Scenes of the using and redistributing textbooks provided by JET

(3) Effective use of training facilities in Pakistan and materials and equipment provided from Japan

Table 3-32 shows the outline of the candidate training equipment that are considered to be effective for the development of O&M personnel in the power stations of GENCOs through field surveys and communication with GHCL/GENCOs. The introduction cases are shown in Table 3-33.

Table 3-32: Outline of candidate training equipment

	Power Plant Operation Simulator	Vibration Analysis Demonstrator	NDI Demonstrator (PT/MT/UT)
Image			
Main Purpose	**Replacement of existing simulator (out of order) in WEA** with this generic simulator for GTCC & conventional type (Oil/Gas).	It's useful for JICA-trained engineers to **disseminate the theoretical knowledge obtained in Japan to other colleagues**, in terms of many vibration troubles at TPPs.	It's useful for JICA-trained engineers & technicians **to disseminate the theoretical knowledge and skill obtained in Japan to other colleagues** at TPPs.
Notice	**NOT useful for advanced operator course** because of generic (default spec.).	Some maintenance (lubrication etc.) is required.	Some consumables are required.
Main Target	Operators	Engineers (both mechanical & electrical)	Engineers/technicians (both mechanical & electrical)

Table 3-33: Introduction case of training equipment

		Case 1	Case 2	Case 3	Case 4
Power Plant Operation Simulator		1 set	None	None	None
Vibration Analysis Demonstrator*		None	2 sets	1 set	None
NDI Demonstrator** (PT/UT/MT)		None	None	4 sets	7 sets
Installed Site		**Simulator** WEA	**Vibration** WEA and Guddu T/C	**Vibration** WEA **NDI** WEA(2) and Guddu T/C(2)	**NDI** WEA(2), Guddu T/C(2) and TPPs(3)
Expected effect	Number of trainees	✓ Limited & far from TPPs	✓✓ Limited &far from TPPs	✓✓✓ Many but far from TPPs	✓✓✓✓ Many & on TPPs
	Training Field	1 Only Simulator	1 Only Vibration Analysis Demo.	2 Both Vibration Analysis Demo. & NDI Demo.	1 Only NDI Demo.
Evaluation from JICA Expert		✗	✓	✓✓✓	✓✓

*Vibration (1set) contains one Fluid-Film Bearing Rotor Kit. **NDI (1set) contains four PTs , one UT and one MT.

As for these training equipment, in the 2nd management training in Japan, participants were given a tour of the actual training for engineer and technician using the equipment, and discussions were held on the methods and effects of using the equipment for O&M personnel training at KEPCO. As a result, it was decided that two types of training equipment, "Vibration Model Rotor" and "NDI kit ", would be provided from Japan to Muzzaffargarh and Guddu training center in this project as described in Section 3.1.3(2).
(For the detaile of the equipment provided by Japan, refer to Annex 8.)
In addition, when providing training materials and equipment, JET asked for cooperation to the management of each training center on these new training continuously on top of existing training menu so that instructors can conduct practical training by themselves in Pakistan, online training will be conducted to train new instructors as described in Section 3.2.4 (4) and they can formulate action plan for continuous training using materials and equipment.
We believe that we were able to effectively enhance and improve OFF-JT in the training of GENCOs thermal power generation personnel by these activities in the three fields of "human requirements (training of instructors)", "physical requirements (providing training materials and equipment)", and "system requirements (formulation of action plans and cooperation from management)".

Figure 3-18: Scenes of using materials and equipment in the training(Muzaffargarh TC)

Figure 3-19: Scenes of using materials and equipment in the training(Guddu TC)

Chapter 4 Issues, Ingenuities and Lessons concerning Management and Implementation of the Projects

4.1 Issues, Ingenuities and Lessons concerning Implementation of Training in Japan

(1) Job Report presentation

The JET asked respective participants to summarize the work performed in the TPSs that they belonged to and the issues related to it in a report before they visit Japan. They recognized their own issues again by explaining their own duties, roles, and problems to the JET on the first day of the training. The JET also utilized the report later for some purposes including the preparation of lecture items to solve issues by understanding the issues recognized by the participants.

(2) Instruction for preparing Action Plan (PCM method)

As the instruction for preparing Action Plan, lecture of "Acquisition of planning method using PCM (Project Cycle Management)" to improve "Understanding of the logical structure of Action Plan from problems and issue analysis" was implemented.

The PCM method is the problem-solving method based on the idea of solving "Existing problems". In this lecture, the method of organizing issues in the O&M of the TPS that the participants belonged to was instructed by using the problem tree chart and objective tree chart to be used at the phase of the PCM planning.

The problem analysis and objective analysis that were implemented this time are as shown below.

- Problem analysis:
  The existing problems of the O&M in TPS are indicated by the relationship of "Cause and result" and are visually expressed as a tree chart for easier understanding.
- Objective analysis:
  Concerning the preferable status that problems were solved and the method to lead it, relationship of "Means and purpose" is clarified and organized by the tree chart in a similar manner to the problem analysis.

(3) Preparation and presentation of Action Plan

The participants summarized the method of solving the issues found through the problem analysis and objective analysis that were implemented in the former half of the training based on the knowledge and experiences acquired by the training as the Action Plan. Specifically, the Action Plan was prepared as shown below.

- Review of issues found by PCM method:
  The participants reviewed and re-confirmed the issues of O&M in the TPS prepared in the former half of the training.
- Review of knowledge, experiences, and lessons obtained in training in Japan:
  Knowledge and experiences obtained in the training in Japan were reviewed for each subject.
- Selection of issues:
  The participants deliberated how they utilize the knowledge obtained in the training in Japan against the respective issues and solve them by themselves. Though many issues are remained in the O&M of TPS (for example, spare parts run short due to insufficient budget), measures that engineers and technicians can provide on-site for them are limited, and the range that the training in Japan can directly contribute to is restrictive. To make the training in Japan more effective, the approach prioritizing "Issues that can be solved within the range of activity of participants themselves" and "Issues that can be solved by the technical method" were noted.

- Planning of issue countermeasure (summary as an Action Plan):
  How to solve the selected issues in the O&M of TPS was summarized as an Action Plan. Action Plan is based on the countermeasure of technical issues by giving knowledge to other colleagues in TPS and improving the technical level. In the Action Plan, purpose was embodied by specifying the period that the knowledge should be given to (training).

(4) Awareness building of participants

The project is intended for the strengthening of the training capacity related to the O&M of the public utilities by the participants who received the training in Japan and serve as instructors. For this purpose, the participants need to build the awareness of receiving the training always taking into consideration the case that the participants themselves come to be trainers. Therefore, in the "Course orientation" at the beginning of the training the participants were asked to understand that the training include contents at varied levels from the beginner level to the advanced level and they were made to be conscious of receiving the training including the mastery of the teaching method.

(5) Assignment of support members to respective trainings

In the training in Japan that was antecedently provided for the engineers and technicians in Egypt, it was found that only lecturers and coordinators (interpreters) could not respond to the participants successfully. Learning from this experience, persons in charge of the project were assigned as the support members to respective trainings for engineers and technicians. By the assignment of the support members, response to the participants could be satisfactory, especially in the case that they are divided into some groups. Furthermore, the response of the participants during the training could be grasped objectively, and it can be utilized for the improvement and enhancement of the future training contents by the collection of the participant's opinions through the conversation with them.

(6) Change in instruction for preparing Action Plan

While the problem analysis with using the PCM method was performed for the preparing of Action Plan in the 1st training in Japan, the PCM method is effective for the rough decision-making for matters such as the target setting of the project and the preparation of activity plan. On the other hand, it is hard for the participants who are conducting their own work on site of TPS to see the problem analysis with using the PCM method as that in the work of the participants, and the use of the PCM method inevitably caused the tendency of vague target setting or Action Plan.

In the 2nd training in Japan, for concrete target and activity plan, the participants attempted the following method: The ideal state of the O&M in TPS was extracted at the phase before receiving the training in the three fields of "Human resources", "Material resources", and "Institutional resources", not by using the PCM method. Then, the respective participants analyzed and recognized the current situation of the TPS they were working for and the gap (issue) from the ideal sate of the TPS, and they themselves found the countermeasures of the gap through the training in Japan. The issue analysis tree after the issue analysis and the syllabus of the training in Japan (purposes and important matters are organized for each training item) were distributed to all participants, and during the training, the participants were made to be conscious of the issues and countermeasures that they themselves analyzed and made to receive the training actively with the clear image of their activities after they return to their mother country. The Action Plan to be implemented by the participants after they return could be made more effective by utilizing the method.

Furthermore, the abovementioned method was introduced in earnest in the 3rd training in Japan. The Action Plan format was compared with the format that was used in the 1st training in Japan and it was reviewed so that the plan can be designed more specifically, and the results can be recorded.

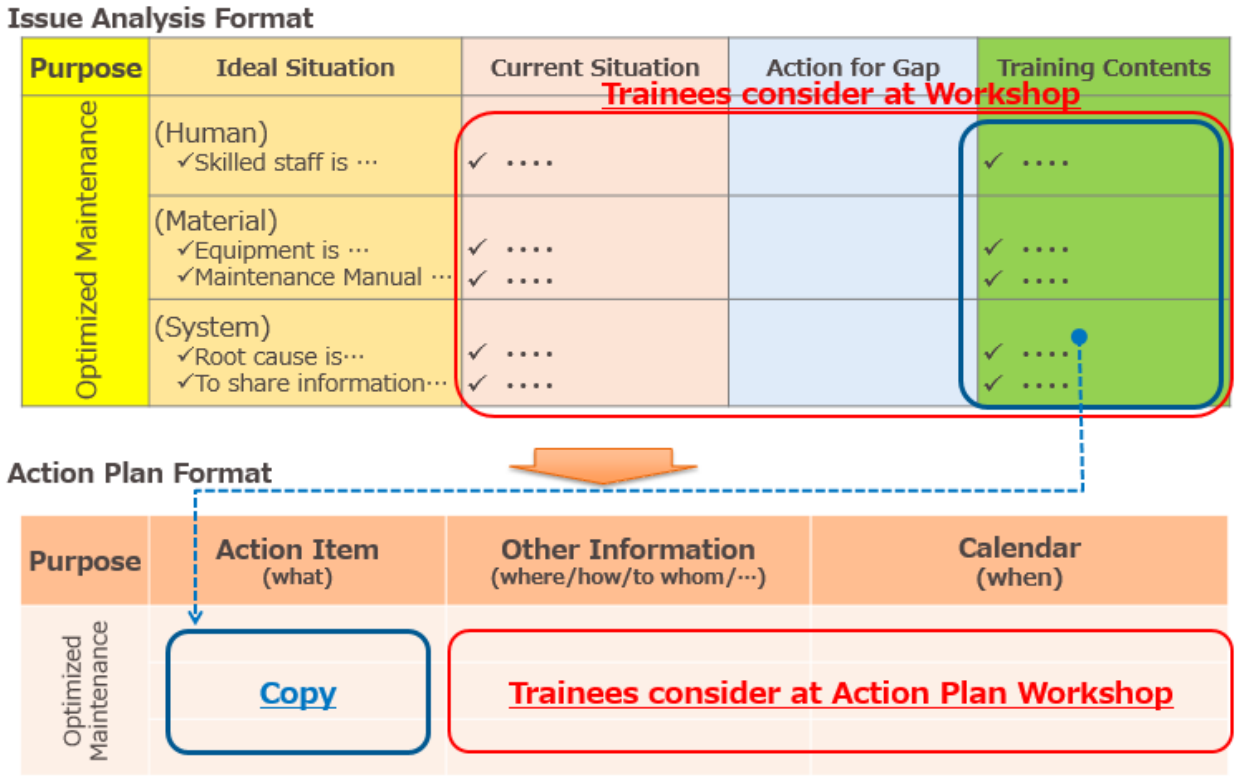


Figure 4-1: Flow from Issue Analysis to Action Plan

(7) Risk prediction meeting training

For further fostering of safety consciousness, the toolbox meeting (TBM) training, one of the risk prediction activities, was implemented from the 2nd training in Japan. Since people in Pakistan have no practice of such TBM activities, in addition to the lecture of the implementation method of TBM, the actual state of TBM was introduced by using video and implementing TBM actually by the participants before the practical training to enhance their understanding. The training was well-received, and the participants told that they wanted to utilize the method after they return to their mother country.

(8) Introduction of weekly review

For thorough consciousness of receiving the training including the mastery of teaching method not only learning the lectured contents, the review session system to review the training they received was introduced from the 2nd training in Japan. Respective participants' reviewing the training with using the syllabus, recognizing "Lessons" of the training, and practicing the extraction of "Lessons" were also effective for the consciousness of the Action Plan prepared in the latter half of the training and sharing the recognition of issues.

(9) Implementation of comprehension test

Before starting the training every morning, JET asked all the participants to make sure they understand the important points in the lectures and practical training held the day before by asking them questions in the form of tests. In addition, by having some of the correct respondents explain the tests, they practiced to train themselves as instructors after returning to Pakistan.

(10) Enhancement of training environment

1) Engineer training

- In order to suit the tastes of the participants as much as possible, the JET prepared mainly fried and roasted fish dishes at the cafeteria of KEPCO Training Center. In addition, the JET created an environment where participants can concentrate on training as much as possible, such as by introducing nearby halal restaurants.
- At the training center and each tour site, the JET made efforts to secure a prayer room and prayer time for participants, and gave maximum consideration to requests such as weekend mosque worship. Specifically, the JET introduced a neighboring mosque and extended the lunch break time.

2) Technician training

- By having the coordinator who can interpret in Urdu always accompany the participants, the JET made it possible for participants to active with peace of mind in terms of travel and living in Japan, and to concentrate on the training curriculum.
- In order to suit the tastes of the participants, the JET prepared dedicated curry dishes at the cafeteria of Kanden Plant Technocenter. In addition, the JET created an environment where participants can concentrate on training as much as possible by having the coordinator negotiate with the kitchen of the accommodation and have it suit the taste of the participants.
- At the training center and each tour site, the JET made efforts to secure a prayer room and prayer time for participants, and gave maximum consideration to requests such as long weekend worship.

(11) Review of online training

- For online training, we will adopt a live-streaming online training method in order to provide a training environment similar to that in Japan, and assign an Urdu interpreter to activate two-way communication.
- In consideration of the fact that the amount of information transmitted on both Japanese side and Pakistani side is lower in the online training than in-person training in Japan or in Pakistan, we prepared various materials specialized for the online training. In addition, we will strive for smooth implementation of online training by confirming the connection of the online training system on Japanese side and Pakistani side just before the training start date, and confirming IT literacy including PC operation of participants.
- Furthermore, as a feature of this online training, the training participants actually use the training materials and equipment provided from Japanese side to Pakistani side. We prepared the same equipment and used it as a model so that the trainees who handle the materials and equipment for the first time could easily understand. Also, training equipment manufacturer staff was involved in the online training in consideration of detailed support and unexpected troubles of the equipment. We have put in place a support system as much as possible so that even online training can be effective and efficient.

4.2 Issues, Ingenuities and Lessons concerning Implementation of Action Plan by Participants

In order to create an environment that makes it easier to implement the Action Plan at the TPSs to which the participants belong, respective counterparts on the Pakistan side needs to follow-up the implementation of the Action Plan by the participants. Therefore, JET arranged for the participation of GHCL/GENCOs management at the presentation of action plan by participants trained in Japan and requested JICA to issue a follow-up letter to the MoE Power Division, which is the coordinator of the counterpart on the Pakistan side.

In addition, at the time of the interviews with the management of GHCL/GENCOs during the on-site work, the JET encouraged the management to be involved in the implementation of the Action Plan by the participants. At the time of JCC, the JET made each C/P on the Pakistan side aware of the importance of involvement by management.

As a result of the above-mentioned efforts, it was confirmed that the management was actively following the implementation of the action plan for the trainees, such as the coordination and calling of the trainees at each power station and the preparation of lecture rooms and training equipment.

Chapter 5 Achievement Level of Project Purpose

5.1 Achievement of Overall Goal / Project Purpose

5.1.1 Achievement of Overall Goal

Regarding the Overall Goal of "Technology and technical skills obtained by the project are utilized in actual O&M at GENCOs power stations", the following has been confirmed at present due to the dissemination of knowledge and skills through the implementation of the Action Plans.

- Increased basic technical and safety knowledge of O&M personnel at thermal power stations
- Utilization in actual operations and improvement of operation quality in O&M personnel

Therefore, it is highly possible that Overall Goal will be achieved.

5.1.2 Achievement of Project Purpose

The Project Purpose, "Training capacity on O&M of WEA and GENCOs is strengthened", is almost achieved as follows considering monitoring indicators of the project such as number of improved training courses and number of trained instructors.

- As of the end of December 2021, the participants of engineers who participated in the the 1st, 2nd and 3rd training in Japan conducted 385 trainings as instructors and trained 3,521 O&M personnel at TPSs. On the other hand, the participants of technicians who participated in the training in Japan conducted 437 trainings as instructors and trained 2,808 O&M personnel at TPSs. (refer to Table 3-30)
- 24 engineers (including one who returned to Pakistan during training in Japan) and 24 technicians were trained as expected instructors in the training in Japan. The participants in respective trainings answered that they had almost achieved the training objective ("Training capacity on O&M of WEA and GENCOs is strengthened"), and that the knowledge and experience they acquired can be directly applied or adaptable to their work as shown in Table 5-1 and 5-2.

  The trainees who answered in Table 5-2 that "it cannot be directly applied or adapted, but it can be of reference " pointed out that the same equipment as used in the training in Japan is not available in Pakistan when they conduct training activities as instructors based on the skills acquired in Japan.

  In the later stage, based on the opinions of participants in the training in Japan, we provided training materials and equipment and trained instructors for the purpose of strengthening training capabilities, and we think the project goals were achieved through these activities.

Table 5-1: Achievement level of the training objective in the training in Japan

	← Fully Achieved Achieved →			Not
	4	3	2	1
Engineer training (23 people)	15 (65%)	8 (35%)	0 (0%)	0 (0%)
Technician training (24 people)	14 (58%)	10 (42%)	0 (0%)	0 (0%)

Table 5-2: Usefulness level of the training results from the training in Japan

	It can be directly applied to work	It cannot be directly applied, but it can be adaptable to work	It cannot be directly applied or adapted, but it can be of reference	It was not useful at all
Engineer training (23 people)	17 (74%)	1 (4%)	5 (22%)	0 (0%)
Technician training (24 people)	16 (67%)	7 (29%)	1 (4%)	0 (0%)

- We evaluated the items that can be grasped numerically regarding confirmation of the quality of contents in the training conducted by the trainees as instructors and the acquisition level of the trainees in the Pakistan. The evaluation data are from the evaluation questionaire submitted by the instructors who took the training and the local O&M personnel who took the training in Pakistan.
  As mentioned in Section 3.3.3, it is understood that training activities in Pakistan are being disseminated at high level as both instructors and trainees gave high scores in all the evaluation items in the questionnaire.
- In the extension project, eight instructors from the Muzaffargarh training center and Guddu training center were trained through the 4th online training. As of the end of December 2021, they conducted 13 training sessions in total using training materials and equipment provided by Japanese side in each training center and 85 people in total were trained. (refer to Table 3-31)

5.2 Achievement of Project Output

5.2.1 Achievement of Output 1

Output 1, Current situation of O&M of thermal power stations is analyzed and training needs are identified, is achieved as follows.

- The JET analyzed the current situation of O&M and training system at TPSs through 3 times of field surveys and interviews with participants trained in Japan.
- Based on these analysis results, the JET confirmed the training needs of each technical level and proposed the training needs to Pakistan side.
- We summarized training materials and equipment needs for improving O&M capabilities through surveys of GHCL / GENCOs training centers during on-site survey, discussions with management, and equipment needs surveys through action plans by participants to training in Japan.

5.2.2 Achievement of Output 2

Output 2, Capacity of WEA and GENCOs' instructors is enhanced, is achieved as follows.

- Based on the analysis of training needs shown in Output 1, the JET prepared the training program which were held 3 times in Japan
- The JET provided the training programs as the measures to fill the gap between the actual conditions and the ideal conditions for the O&M of TPSs obtained from the opinions of participants, survey results and issue analysis training.
- 24 engineers and 24 technicians were trained as expected instructors in the trainings in Japan. The participants in respective trainings answered that they had almost achieved the training objective (“Training capacity of the participants for O&M of TPSs will be

strengthened."), and that the knowledge and experience they acquired can be directly applied or adaptable to their work. (refer to Table 5-1 and 5-2)

- Based on the summary of the equipment and materials needs shown in Output 1, we provided the "vibration model rotor" and "non-destructive inspection kit" to the Muzaffargarh training center and Guddu training center, and we trained instructors through online training so that they can conduct trainings by themselves using the materials and equipment provided. As a result, total of eight instructors were trained.

5.2.3 Achievement of Output 3

Output 3, Training as well as OJT at WEA and GENCOs are improved, is achieved as follows.

- In the trainings in Japan, engineers and technicians made the Action Plans for improvement of the O&M capacity of TPSs. Due to the dissemination of knowledge through the implementation of the Action Plans, basic technical and safety knowledge of the O&M staff of TPSs were enhanced, which lead to reduction in accidents at TPSs, and improvement of O&M quality of the staff of TPSs as shown in Figure 5-1.

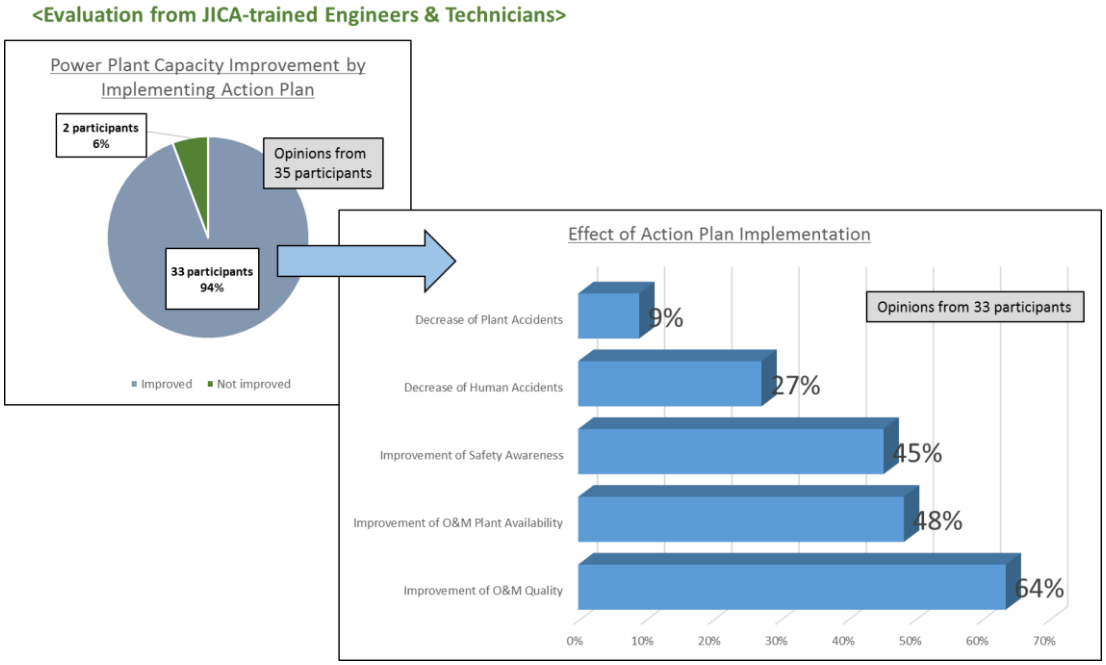


Figure 5-1: Improvement status of O&M ability by implementing Action Plans

- As of the end of December 2021, the participants of engineers who participated in the 1st , 2nd and 3rd training in Japan conducted 385 trainings as instructors and trained 3,521 O&M personnel at TPSs. On the other hand, the participants of technicians who participated in the training in Japan conducted 437 trainings as instructors and trained 2,808 O&M personnel at TPSs. (refer to Table 3-30)
  At the same time, the instructors of the training centers who participated in the 4th online training conducted 13 training sessions in total and trained a total of 85 people. (refer to Table 3-31)
  The total beneficiaries of this project are shown in Table 5-3.

Table 5-3: Beneficiaries of this project

	Direct Beneficiaries			Final Beneficiaries	Remarks
	Number of Trained Instructors in Japan or by online			Number of Trainees	
	Engineer	Technician	Instructor		
Jamshoro TPS	4	4	-	730	
Kotri TPS	0	2	-	98	
Guddu TPS	11	9	-	4,569	1 technician has left the project
Muzaffargarh TPS	4	6	-	463	
Nandipur TPS	1	0	-	30	
Lakhra TPS	1	3	-	426	
Faisalabad TPS	1	0	-	0	1 engineer has left the project.
GHCL	2	0	-	13	
Muzaffargar TC			4	53	
Guddu TC			4	32	
Total	24	24	8	6,414	
	56				
Target	60 → 48*		Additional 8	4,000	*Due to planning of 12 management personnel training

- The OJT at TPSs has been improved from the previous oral training provided by veteran O&M personnel using their experience and notes, to stable quality training using textbooks provided by JET, practical training using idle and waste equipment in the power plant, and safety training using safety protective equipment and cranes in addition to technology. In addition to technical training, safety training using safety protective equipment and cranes has been implemented, which is an improvement over the previous OJT in Pakistan.
- In the management training in Japan, the participants analyzed and confirmed the actual status of training at TPSs in Pakistan grasped the gap between the current status and ideal status of HRD, and prepared an action plan.
- The action plan prepared in the management training mainly consists of following up on O&M training at thermal power stations and having participants trained in Japan act as instructors at training centers. In addition, it was stated that the training for engineers, which had been conducted at WEA, would be transferred after the establishment of GENCOs own training facilities. This new training facility is a replacement for the training center attached to the Muzaffargarh power station. It is confirmed in the survey that the facility has been set up and they conduct training actually. And we are informed that engineers and technicians who participated in training in Japan in this project have been appointed as instructorsin the facility. In Pakistan, the training capabilities of both the training at the power plant (OJT) and the training at the training center (Off-JT) have improved.

Figure 5-2: Muzaffargarh Training Center

- As an extension of this project, in order to further improve the O&M capacity of thermal power plants in GHCL / GENCOs, we provided training materials and equipment to the above-mentioned Muzaffargarh training center and Guddu training center and we trained instructors so that they can conduct training by themselves using those materials and equipment.
  As described in Section 3.3.4 (2), practical training using the materials and equipment provided at each training center has already been conducted, and we believe that this will be greatly contributed to the improvement of O&M training capacity of thermal power plants in Pakistan through expansion of training menu and more effective training using the equipment.
- At the 5th JCC conducted in February 2022, JET explained that it is indispnensable for continuous improvement of O&M training by trainees at thermal power plants not only that engineers, technicians and instructors conduct their activities, but also that management give continuous support and of the human resources development action plan is implemented and continuaouly developed. Since the Pakistani side agrees on this point, we believe that the human resources development action plan will be continuously implemented even after the project is completed.

5.3 Project Evaluation

Joint monitoring activities were conducted periodically with the C/Ps of Pakistani side by using Monitoring Sheets. In this part, evaluatin results are shown in accordance with the five criteria set by the DAC (Development Assistance Committee) Evaluation Criteria, namely (1) relevance, (2) effectiveness, (3) impact, (4) efficiency and (5) sustainability.

5.3.1 Relevance

Relevance is considered “high” for the following reasons.

Priority	➢ In the GENCOs, it is an urgent task to efficiently operate and maintain thermal power generation, which is consistent with the goal of the Project.
Adequacy of Project Approach	➢ As for the approach of the Project, it is appropriate that O&M personnel in leading positions are trained as instructors through O&M training in Japan including practical training, and the trained instructors implement dissemination activities at TPSs. ➢ We gave training materials and equipment to Pakistan's public training facilities (Muzaffargarh TC and Gudddu T C) and trained instructors in order to conduct effective training using the provided materials and equipment in addition to the original project. ➢ These are appropriate approaches to achieve the goals of this project.
Consistency with the Japanese ODA policy	➢ The Project is consistent with Japanese Official Development Assistance (ODA) policy for Pakistan

5.3.2 Effectiveness

Effectiveness is considered “high” for the following reasons.

Achievement of Project Outputs	➢ The Output 1 and 2 are achieved. ➢ With regard to Output 3, although some action plans of some participants has been changed its timing due to the global spread of the COVID-19. However, it is implemented as much as possible after taking measures against infection. So, Output 3 is considered to have been almost achieved because the training was highly evaluated by the participants. ➢ In addition to the initial project, appropriate training equipment were provided to each training center based on the on-site survey in Pakistan, discussions with the management of GHCL / GENCOs, and follow-up surveys to training participants in Japan. Also we trained instructors who are going to conduct trainings using those equipment. ➢ From these view, it can be concluded that this project including additional projects was achieved at a satisfactory level.

Achievement of Project Purpose	➢ It has been confirmed that OJT in Pakistan has been strengthened and improved through the "(1) Implementation of action plans prepared by participant trained in Japan" "(2) Improvement of educational textbooks" described in Section 3.3.4, and it is believed that the project objectives have been achieved. ➢ Furthermore, it has been confirmed that Off-JT was strengthened and improved through "(3) Effective use of training facilities in Pakistan", and it is believed that the project objectives have been achieved. ➢ According to the questionnaire survey, it can be concluded that the implementation of the action plan by the participants improved the O&M performance of TPS and the purpose of the project as a whole was achieved.
Beneficiaries of Project	➢ As of the end of December 2021, a total of 6,414 O&M personnel benefited from this project.This number exceed 4,000 personnel as target of PDM.

5.3.3 Impact

Impact is considered “high” for the following reasons.

Prospect of achieving Overall Goal	➢ It was confirmed that the training capacity for O&M at the target thermal power plants and training centers was improved. In addition, the results of a questionnaire survey of management and trainees show that the O&M performance of TPS has improved, so there is a high possibility that the overall goals will be achieved.
Ripple Effects	➢ The participants not only have implemented training to disseminate the knowledge and skills learned during O&M training in Japan, but have worked on the improvement activities through 4S (Sort, Set in order, Shine and Standardize) activities and TBM (Tool Box Meeting) learned in Japan. The improvement activities have a positive impact on the safety and quality at TPSs.

5.3.4 Efficiency

Efficiency is considered “relatively high” for the following reasons.

Inputs	➢ For Japanese side, due to the worldwide spread of COVID-19, the 4th on-site survey (3rd follow-up survey) and the final survey added to the initial project (on-site training and 4th follow-up survey) were canceled and the dispatch of Japanese experts could not be carried out as planned. However, emails, web conferencing and online training complemented these activities. These activities are appropriate to get the planned output. ➢ For Pakistani side, due to adjustment in advance, the planned number of participants in the 1st Japan training (management) was reduced, the 3rd Japan training (management) was canceled, and the 3rd Japan training (engineer) was

	implemented in a shorter period.
Improvement of Efficiency	➢ Since the Project has been conducted as the same program including other countries, synergistic effects have been able to achieve by laterally applying the activity results of each project. In addition, the efficiency of the Project has been able to improve.

5.3.5 Sustainability

Sustainability is considered "relatively high" for the following aspects.

Policy / Institutional aspect	➢ It is not predicted any policy or institutional change that may affect the sustainability of the Project effects.
Organization aspect	➢ As a change inside of the organization that affects the sustainability of the effects produced by this project, a training center (Muzaffragarh TC) for GENCOs was newly established base on the human resources development action plan formulated by the management. ➢ In the engineer training in GENCOs, engineer is able to acquire the technology which is more specialized to thermal power generation technology by this training center instead of the existing training at WEA. ➢ We confirmed that the organization is trying to sustain and develop this project because engineers and technicians who have taken training in Japan are appointed as instructors in the training center of GENCOs.
Technical aspect	➢ In the trainings in Japan, engineers and technicians made the Action Plans for improvement of the O&M capacity of TPSs. Due to the dissemination of knowledge through the implementation of the Action Plans, basic technical and safety knowledge of the O&M staff of TPSs were enhanced, which lead to reduction in accidents at TPSs, and improvement of O&M quality of the staff of TPSs. ➢ The HRD Action Plan prepared by management includes the items that support, promote and supervise the Action Plans of engineers and technicians, and it is considered that it is essential to implement the HRD Action Plan by management in order to sustainably disseminate the knowledge and skills learned during O&M training in Japan.
Finance and Material aspect	➢ In the GENCOs training center, practical training was limited due to lack of finance and equipment, however based on the on-site surveys, discussions with management, and questionnaire results from participants in training in Japan, We provided necessary training materials and equipment to improve the technical capabilities of GENCOs thermal power plant O&M personnel.

	(For the detaile of the equipment provided by Japan, refer to Annex 8.) ➢ At the same time, we also trained instructors to convey the technology to many O&M personnel by utilizing the materials and equipment provided. And it became possible to continue the training by themselves even after this cooperation was completed.

Chapter 6 Recommendations for achieving upper goals

6.1 Prospects for achieving upper goals

Regarding the upper goal, "Use the acquired technology and skills for the operation and maintenance of GENCOs thermal power plants", we believe that there is a high possibility that the upper goal will be achieved after the project is completed. That is because the trainees will disseminate their knowledge and skills through the implementation of action plans at thermal power plants and the basic technical and safety knowledge of O&M personnel has been strengthened, and moreover the questionnaire results shown in Figure 5-1 confirm that accidents at thermal power plants are reduced and O&M quality in terms of O&M factors are improved.

6.2 Recommendations for achieving upper goals

We summarize the items to be implemented to achieve the upper goals by the Ministry of Energy Power Division (MoE Power Division), which is the supervisory body of this project, and GHCL / GENCOs, which is the implementing body.

(1) Continuous support for action plan implementation by trainees participated in Japanese training and online training

Through three training sessions in Japan and one online training in this project, a total of 56 instructors were trained at each power plant and training center, and action plans were formulated by each trainee and team.

This action plans are activity plan to objectively analyze the actual conditions of thermal power plant O&M in Pakistan through each training including issue analysis, and to lead to better state of the O&M of thermal power plants in Pakistan. Therefore, it is necessary to get the understanding and continuous support not only from the trainees themselves and colleagues, but also from the management and the entire organization.

Through these activities, fostering and developing a culture that trains human resources with the essential skills for the O&M of thermal power plants contributes to the advanced O&M of thermal power plants in Pakistan in the future.

(2) Expansion of training center facilities and menus and implementation of specialized and practical training

In the management training in Japan, sharing the concept of human resource development in Japan and the tour to the actual training facility motivate participants from the management to find out the gap between current situation and ideal state in the area of human resource development in the thermal power plant in Pakistan. And they formulated action plans including replacement of training facility.

Until now, Off-JT training on thermal power generation in Pakistan were conducted for engineers by WEA and for technician by Guddu training center. However, the Muzaffargarh training center was established and started its operation in line with the formulated action plan. And training environment for engineers is developing so that more specialized training in thermal power technology can be carried out in Muzaffargarh rather than the training using the equipment of WEA.

Regarding these activities, the roles required to the training center are to expand the equipment and training menu, including practical training using the demonstration materials and equipment which are provided and implemented in this extension project. And making the trainigs more specialized and practical we believe that it will be possible to train O&M personnel in thermal power plants with higher levels of technology and skills.

(3) Training of instructors in a leadership position

Through on-site surveys and training needs surveys in this project, it was found that there is an urgent need to improve the basic technical capabilities in the area of equipment maintenance at thermal power plants in Pakistan. In the last three trainings in Japan, trainings in “mechanical”,” electricity” and “instrument and control” were conducted in Japan once in each field. And instructors with the basic maintenance technology in each field were trained.

We believe that it will be possible to further improve the O&M capacity of thermal power plants by trainig instructors and assigning appropriate position to them and motivating them to do activities. By doing so, both OJT / OFF-JT will be carried out sustainably by themselves with more advanced and specialized content, including power plant operation technology.

(4) Measurement, monitoring, evaluation and improvement of O & M capacity in thermal power plants

According to the APEC Guideline for Quality Electric Power Infrastructure, it is recommended that the O&M capacity of thermal power plants be evaluated using the indicators shown in Table 6.1.

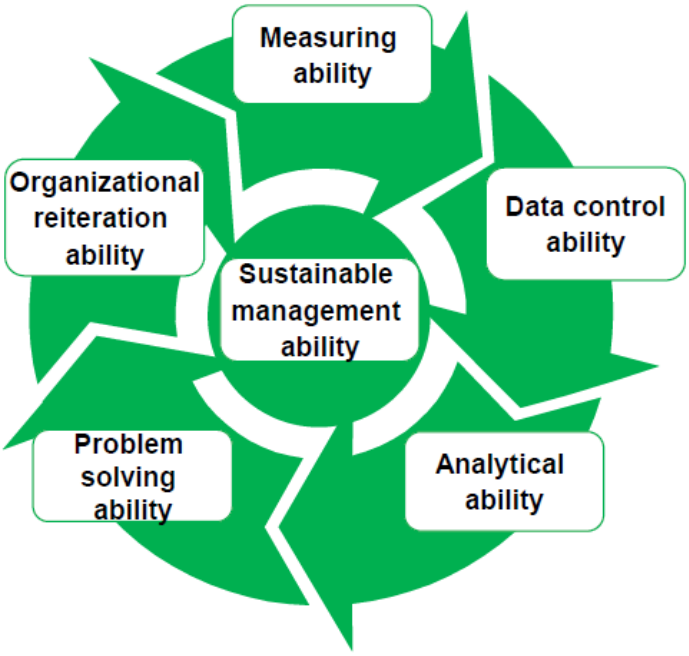
In order to confirm the achievement status of the upper goal of “strengthening the operation and maintenance capacity of thermal power plants”, it is recommended that among the components shown in Table 6.1, ”Suply Stability”, "Ability to smoothly stop and recover" and "Safety" be regularly measured and continuously monitored as those components are relating to effectivenes produced by this project. We hope Pakistani side improve their O&M capabilities by evaluating the achievement status.

Table 6-1: The evaluation components of O&M capabilities in thermal power plants

Components	Performance Indicators of O&M Capabilities
Supply stability	Availability
	Increase of heat rate
	Ability to adjust power supply and demand
Ability to smoothly stop and recover	Forced outage rate(FOR)
	Long-Term FOR
Environmental and social consideration	SOx, NOx discharge rate
	CO_2 emission rate
	Water quality
	Noise / vibration
	Waste recycling rate
	Employment rate from an economy concerned
Safety	Number of casualties caused by industrial accidents
Life Cycle Cost(LCC)	LCC considering all other five components

Source: JET based on APEC quality power infrastructure guidelines

In addition, according to APEC Guideline for Quality Electric Power Infrastructure, in order to improve and strengthen O&M capabilities in thermal power plants, a management cycle called "Self-Elevating Mechanism for Sustainable Operation and Management Practice" (refer to Figure 6-1) is recommended to adopt. In the MoE Power Division and GHCL / GENCOs, we think it is necessary to realize the six requirements (refer to Table 6-2) that make up this management cycle for the achievement of the upper goals.



Source: APEC Guideline for Quality ElectricPower Infrastructure

Figure 6-1 Self-Elevating Mechanism for Sustainable Operation and Management Practice

Table 6-2 Self-Elevating Mechanism for Sustainable Operation and Management Practice

Requirements	Definition
Measuring ability	Ability to measure and collect data
Data control ability	Ability to comprehensively record, manage and store data
Analytical ability	Ability to identify problems through comprehensive consideration and interpretation of the collected data
Problem solving ability	Ability to identify and solve causes of unexpected problems/risk factors through use of analytical data
Organizational reiteration ability	Ability to reiterate the entire process from measuring data to problem-solving
Sustainable management ability	Ability to design an organization and other factors which maximizes the quality of electric power infrastructure

Source: APEC Guideline for Quality ElectricPower Infrastructure

Annex

Annex 1

Record of Discussions (R/D) and Minutes of Meeting

(1) Record of Discussions (R/D)

Section Officer (Japan)
Phone: 051-9201805
Fax: 051-9104016

No. 4(409)Japan-I/2016
Government of Pakistan
Ministry of Finance, Revenue, Economic Affairs,
Statistics and Privatization
(Economic Affairs Division)

Islamabad the May 22, 2017

Subject: **Record of Discussion (R/D) for the Project for Capacity Building and Strengthening of Thermal Power Generation Operation & Maintenance.**

Dear Mr. Imran Ahmed,

This is with reference to JICA, Pakistan Office's letter No. JICA/May/22001/Project/2017 dated May 22, 2017 on the above subject.

2. The requisite four original sets of Record of Discussions duly signed by the Joint Secretary (Japan) are enclosed for your information / further necessary action. One set has been retained in EAD.

Yours sincerely,

(Yasmeen Sadiq)

Mr. Imran Ahmed,
Team Leader Energy /
Sr. Programme Officer
JICA Pakistan Office,
Islamabad.

RECEIVED
22 MAY 2017
BY:

RECORD OF DISCUSSIONS
ON
THE PROJECT FOR CAPACITY BUILDING AND STRENGTHENING OF THERMAL POWER GENERATION OPERATION AND MAINTENANCE
IN
THE ISLAMIC REPUBLIC OF PAKISTAN

AGREED UPON BETWEEN

MINISTRY OF WATER AND POWER
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

Islamabad, Date: 22 May 2017

Yasuhiro Tojo
Chief Representative
JICA Pakistan

Syed Mujtaba Hussain
Joint Secretary
Economic Affairs
Division, Ministry of
Finance, Revenue,
Economic Affairs,
Statistics and
Privatization

Zafar Abbas
Joint Secretary
(Transmission)
Ministry of Water and
Power

Badr-ul-Munir Murtiza
Member (Power)
WAPDA

Muhammad Imran
Chief Executive Officer
GENCO Holdings Company

In response to the official request of the Government of the Islamic Republic of Pakistan (hereinafter referred to as "GOP") to the Government of Japan (hereinafter referred to as "GOJ"), the Japan International Cooperation Agency (hereinafter referred to as "JICA") held a series of discussions with Ministry of Water and Power of GOP (hereinafter referred to as "MOWP") and relevant organizations to develop a detailed plan of the Project for Capacity Building and Strengthening of Thermal Power Generation Operation and Maintenance (hereinafter referred to as "the Project").

Both parties agreed the details of the Project and the main points discussed as described in the Appendix 1 and the Appendix 2 respectively.

Both parties also agreed that WAPDA Engineering Academy (hereinafter referred to as "WEA") and GENCO Holdings Company Ltd (hereinafter referred to as "GHCL"), the counterpart to JICA, will be responsible for the implementation of the Project in cooperation with JICA, coordinate with other relevant organizations and ensure that the self-reliant operation of the Project is sustained during and after the implementation period in order to contribute toward social and economic development of the Islamic Republic of Pakistan (hereinafter referred to as "Pakistan").

The Project will be implemented within the framework of the Agreement on Technical Cooperation signed on April 30, 2005 (hereinafter referred to as "the Agreement") and the Note Verbales exchanged on April 20, 2015 between the GOJ and GOP.

The effectiveness of the record of discussions is subject to the approval of JICA.

Appendix 1: Project Description
Appendix 2: Main Points Discussed

Appendix 1

PROJECT DESCRIPTION

I. BACKGROUND

The power plant facilities capacity in Pakistan as of 2014 were hydropower 28.4 % (7,097 MW), thermal power 68.0 % (16,963 MW), nuclear power 3.2 % (787 MW) and wind power 0.4 % (106 MW).

On the other hand, the supply capacity, due to the circular debt, in 2013/2014 was 16,170 MW while the peak demand was 20,576 MW, and forced outages were frequently occurred. Since industry development in addition to the domestic consumers' need is inhibited, the sufficient power supply is essential for the improvement of living standard as well as economic development.

According to National Power System Expansion Plan 2011 - 2030, the disused facilities caused by the deterioration are predicted to reach 6,935 MW by 2030, and the annual electric energy production will be reduced by 30,400 GWh. As such, new power plant facilities construction of 98.1 GW is assumed, including the new construction of thermal power plant facilities. Along with the enhancement of these thermal power plants and the up-gradation, the development of operation and maintenance (hereinafter referred to as "O&M") personnel of thermal power stations also has become an urgent issue. The capacity development of electric power generation in Pakistan is carried out by WAPDA Engineering Academy (hereinafter referred to as "WEA") Faisalabad and GENCO Holdings Company Ltd. (hereinafter referred to as "GHCL"), but the contents are mainly On-the-Job Training (OJT) at each power station, and there are not comprehensive courses that train O&M personnel for thermal power stations. Therefore, the O&M training specifically targeting technicians/ engineers, who are engaging in operating thermal power station is necessary. In this context, technical cooperation for setting up trainings as well as instructors training is essential for effective/efficient thermal power station operation in Pakistan.

II. OUTLINE OF THE PROJECT

Details of the Project are described in the【Logical Framework (Project Design Matrix: PDM) (Annex 1) and the Plan of Operation (Annex 2).】

1. Input
   (1) Input by JICA
   (a) Training
   Training in Japan on O&M of thermal power stations including advanced environmental practices in Japan for instructors who will conduct trainings as well as OJT at WEA and thermal power stations under Generation Company I to IV (hereinafter referred to as "GENCOs")
   (b) Dispatch of Experts
   - Chief Advisor/Thermal Power Generation Maintenance
   - Thermal Power Generation Operation
   - Training Planning
   (c) Equipment such as inspection tools, if any

(2) Input by MOWP

MOWP will take necessary measures to provide at its own expense:

(a) Services of MOWP's counterpart personnel and administrative personnel as referred to in II-2;
(b) Suitable office space with necessary equipment;
(c) Supply or replacement of machinery, equipment, instruments, vehicles, tools, spare parts and any other materials necessary for the implementation of the Project;
(d) Information as well as support in obtaining medical service;
(e) Credentials or identification cards, if necessary;
(f) Available data (including maps and photographs) and information related to the Project;
(g) Running expenses necessary for the implementation of the Project;
(h) Expenses necessary for transportation within Pakistan of the equipment, if any, referred to in II-1 (1) as well as for the installation, operation and maintenance thereof; and
(i) Necessary facilities to the JICA experts for the remittance as well as utilization of the funds introduced into Pakistan from Japan in connection with the implementation of the Project

2. Implementation Structure

The project organization chart is given in the Annex 3. The roles and assignments of relevant organizations are as follows:

(1) MOWP

(a) Project Chairperson

Joint Secretary (Transmission) of MOWP will be the Project Chairperson who supervises overall implementation of the Project in consultation with CEO, GHCL and Member (Power), WAPDA.

(b) Project Director

Principal of WEA under General Manager (Training) WAPDA and Chief Engineer of GHCL will be the Project Director who is responsible for overall administration and implementation of the Project.

(c) Project Manager

Additional Director General of WEA and Additional DG/Director of GHCL will be the Project Manager who is responsible for managerial and technical matters as well as coordination of the Project.

(2) JICA Experts

The JICA experts will give necessary technical guidance, advice and recommendations to MOWP on any matters pertaining to the implementation of the Project.

(3) Joint Coordinating Committee

Joint Coordinating Committee (hereinafter referred to as "JCC") will be established in order to facilitate inter-organizational coordination. JCC will be held at least once a year and whenever deems it necessary. JCC will review the progress, revise the overall plan when necessary, approve an

annual work plan, conduct evaluation of the Project, and exchange opinions on major issues that arise during the implementation of the Project. A list of proposed members of JCC is shown in the Annex 4.

3. Project Site(s) and Beneficiaries

(1) Project Site:

WEA in Faisalabad and GENCOs' thermal power stations in Jamshoro, Guddu, Muzaffargarh, Lakhra, Nandipur, etc

JICA Experts' entry to the Project sites comply with the security regulation of JICA.

(2) Beneficiaries:

O&M instructors of WEA and GENCOs and their trainees

4. Duration

Three (3) years from the first arrival of JICA expert (s)

5. Reports

MOWP and JICA experts will jointly prepare the following reports in English.

(1) Monitoring Sheet on annual basis until the project termination

(2) Project Completion Report one (1) month before the termination of the Project

6. Environmental and Social Considerations

MOWP will abide by 'JICA Guidelines for Environmental and Social Considerations (April 2010)' in order to ensure that appropriate considerations will be made for the environmental and social impacts of the Project.

III. UNDERTAKINGS OF MOWP

1. MOWP will take necessary measures to:

(1) ensure that the technologies and knowledge acquired by the Pakistan nationals as a result of Japanese technical cooperation contributes to the economic and social development of Pakistan, and that the knowledge and experience acquired by the personnel of Pakistan from technical training as well as the equipment provided, if any, by JICA will be utilized effectively in the implementation of the Project; and

(2) grant privileges, exemptions and benefits to the JICA experts referred to in II-1 above and their families, which are no less favorable than those granted to experts and members of the missions and their families of third countries or international organizations performing similar missions in Pakistan.

(3) provide security-related information as well as measures to ensure the safety of the JICA experts／members of the JICA missions;

(4) permit the JICA experts to enter, leave and sojourn in Pakistan for the

duration of their assignments therein and exempt them from foreign registration requirements and consular fees.

(5) exempt the JICA experts from taxes and any other charges on the equipment, machinery and other material necessary for the implementation of the Project;

(6) exempt the JICA experts from income tax and charges of any kind imposed on or in connection with any emoluments or allowances paid to them and/or remitted to them from abroad for their services in connection with the implementation of the Project; and

(7) meet taxes and any other charges on the equipment and other material, if any, referred to in II-1 (1) above, necessary for the implementation of the Project.

2. GOP will bear claims, if any arises, against the JICA experts resulting from, occurring in the course of, or otherwise connected with, the discharge of their duties in the implementation of the Project, except when such claims arise from gross negligence or willful misconduct on the part of the JICA experts.

IV. MONITORING AND EVALUATION

JICA and MOWP will jointly and regularly monitor the progress of the Project through the Monitoring Sheets based on the Project Design Matrix (PDM) and Plan of Operation (PO). The Monitoring Sheets will be reviewed every one (1) year.
Also, Project Completion Report will be compiled one (1) month before the termination of the Project.

1. Ex-post evaluation three (3) years after the project completion, in principle
2. Follow-up surveys on necessity basis

V. PROMOTION OF PUBLIC SUPPORT

For the purpose of promoting support for the Project, MOWP will take appropriate measures to make the Project widely known to the people of Pakistan.

VI. MISCONDUCT

If JICA receives information related to suspected corrupt or fraudulent practices in the implementation of the Project, MOWP and relevant organizations will provide JICA with such information as JICA may reasonably request, including information related to any concerned official of the government and/or public organizations of the Pakistan.
MOWP and relevant organizations will not, unfairly or unfavorably treat the person and/or company which provided the information related to suspected corrupt or fraudulent practices in the implementation of the Project.

VII. MUTUAL CONSULTATION

JICA and MOWP will consult each other whenever any major issues arise in the course of Project implementation.

VIII. AMENDMENTS

The record of discussions may be amended by the minutes of meetings between JICA and MOWP. However, PO may be amended in the Monitoring Sheets.
The minutes of meetings will be signed by authorized persons of each side who may be different from the signers of the record of discussions.

Annex 1 Logical Framework (Project Design Matrix: PDM)
Annex 2 Tentative Plan of Operation
Annex 3 Project Organization Chart
Annex 4 A List of Proposed Members of Joint Coordinating Committee/ Steering Committee

Appendix 2

MAIN POINTS DISCUSSED

1. Both sides agreed that the target of the Project is Operation and Maintenance (hereinafter referred to as "O&M") of Conventional type thermal power generation (Gas, Coal and Oil), Gas Turbine and Combined Cycle power generation including advanced environmental practices in Japan, and the target group is in-house O&M instructors who will conduct trainings at WEA as well as OJT and thermal power stations under Generation Company I to IV (hereinafter referred to as "GENCOs").

2. Both sides confirmed that the main training will be conducted in Japan by Japanese trainers and On-the-Job Training (OJT) at each GENCOs' thermal power station as well as trainings at WEA will be conducted in Pakistan by instructors who participated in the trainings in Japan.
   Pakistan side requested the Team that, at the conclusion of each training, GHCL/GENCOs top management also be invited in the concluding sessions to get briefing on the training received by the participants. The Team agreed to consider it.

3. MOWP explained that MOWP will coordinate between WAPDA and GHCL towards the achievement of the Project Purpose on the PDM, and if necessary, will adjust the interests among them.

4. Both sides agreed that WEA and GHCL will nominate candidates for instructor based on criteria prepared by the Project and JICA and Experts will make the selection by conducting screenings.

5. Both sides agreed that WEA and GENCOs will make a necessary arrangement to secure Action Plans to be implemented based on the Project Design Matrix attached in the R/D.

6. WAPDA and GHCL agreed to take possible measures to secure the sustainability of the Project such as the arrangement of attractive incentive to instructors.

7. Both sides agreed that operational costs such as daily allowance, accommodation and travel cost etc. in Pakistan will be provided by WEA and GENCOs for their own personnel.

8. Since WAPDA has the role of conducting trainings for generation and will continue trainings for GENCOs, WAPDA requested GHCL to fill up the vacant posts of generation instructors at WEA at the earliest or allow WAPDA to recruit instructors from open market.

9. WAPDA raised the issue that training facilities at WEA should be upgraded to disseminate obtained knowledge and technical skills to GENCOs and requested up-gradation of existing equipment like simulators, PLC (program

logical control) etc.. JICA explained that it is difficult to mobilize training facilities within the Project; however concrete needs would be specified through the implementation of the Project for the future up-gradation of WEA by WAPDA/GHCL.

10. Details of the training in Japan will be determined by JICA and Experts based on the result of the detailed planning survey conducted in 2016.

END

Project Design Matrix

Project Title: Project for Capacity Building and Strengthening of Thermal Power Generation Operation and Maintenance

Version No. 0

Dated November, 2016

Implementing Agency: WAPDA Engineering Academy (WEA) and GENCO Holding Company Ltd.(GHCL)

Target Group: In-house O&M Instructors who will conduct trainings as well as On-the-Job Training (OJT) at WEA and GENCOs

Period of Project: June 2017 - May 2020

Project Site: WEA in Faisalabad and GENCOs' thermal power stations in Jamshoro, Guddu, Muzaffargarh, Lakhra etc.

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	Achievement	Remarks
Overall Goal Technology and technical skills obtained by the Project are utilized in actual O&M at GENCOs power stations.	- Number of GENCOs power stations which utilize obtained technology and technical skills.	- Questionnaire to WEA and GENCOs			
Project Purpose Training Capacity on Operation and Maintenance (O&M) of WEA and GENCOs is strengthened.	- More than XX% of GENCO power stations implement trainings (OJTs) based on the Action Plan prepared by trained instructors. - Improvement of WEA training contents based on the Action Plan developed by trained instructors.	- Project Monitoring Sheet - Modified WEA training contents - Interview	- Trained instructors will not resign and/or transfer outside of WEA and GENCOs.		
Outputs 1. Current situation of O&M of thermal power stations is analyzed and training needs are identified.	- Training needs are compiled based on the current situation.	- Project Monitoring Sheet			
2. Capacity of WEA and GENCOs' Instructors is enhanced.	- Training program is formulated based on the training needs. - Total number of trained instructors - Total number of Training in Japan	- Project Monitoring Sheet	- Trained instructors continue to work for WEA and GENCOs during the project period.		
3. Trainings as well as On-the-Job Training (OJT) at WEA and GENCOs are improved.	- Achievement level of Action Plans developed by trained instructors. - The results of checklists.	- Project Monitoring Sheet - Progress report of each Action Plan - Checklist			

Activities	Inputs		Important Assumption
	The Japanese Side	**The Pakistan Side**	
1-1 To analyze the current situation of O&M at thermal power stations. 1-2 To review the training system of thermal power generation, and analyze the current situation and issues of O&M personnel. 1-3 To specify the training needs.	a. Training in Japan Training in Japan on O&M of thermal power stations. b. Experts - Chief Advisor / Thermal Power Generation Maintenance - Thermal Power Generation Operation - Training Planning c. Equipment such as inspection tools, if necessary	a. Assignment of Counterpart personnel - Project Chairperson - Project Director - Project Manager - Project Coordinator - Counterpart members b. Office space and necessary facilities for Japanese experts c. Other operational cost	
2-1 To set the target O&M skills that instructors and potential instructors should obtain. 2-2 To formulate the program of Training in Japan for instructors. 2-3 To set selection criteria for the Training in Japan. 2-4 To conduct Trainings in Japan. 2-5 To modify the contents of Training in Japan as necessary based on feedbacks of trainings at WEA and GENCOs' thermal power stations (OJTs) in Pakistan.			**Pre-Conditions**
3-1 To develop Action Plans of trainings (OJTs) for O&M of thermal power stations. 3-2 To disseminate obtained knowledge and technical skills to O&M personnel based on the Action Plans and verify the skilled up level by checklist developed at the above 2-4. 3-3 To review the results of Action Plans to improve the trainings at WEA and GENCOs' thermal power stations (OJTs) in Pakistan.			**<Issues and countermeasures>**

Plan of Operation

別紙3

Dated ●●,●●,●●

Project Title: Project for Capacity Building and Strengthening of Thermal power Generation Operation and Maintenance

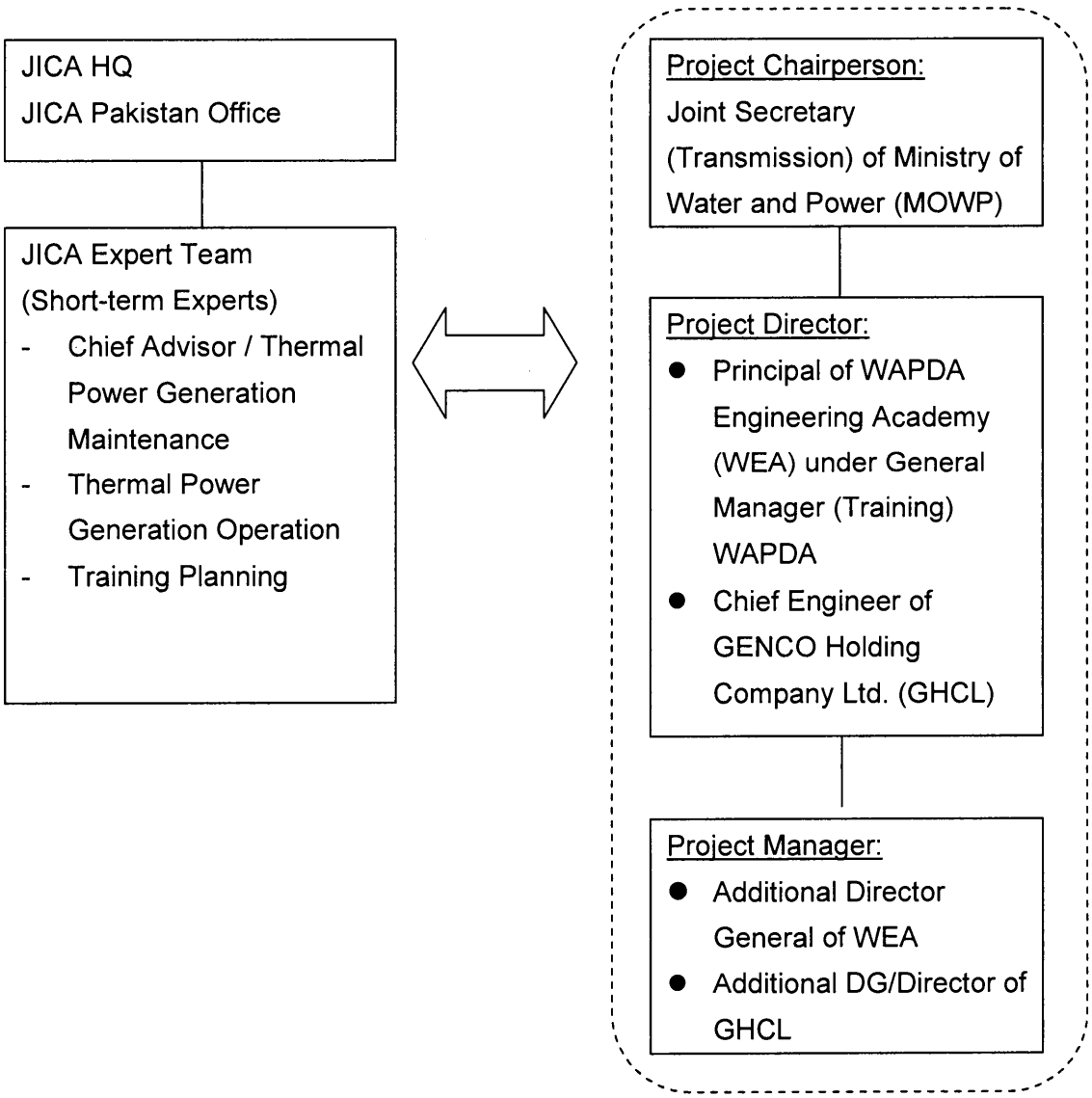
Inputs	Plan/Actual	2016 I	2016 II	2016 III	2016 IV	2017 I	2017 II	2017 III	2017 IV	2018 I	2018 II	2018 III	2018 IV	2019 I	2019 II	2019 III	2019 IV	2020 I	2020 II	2020 III	2020 IV	2021 I	2021 II	2021 III	2021 IV	2022 I	2022 II	2022 III	2022 IV	Remarks	Monitoring: Issue	Monitoring: Solution
Expert																																
Chief Advisor	Plan																															
	Actual																															
Other Experts	Plan																															
	Actual																															
	Plan																															
	Actual																															
	Plan																															
	Actual																															
Equipment																																
Necessary Equipment if any	Plan																															
	Actual																															
	Plan																															
	Actual																															
Training in Japan																																
Training on O&M of thermal power stations	Plan									■				■				■														
	Actual																															
In-country/Third country Training																																
	Plan																															
	Actual																															

To be assigned by JICA

Activities / Sub-Activities	Plan/Actual	2016 I	2016 II	2016 III	2016 IV	2017 I	2017 II	2017 III	2017 IV	2018 I	2018 II	2018 III	2018 IV	2019 I	2019 II	2019 III	2019 IV	2020 I	2020 II	2020 III	2020 IV	2021 I	2021 II	2021 III	2021 IV	2022 I	2022 II	2022 III	2022 IV	Responsible Organization: Japan	Responsible Organization: GO●●	Achievements	Issue & Countermeasures
Output 1: Current situation of O&M of thermal power stations is analyzed and training needs are identified.																																	
1.1 To analyze the current situation of O&M at thermal power stations.	Plan					■																											
	Actual																																
1.1.1	Plan																																
	Actual																																
1.1.2	Plan																																
	Actual																																
1.2 To review the training system of thermal power generation, and analyze the current situation and issues of O&M personnel.	Plan					■																											
	Actual																																
1.2.1	Plan																																
	Actual																																
1.2.2	Plan																																
	Actual																																
1.3 To specify the training needs.	Plan					■																											
	Actual																																
1.3.1	Plan																																
	Actual																																
1.3.2	Plan																																
	Actual																																
Output 2: Capacity of WEA and GENCOs' Instructors is enhanced.																																	
2.1 To set the target O&M skills that instructors and potential instructors should obtain.	Plan					■																											
	Actual																																
2.1.1	Plan																																
	Actual																																
2.1.2	Plan																																
	Actual																																
2.2 To formulate the program of Training in Japan for instructors.	Plan					■				■				■																			
	Actual																																
2.2.1	Plan																																
	Actual																																
2.2.2	Plan																																
	Actual																																
2.3 To set selection criteria for the Training in Japan.	Plan						■				■				■																		
	Actual																																
2.3.1	Plan																																
	Actual																																
2.3.2	Plan																																
	Actual																																
2.4 To conduct Trainings in Japan.	Plan							■		■		■		■		■		■															
	Actual																																
2.4.1	Plan																																
	Actual																																
2.4.2	Plan																																
	Actual																																
2.5 To modify the contents of Training in Japan as necessary based on feedbacks of trainings at WEA and GENCOs' thermal power stations (OJTs) in Pakistan.	Plan										■				■																	
	Actual																																
2.5.1	Plan																																
	Actual																																
2.5.2	Plan																																
	Actual																																
Output 3: Trainings as well as On-the-Job Training (OJT) at WEA and GENCOs are improved.																																	
3.1 To develop Action Plans of trainings (OJTs) for O&M of thermal power stations.	Plan														■				■													
	Actual																																
3.1.1	Plan																																
	Actual																																
3.1.2	Plan																																
	Actual																																
3.2 To disseminate obtained knowledge and technical skills to O&M personnel based on the Action Plans and verify the skilled up level by checklist developed at the above 2-4.	Plan										■	■	■	■	■	■	■	■	■	■	■											
	Actual																																
3.2.1	Plan																																
	Actual																																
3.2.2	Plan																																
	Actual																																
3.3 To review the results of Action Plans to improve the trainings at WEA and GENCOs' thermal power stations (OJTs) in Pakistan.	Plan										■				■				■													
	Actual																																
3.3.1	Plan																																
	Actual																																
3.3.2	Plan																																
	Actual																																
Duration / Phasing	Plan					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■												
	Actual																																

Monitoring Plan	Plan/Actual	2016 I	2016 II	2016 III	2016 IV	2017 I	2017 II	2017 III	2017 IV	2018 I	2018 II	2018 III	2018 IV	2019 I	2019 II	2019 III	2019 IV	2020 I	2020 II	2020 III	2020 IV	2021 I	2021 II	2021 III	2021 IV	2022 I	2022 II	2022 III	2022 IV	Remarks	Issue	Solution
Monitoring																																
Joint Coordination Committee	Plan					■				■				■				■														
	Actual																															
Set-up the Detailed Plan of Operation	Plan					■																										
	Actual																															
Submission of Monitoring Sheet	Plan									■				■																		
	Actual																															
Reports/Documents																																
	Plan																															
	Actual																															
Project Completion Report	Plan																				■											
	Actual																															
Public Relations																																
	Plan																															
	Actual																															
	Plan																															
	Actual																															

Annex 3 Project Organization Chart



Annex 4 Proposed members of Joint Coordinating Committee

1. Functions

The Joint Coordinating Committee (JCC) will be held at least once a year or whenever necessity arises. The functions of the JCC are as follows;

(1) To supervise the annual work plan of the project in line with the Plan of Operation.

(2) To review the annual and overall progress of the project and to evaluate the accomplishment of the annual targets an achievement of the objectives.

(3) To find out proper ways and means for solution of the major issues arising from or in connection with the project.

2. Composition of the Committee

(1) Chairperson:

Joint Secretary (Transmission) of Ministry of Water and Power (MOWP)

(2) Members:

a. Pakistan side

- Project Directors
- Project Managers
- Other concerned member(s) of WAPDA Engineering Academy (WEA) and GENCO Holdings Company Ltd. (GHCL)

b. Japanese side

- Short-term Visiting Experts
- Representative(s) of JICA Pakistan Office
- Other concerned member(s) of JICA

Note: Official(s) of the Embassy of Japan may attend the JCC as observer(s). Other staff of related department of MOWP and relevant Ministry(s) may be invited upon mutual consent by both sides, when necessary.

(2) Minutes of Meeting for Amendment of R/D

No. 4(409)Japan-I/2016

Government of Pakistan
Ministry of Economic Affairs
******

Section Officer (Japan)
Phone: 051-9201805
Fax: 051-9104016

Islamabad the October 5, 2020

Subject: **Minutes of Meeting (MoM) for Amendment in the Record of Discussion (R/D) for the Project for Capacity Building and Strengthening of Thermal Power Generation Operation & Maintenance.**

Dear Mr. Ahmed,

This is with reference to your email dated September 3, 2020 on the above subject.

2. Please find enclosed copy of amendment of the Record of Discussions, for "The Project for Capacity Building and Strengthening of Thermal Power Generation Operation & Maintenance" duly signed by Joint Secretary (Japan), Ministry of Economic Affairs, for necessary action.

Yours sincerely,

(Muhammad Muddasser Ahmed)

Mr. Imran Ahmed,
Team Leader Energy /
Sr. Programme Officer
JICA Pakistan Office,
Islamabad.

MINUTES OF MEETINGS
BETWEEN
JAPAN INTERNATIONAL COOPERATION AGENCY
AND
MINISTRY OF ENERGY (POWER DIVISION) OF THE ISLAMIC REPUBLIC OF PAKISTAN
AND
GENCO HOLDING COMPANY LIMITED
FOR AMENDMENT OF THE RECORD OF DISCUSSIONS
ON
THE PROJECT FOR CAPACITY BUILDING AND STRENGTHENING OF THERMAL POWER GENERATION OPERATION & MAINTENANCE

The Japan International Cooperation Agency (hereinafter referred to as "JICA"), Ministry of Energy (Power Division) of the Islamic Republic of Pakistan (hereinafter referred to as "MOE") and GENCO Holding Company Limited (hereinafter referred to as "GHCL"), which is the main counterpart of the Project hereby agree that the Record of Discussions on The Project for Capacity Building & Strengthening of Thermal power Generation Operation & Maintenance signed on 22nd May, 2017 will be amended as follows;

1. Overall

Before	Amended Version
WAPDA Engineering Academy (hereinafter referred to as "WEA") and GENCO Holdings Company Ltd (hereinafter referred to as "GHCL"), the counterpart to JICA, will be responsible for the implementation of the Project in cooperation with JICA	GENCO Holding Company Limited (hereinafter referred to as "GHCL"), the counterpart to JICA, will be responsible for the implementation of the Project in cooperation with JICA
Reason: Due to continuing development of GENCOs' Training Centers, sufficient capacity has been established to carry out trainings related to thermal power plants at these Training Centers. Consequently, trainings of thermal power plants' personnel from WEA Faisalabad has been seized/discontinued by GENCOs.	

2. Duration of the Project

Before	Amended Version
Appendix 1 II. 4. Duration Three (3) years from the first arrival of JICA expert(s)	Appendix 1 II. 4. Duration Four (4) years and four (4) month from the first arrival of JICA expert(s)
Reason: In order to secure sufficient time to develop GENCOs' training abilities by using the equipment (Vibration analysis demonstrator, Non-destructive inspection demonstrator) to be provided under this project, the duration need to be extended by above period.	

The parties acknowledge and agree that this Minutes of Meetings may be executed by

02.10.2020

30/06/2020

electronic signature, which is considered as an original signature for all purposes and has the same force and effect as an original signature. "Electronic signature" includes faxed versions of an original signature or electronically scanned and transmitted versions (e.g., via pdf) of an original signature.

This amendment will become effective as of the signature date.

Annex 1 : Record of Discussions (signed on 22nd May, 2017)

Islamabad, (02 / 10 / 2020

FURUTA Shigeki
Chief Representative
JICA Pakistan

Economic Affairs Division,
Ministry of Economic Affairs

Abbas

Zafar Abbas
Joint Secretary
Ministry of Energy (Power Division)

Muhammad Imran 30/06/2020
Chief Executive Officer
GENCO Holding Company Limited

Annex 2

Record of Dispatched JICA Short-term Experts

Record of Dispatched JICA Short-term Experts

JICA Short-term experts who engaged in this Project, their dispatch periods and assigned period (MM) (Activity in Pakistan) are as follows.

Expert Title / Responsibility	Name	Dispatch periods to Pakistan (Travelling days to/ from Pakistan are included.)	Assigned period (M/M)
Chief Adviser / Thermal power generation (Operation & Maintenance)	Hiroki Hirahata	12th Nov. - 25th Nov. 2017 (14 days) 2nd Sep. - 15th Sep. 2018 (14 days) 30th Sep. - 12th Oct. 2019 (13 days)	1.37
Thermal power generation (Operation & Maintenance)	Tooru Kawai	12th Nov. - 25th Nov. 2017 (14 days)	0.47
	Akira Kozakai	30th Sep. - 12th Oct. 2019 (13 days)	0.43
Thermal power generation (Mechanical Maintenance)	Shigeru Yoshitake	2nd Sep. - 15th Sep. 2018 (14 days)	0.47
	Yoshihiro Doi	12th Nov. - 25th Nov. 2017 (14 days) 2nd Sep. - 15th Sep. 2018 (14 days) 30th Sep. - 12th Oct. 2019 (13 days)	1.37
Thermal power generation (Electrical Maintenance)	Haruaki Furukawa	12th Nov. - 25th Nov. 2017 (14 days) 2nd Sep. - 15th Sep. 2018 (14 days)	0.93
	Hidenobu Ichioka	30th Sep. - 12th Oct. 2019 (13 days)	0.43
Thermal power generation (Control & Instrumentation Maintenance)	Yuuki Obe	12th Nov. - 25th Nov. 2017 (14 days) 2nd Sep. - 15th Sep. 2018 (14 days) 30th Sep. - 12th Oct. 2019 (13 days)	1.37
		(Total)	**6.84**

Annex 3

Records of the Joint Coordination Committee (JCC)

(1) Minutes of Meeting for the 1st JCC

MINUTES OF MEETING
FOR
THE FIRST JOINT COORDINATION COMMITTEE (JCC)
ON
THE PROJECT FOR CAPACITY BUILDING AND STRENGTHENING OF THERMAL POWER GENERATION OPERATION & MAINTENANCE
BETWEEN
JAPAN INTERNATIONAL COOPERATION AGENCY
AND
THE ISLAMIC REPUBLIC OF PAKISTAN

Japan International Cooperation Agency (hereinafter referred to as "JICA") and the Ministry of Energy (Power Division) of the Government of the Islamic Republic of Pakistan (hereinafter referred to as "MOE") and relevant organizations established a Joint Coordination Committee (hereinafter referred to as "JCC") for the effective and successful implementation of the Project for Capacity Building and Strengthening of Thermal Power Generation Operation and Maintenance (hereinafter referred to as "the Project").

The first JCC on the Project was held on 24th November 2017, at GENCO Holding Company, Ltd. (hereinafter referred to as "GHCL"), Islamabad. As a result of discussions on the 1st JCC Meeting, the Japanese side and the Pakistan side have confirmed the main items described in Annex.

Islamabad, 24th November, 2017

小笠原健二 for

Yoshihisa Onoe
Senior Representative
JICA Pakistan office

Zafar Abbas
Joint Secretary (Transmission)
MOE

平畑 弘樹

Hiroki Hirahata
Chief Advisor
JICA Expert Team

Muhammad Imran
Chief Executive Officer
GENCO Holding Company, Ltd

Muhammad Khalid
Additional Director General
GENCO Holding Company, Ltd

Riffat Ara Qureshi
General Manager (Training)
Water and Power Development Authority

ANNEX

1. Project Organization

(1) Delegation of Authority

The both sides confirmed that role and responsibility held by the Ministry of Water and Power (hereinafter referred to as "MOWP") at the time of signing of the Record of Discussion dated 22nd May, 2017(hereinafter referred to as "RD"), has been transferred to MOE. MOE shall bear and implement all undertakings of MOWP which has been confirmed by the both sides on RD.

(2) Formation of JCC

Based on RD, JCC was established in order to facilitate inter-organizational coordination. JCC will be held at least once a year and whenever deems it necessary. JCC with the following structure in accordance with RD, will review the progress, revise the overall plan when necessary, approve an annual work plan, conduct evaluation of the Project, and exchange opinions on major issues that arise during the implementation of the Project.

a. Chairperson:

Joint Secretary (Transmission) of MOE is the Project Chairperson who supervises overall implementation of the Project in consultation with CEO, GHCL and Member (Power), Water and Power Development Authority (hereinafter referred to as "WAPDA").

b. Members:

(a) Pakistan side

- Project Directors

  Principal of WAPDA Engineering Academy (hereinafter referred to as "WEA") under General Manager (Training) WAPDA, and Additional Director General of GHCL are the Project Directors who are responsible for overall administration and implementation of the Project.

- Project Managers

  Additional Director General of WEA, and Additional Director of GHCL are the Project Managers who are responsible for managerial and technical matters as well as coordination of the Project.

- Other concerned member(s) of WEA and GHCL.

(b) Japanese side

- Short-term Visiting Experts (KANSAI)
- Representative(s) of JICA Pakistan Office
- Other concerned member(s) of JICA

(3) Functions of JCC

The functions of the JCC are as follows;

a. To supervise the annual work plan of the project in line with the Plan of Operation.
b. To review the annual and overall progress of the project and to evaluate

the accomplishment of the annual targets and achievement of the objectives.

c. To find out proper ways and means for solution of the major issues arising from or in connection with the project.

2. Project Outline

(1) Work Plan

The JICA Expert Team has explained the scope of works, overall schedule and the activities to be conducted in the project based on Attachment 3. The JICA Experts Team requested close collaboration from the Pakistan side for the implementation of project activities, including nomination of training candidates, implementation and monitoring of Action Plans, support for follow up survey by the Team, and organizing of the JCC, which is to be held at least once a year during the project period.

The Pakistan side acknowledged the contents of the explanation and the request from the JICA Expert Team, and agreed the plan in principle.

(2) Project Activities

The both sides confirmed that the activities to be implemented under the Project include training courses in Japan, and also follow up of action plans to be formulated during training in Japan by the participants. The details of each activity are explained below.

(3) Roles and Duties of Human Resource Development

The both sides confirmed the roles and duties of each organization of Pakistan side on human resource development related to operation and maintenance (hereinafter referred to as "O&M") of thermal power stations (hereinafter referred to as "TPS") are as follow;

- MOE: Overall supervision
- WEA (WAPDA): To conduct Off-JT mainly for engineers
- Guddu Training Center: To conduct Off-JT mainly for technicians
- GENCOs: To hold on-site trainings including OJT in each TPS.

3. Result of the First Mission

(1) Outline of the Mission

The JICA Expert Team implemented its first mission on Pakistan from 13th to 24th November 2017 started by the kickoff meeting held in Lahore on 14th November, to collect data and information on current situation of O&M in TPS. The JICA Expert Team made a brief explanation of analysis on current situation based on Attachment 3. Further analysis shall be done based on close examination of the answers for the questionnaires attained through the mission, and shall be provided in the form of the baseline survey report within 3 month after the first mission.

(2) Major Facing Issues

The JICA Expert Team explained its observations on major facing issues on O&M of public TPS in Pakistan as follow. Pakistan side took note of it.

- Enhancement of Health Safety and Environment, especially safety
- Development of original rules and manuals based on Total Quality

Management (hereinafter referred to as "TQM")
- Enhancement of human resource development in each TPS, through on-site training including OJT

4. Action Plan

(1) Purpose of Action Plan

The both sides confirmed that the Action Plans for improving human resource development for O&M of TPS shall be formulated and implemented under the Project in accordance with RD.

An Action Plan includes a goal, issues to be tackled, analysis on causes of the issues, activities to be conducted, target groups, a time frame, and etc. In this Project, Action Plans are expected to be formulated for the purpose of; i) improvement of training conducted on training centers (WEA or Guddu), or ii) improvement of on-site training conducted on each TPS.

The both sides reconfirmed that the Project Purpose agreed on RD is to strengthen training capacity of WEA and GENCOs on O&M of TPS, and agreed that it is critical for the Project to improve training conducted in Pakistan through Action Plans, not only to enhance knowledge of each participants of training in Japan.

(2) Roles and Duties on Action Plan

The both sides confirmed the roles and the duties of each stake holders on formulation, implementation, monitoring and following up of Action Plans as follows;

- Participants of Training in Japan

  (Instructors):
  - To develop an Action Plan for improving training conducted in training centers during the training in Japan
  - To report the contents to colleagues as well as higher authorities of the training center to get an approval
  - To participate in implementation of the approved Action Plan by the training center

  (On-site engineers/technicians):
  - To develop an Action Plan for improving on-site training including OJT, during the training in Japan
  - To report the contents to colleagues as well as higher authorities of TPS and GENCO to get an approval
  - To participate in implementation of the approved Action Plan by TPS or GENCO

- Training Centers/GENCOs/TPS;
  - To give an approval for the Action Plan when it is appropriate, and to make comments or revisions on the Action Plan if necessary.
  - To implement the approved Action Plan.
  - To report the situation of the Action Plan to JICA Expert Team through Project Directors and Project Managers.

- JICA Expert Team;
  - To give advice on formulation of Action Plans in the training in Japan.
  - To share knowledge on human resource development for O&M of TPS in Japan.
  - To monitor the implementation of Action Plans based on the reports

from each organization.
- To follow the result of Action Plans through on-site survey and to provide necessary advice or lecture when appropriate.

➢ JCC;
- To review the result of formulated Action Plans.

5. First Counterpart Training in Japan

(1) Schedule

The first Counterpart Training in Japan is tentatively planned from 22nd March to 27th April, 2018 for Engineers, and from 18th February to 10th March for Technicians, 2018. (From arrival to departure on Japan)

(2) Goal

The goal of the first training in Japan is to deepen understanding of participants on O&M of TPS, and to share Japanese experience and knowledge useful to develop Action Plans.

(3) Overall Contents

The both sides confirmed that the overall contents of the first training in Japan shall be as follows;

Expected Output	Training Subjects/Agendas	Training Methods	For Engineers	For Technicians
Enhance capacity of WEA and GENCO's instructors	Introduction of the latest technology in thermal power generation such as GTCC and USC (Ultra Super Critical)	Lecture	O	O
	Total Quality Management (TQM) in thermal power generation performance	Lecture	O	
	Human resource development in thermal power generation	Lecture	O	
	GTCC maintenance technology	Lecture	O	
	HSE (Health, Safety and Environment)	Lecture Exercise	O	O
	Onsite Repair Work	Lecture Exercise		O
	Non-destructive inspection with remaining life assessment	Lecture Exercise	O	O
	Site visit on thermal power plant and manufacturer's factory	Site Visit	O	O
Improve training and OJT at targeted thermal power plants	Methodology to formulate action plan	Lecture	O	O
	Presentation about action plan	Discussion	O	O

The JICA Expert Team explained the purpose of the training subjects/agendas.

The contents of the training include both general subjects related to O&M of TPS (ex. TQM, HSE) and technical subjects (ex. GTCC maintenance technology).For technical subjects, the both sides confirmed that mechanical engineering related to GTCC will be the main target in the first year, as GTCC

is expected to take important role on power generation by public sector under policy of the Pakistan side. The both sides agreed to make further discussion to decide the main targets of technical subjects in the second and the third year.

(4) Participants

The both sides agreed that the eligible participants for the first training in Japan shall be as follows;

Items	Qualification (Engineers)	Qualification (Technicians)
Number	10 persons per annual	10 persons per annual
Training Term	About 1 month	About 3 weeks
Current Duties	Be a Leading engineer working on thermal power plants or instructors of WEA, and has expertise related to mechanical engineering (especially GTCC)* who are capable to be instructors to train other engineers. *Training program (e.x. electrical and C&I engineering) would be under discussion on 2nd and 3rd year.	Be a Leading technician or instructors of Guddu training center working on thermal power plants, and has expertise related to mechanical work (especially GTCC)* , who are capable to be instructors to train other technicians. *Training program (e.x. electrical and C&I work) would be under discussion on 2nd and 3rd year.
Experience in the relevant field	Have more than 5 years' experience in the field O&M of thermal power plants ideally.	
Educational Background	Be a graduate of university	Be a diploma of technical high school or college, or higher
Language	Have a competent command of spoken and written English.	None*1
Health	Must be in good health, both physically and mentally, to participate in the program in Japan.	

*1: Lecture will be made in Japanese and translated into English or Urdu (under consideration). Course materials will be prepared in English, and participants are expected to prepare job reports and action plans in English.

The both sides confirmed that the participants are expected to make Action Plans described above to improve capacity of O&M of TPS. In this regard, Japanese side requested the Pakistan side to nominate participants who are capable of drafting Action Plans and also spreading their knowledge to other O&M staff through Off-JT or on-site training in each TPS.

The members of JCC shall closely coordinate to follow up the implementation of these Action Plans. Project Directors and Project Managers are requested to provide reports to the JICA Expert Team on the result of the implementation of the Action Plans.

(5) Nomination date

The both sides confirmed the nomination date for this first training is 15th December, 2017. After the nomination from the Pakistan side, the Japanese side will confirm the participants for the first training within 1 week. It is recommended to provide a list of a few alternative nominees in addition to 10 principle nominees, in case the principle nominees cannot participate in the training in Japan.

The Pakistan side will submit the application forms of the confirmed participants to JICA Pakistan Office within 2 weeks after confirmation of the participants and request for providing application forms by the Japanese side.

6. Participation in the Training by Management/Supervising Officers

The Pakistan side reiterated the request stipulated in the RD that, at the conclusion of each training, management/supervising officers be invited in the concluding sessions to get briefing on the training received by the participants, so that they can supervise and support the training participants implementing the Action Plans surely and smoothly after they come back to each Thermal Power Station. JICA explained that JICA would consider the possibility of invitations and will provide the result to the Pakistan side, though invitation especially during the technician training starting from February 2018 will be quite challenging, mainly due to time required for necessary approvals.

However Pakistani side proposed that nominated management staff from GHCL, WAPDA and MOE (Power Division) may join the concluding session or later part of the training as nominated participants.

The both sides agreed to discuss further on the participants and contents of the possible invitation program so that the opportunity would be fully beneficial for the implementation of the formulated Action Plans, and for achievement of the Project Purpose agreed upon RD.

7. Request from JICA Expert Team

(1) Answer for the questionnaire of Guddu Training Center (Soft data).
(2) Answer for the questionnaire of GHCL (Soft data).
(3) Soft data of the answers for the questionnaires of Lakhra TPS and WEA. (Hard copies submitted)
(4) Provision of the name of Project Manager and Project Director of GHCL

Attachment 1 Attendance List (Kickoff Meeting)
Attachment 2 Attendance List (JCC)
Attachment 3 Presentation Materials

Capacity Building and Strengthening of Thermal Power Generation Operation & Maintenance in Pakistan

JCC Attendance List

Date: 24 November 2017

Time: 11 : 30 - 12 : 50

Place: GHC.

Name	Position	Company	Signature
Yoshihisa Oaee	Senior Representative JICA	JICA Pakistan	[illegible]
Junki Mori	Program Officer	Jica HQ	
Kenji Ogasahara	Representative	JICA Pakistan	[illegible]
IMRAN AHMAD	SR. PROGRAM OFFICER	JICA PAKISTAN	[illegible]
Muhammad Khalid	Addl. DG	GHCL	[illegible]
ZAFAR IQBAL	Addl: DG	NEA FSBD.	[illegible]
SHAHZAD BASHIR	Chief Engineer	NEA FSD	[illegible]
RIFFAT ARA	GM	WAPDA	[illegible]
M. IMRAN	CEO	GHCL	[illegible]
SAJID NAZIR GONDAL	Director	GHCL	[illegible]
MUHAMMAD SHOAIB	C.T.O	GHCL	[illegible]
Hiroki Hirahata	General Manager	JICA (Kansai)	[illegible]
Toru Kawai	Manager	JICA (Kansai)	[illegible]

JICA — Kansai Electric Power, power with heart

meeting title: JCC

Name	Position	Company	Signature
[illegible]	Mgr	JICA expert (Kansai)	[illegible]
Haruki Furukawa	Electric Engineer	JICA expert (Kansai)	[illegible]
Yuki OBE	I&C Engineer	JICA expert (Kansai)	[illegible]

JICA — Kansai Electric Power, power with heart

Survey Report and Next Action

November 2017

Japan International Cooperation Agency (JICA)
The Kansai Electric Power Co., Inc.

Contents

Project Summary

<Project Purpose>

Overall Goal	Technology and technical skills obtained by the project are utilized in actual O&M at GENCOs power stations.
Project Goal	**Training capacity on O&M** of WEA and GENCOs is strengthened.

<Project Output>

Output 1	**Current situation of O&M** of thermal power stations is analyzed and **training needs** are identified.
Output 2	**Capacity of WEA and GENCOs' instructors** is enhanced.
Output 3	**Training as well as On the Job Training (OJT) at WEA & GENCOs** are improved.

<Others>

Power generation	Conventional Type (Gas, Coal and Oil) and Gas Turbine Combined Cycle (GTCC) including advanced environmental practices in Japan
Project Sites	WEA in Faisalabad & GENCOs' thermal power station in Jamshoro etc.
Counterpart	MOE, WEA, GHCL, GENCOs
Beneficiaries	O&M instructors of WEA and GENCOs and their trainees
Duration	October 2017 – September 2020 (3 years)

Project Activity toward Output

Output 1	**Current situation of O&M of thermal power stations is analyzed and training needs are identified.**
Activities (1-1)	To analyze the current situation of O&M at thermal power stations.
Activities (1-2)	To review the training system of thermal power generation, and analyze the current situation and issues of O&M personnel.
Activities (1-3)	To specify the training needs.
Output 2	**Capacity of WEA and GENCOs' instructors is enhanced.**
Activities (2-1)	To set the target O&M skills that instructors & potential instructors should obtain.
Activities (2-2)	To formulate the program of training in Japan.
Activities (2-3)	To set selection criteria for the training in Japan.
Activities (2-4)	To conduct trainings in Japan.
Activities (2-5)	To modify the contents of training in Japan at WEA and GENCOs' thermal power stations (OJTs) in Pakistan
Output 3	**Training as well as OJT at WEA and GENCOs are improved.**
Activities (3-1)	To develop action plans of trainings (OJTs) for O&M of thermal power stations.
Activities (3-2)	To disseminate obtained knowledge and technical skills to O&M personnel based on the action plans and verify the skilled up level by checklist developed at the above 2-4.
Activities (3-3)	To review the results of action plans to improve the training at WEA and GENCOs' thermal power stations (OJTs) in Pakistan.

Work Flowchart

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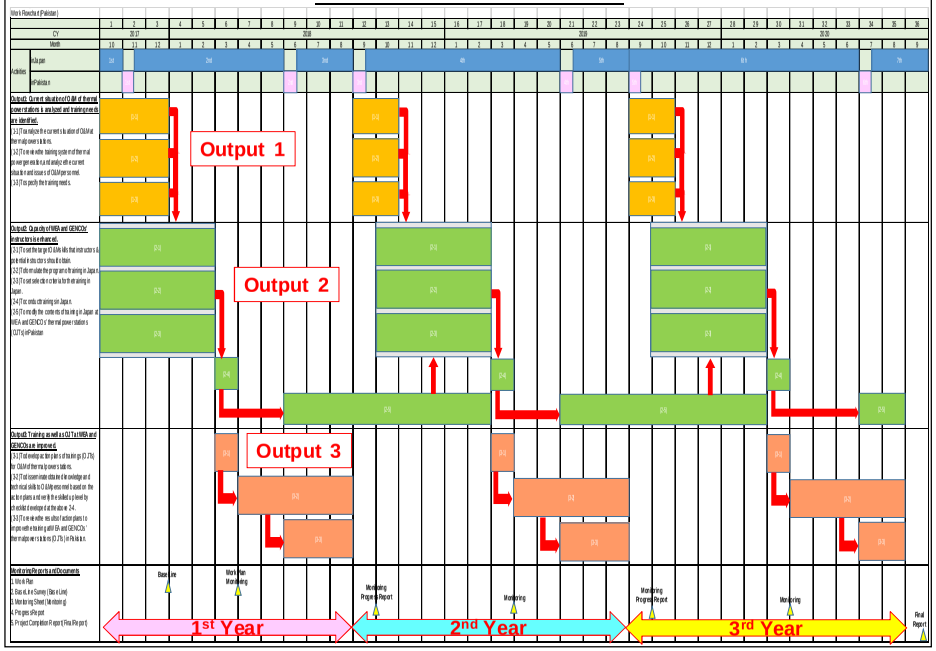

Implementation Structure (JCC)

6

<Japan Side>

JICA HQ
JICA Pakistan Office

JICA Expert Team
(Short-term Experts)
- Chief Adviser/ Thermal Power Generation Operation & Maintenance
- Thermal Power Generation Operation
- Training Planning

<Pakistan Side>

Project Chairperson
Joint Secretary (Transmission) of Ministry of Energy (Power Division) (MOE)

Project Director
- Principal of WAPDA Engineering Academy (WEA) under General Manager (Training) WAPDA
- Chief Engineer of GENCO Holding Company Ltd. (GHCL)

Project Manager
- Additional Director General of WEA
- Additional DG/Director of GHCL

Contents

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1. Project summary
2. **O&M training program in Japan**
3. Selection criteria for the training in Japan
4. Monitoring indicators
5. Main points discussed for next step

(Actual) Itinerary on this Survey

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Date	Activity		Focal Point
13th Nov.	Kick-off Meeting with GHCL & WAPDA/WEA	Lahore	(GHCL) Sajid Nazir Gondal (WEA) Zafar Iqbal
14th Nov.	Meeting with GHCL & WAPDA/WEA	Lahore	(GHCL) Muhammad Khalid (WEA) Zafar Iqbal
15th Nov.	Site Visit to WEA (Training Center)	Faisalabad	Zafar Iqbal
16th Nov.	Site Visit to Muzaffargarh (GENCO III)	Multan	Munir Ahmad abassi
17th Nov.	Site Visit to KAPCO (IPP)	Multan	Waheed Sohail Abdul Wajid Muhammad Arshad Saqib
20th Nov.	Site Visit to Jamshoro (GENCO I)	Hyderabad	Abdul Hafeez Memon
	Site Visit to Lakhra (GENCO IV)		Ghulam shabir Jatoi Rajesh Kumar
21st Nov.	(Document Preparation)	Islamabad	-
22nd Nov.	Arrangement Meeting	Islamabad	-
23rd Nov.	(Document Preparation)	Islamabad	
24th Nov.	JCC (Joint Coordination Committee)	Islamabad	-

Important Assumption for Training Program

9

<Finding of this Mission>

- GENCOs power stations are well operated and maintained, despite of some critical issues such as **aged main equipment.**
- O&M officers and staff are capable of implementing **daily O&M work based on OEM manuals.**

<Remarkable Issues of O&M Current Situation>

- Enhancement of HSE, **especially safety.**
- Improving OEM manuals into **original rules & manuals base on TQM**, for avoidance of excessive dependence on OEM.

O&M Training Needs through this Survey

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<Suggestion from JICA Expert Team>

- **Non-destructive inspection and residue life assessment** for aged main equipment.
  - We'll propose to provide with **practical equipment** such as inspection tools (under consideration).
- **The latest technology of thermal power plant** such as GTCC & USC (Ultra-Super Critical) coal-firing.

<Request from Pakistani Side>

- **Knowledge** of O&M technical skill.
- **Human resource** including development plan.

O&M Training Program in Japan

11

Expected Output	Training Subjects/Agendas	Training Methods	For Engineers	For Technicians
Enhance capacity of WEA and GENCO's instructors	**Introduction of the latest technology** in thermal power generation such as GTCC and USC (Ultra Super Critical)	Lecture	○	○
	Total Quality Management (TQM) in thermal power generation performance	Lecture	○	
	Human resource development in thermal power generation	Lecture	○	
	GTCC maintenance technology	Lecture	○	
	HSE (Health, Safety and Environment)	Lecture Exercise	○	○
	Onsite Repair Work	Lecture Exercise		○
	Non-destructive inspection with remaining life assessment	Lecture Exercise	○	○
	Site visit on thermal power plant and manufacturer's factory	Site Visit	○	○
Improve training and OJT at targeted thermal power plants	Methodology to formulate **action plan**	Lecture	○	○
	Presentation about action plan	Discussion	○	○

GTCC Maintenance Technology: Hot Parts

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1. What is Hot Parts of Gas Turbine?
2. Basic Requirement about Hot Parts
3. Damage Mechanism; Combustor and Blade
4. Maintenance Policy (Repair, Reuse & Replace) for Shortening Planned Maintenance Outage
5. Lifetime Consumption caused by Main Factors including Fuel Quality, Start-up & Shut-down and Environment
6. Calculation Method of EOH (Equivalent Operating Hour)
7. Original Maintenance Planning such as

   -CI (Combustion Inspection),

   -HGPI (Hot Gas Path Inspection)

   -Major Overhaul

Contents

1. Project summary
2. O&M training program in Japan
3. **Selection criteria for the training in Japan**
4. Monitoring indicators
5. Main points discussed for next step

Important Assumption for Selection Criteria

<Finding of this Mission>

- ü **Some GENCOs continuously implement both OJT and Off-JT** as human resource development.
- ü Some GENCOs utilize WEA and Guddu training center.
- ü Leading officers at WEA & GENCOs sometimes implement training course as trainers.

< Suggestion from JICA Expert Team >

- ü Target should be **leading engineers and technicians, or instructors of the training centers** who are capable for **expanding their knowledge attained on the training program in Japan to other members** at the thermal power plants.

Selection Criteria for the Training in Japan

Items	Qualification (Engineers)	Qualification (Technicians)
Number	10 persons per annual	10 persons per annual
Training Term	About 1 month	About 3 weeks
Current Duties	Be a Leading engineer working on thermal power plants or instructors of WEA, and has expertise related to **mechanical engineering (especially GTCC)*** who are capable to be instructors to train other engineers. *Training program (e.x. electrical and C&I engineering) would be under discussion on 2nd and 3rd year.	Be a Leading technician or instructors of Guddu training center working on thermal power plants, and has expertise related to **mechanical work (especially GTCC)*** , who are capable to be instructors to train other technicians. *Training program (e.x. electrical and C&I work) would be under discussion on 2nd and 3rd year.
Experience in the relevant field	Have **more than 5 years' experience in the field O&M** of thermal power plants ideally.	
Educational Background	**Be a graduate of university**	**Be a diploma of technical high school or college**, or higher
Language	**Have a competent command of spoken and written English.**	None*1
Health	Must be in good health, both physically and mentally, to participate in the program in Japan.	

*1:Lecture will be made in Japanese and translated to English or Urdu (under consideration). Course materials will be prepared in English, and participants are expected to prepare job reports and action plans in English.

Contents

1. Project summary
2. O&M training program in Japan
3. Selection criteria for the training in Japan
4. **Monitoring indicators**
5. Main points discussed for next step

Monitoring Indicators for Overall Goal

17

Items	Monitoring Indicators	Means of Verification
Overall Goal Technology and technical skills obtained by the project are utilized in actual O&M at GENCOs power stations.	ü **Number of GENCOs power stations** which utilize obtained technology and technical skills.	ü Questionnaire to WEA and GENCOs **including regular training reports at WEA & GENCOs provided by trained instructors**
Project Goal Training capacity on O&M of WEA and GENCOs is strengthened.	ü **More than XX% of GENCOs power stations implement trainings (OJTs)** based on the Action Plan prepared by trained instructors. ü Improvement of WEA training contents based on the Action Plan developed by trained instructors. ※Trained instructors will not resign and/or transfer outside of WEA and GENCOs.	ü Project monitoring sheet, **including regular training reports at WEA & GENCOs provided by trained instructors**

Monitoring Indicators for Project Output

18

Items	Monitoring Indicators	Means of Verification
Output 1 Current situation of O&M of thermal power stations is analyzed and training needs are identified.	ü **Training needs are compiled** based on the current situation.	ü Project monitoring sheet
Output 2 Capacity of WEA and GENCOs' instructors is enhanced.	ü Training program is formulated based on the training needs. ü **Total number of trained instructors.** ü **Total number of training in Japan.** ※Trained instructors continue to work for WEA and GENCOs during the project period	ü Project monitoring sheet
Output 3 Training as well as OJT at WEA and GENCOs are improved.	ü **Achievement level of Action Plans developed by trained instructors.** ü The results of checklists.	ü Project monitoring sheet **including regular training reports at WEA & GENCOs provided by trained instructors** ü Progress report of each Action Plan ü Checklist

Main Points Discussed for Next Step

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ü **Request for Next Step (By November 30, 2017)**
Comments for Minutes of Meeting (MoM), especially
-O&M training program in Japan.
-Selection criteria for the training in Japan.
-Monitoring indicators.

ü **Undertaking by Pakistani side;**
-Selecting Instructors based on the selection criteria.
(By December 15, 2017)
-Other operational cost.
-Regular training reports at WEA & GENCOs provided by trained instructors.

ü **Undertaking by Japanese side;**
-Training in Japan for each 10 engineers/technicians per year.
-Monitoring the improvement of O&M at WEA & GENCOs, and modifying the training contents/curricula (if necessary).

Hiroki HIRAHATA (Focal Point)
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Thermal Power Division
The Kansai Electric Power Co.,Inc.

(2) Minutes of Meeting for the 2nd JCC

MINUTES OF MEETING
FOR
THE SECOND JOINT COORDINATION COMMITTEE (JCC)
ON
THE PROJECT FOR CAPACITY BUILDING AND STRENGTHENING OF THERMAL POWER GENERATION OPERATION & MAINTENANCE
BETWEEN
JAPAN INTERNATIONAL COOPERATION AGENCY
AND
THE ISLAMIC REPUBLIC OF PAKISTAN

Japan International Cooperation Agency (hereinafter referred to as "JICA") and the Ministry of Energy of the Government of the Islamic Republic of Pakistan (hereinafter referred to as "MOE") and relevant organizations held the second Joint Coordination Committee (hereinafter referred to as “JCC”) on the Project for Capacity Building and Strengthening of Thermal Power Generation Operation and Maintenance (hereinafter referred to as "the Project").

The second JCC on the Project was held on 14th September 2018, at GENCO Holding Company, Ltd. (hereinafter referred to as “GHCL”), Islamabad. As a result of discussions on the second JCC Meeting, the Japanese side and the Pakistan side have confirmed the main items described in Annex.

Islamabad, 14th September, 2018

Yoshihisa Onoe
Senior Representative
JICA Pakistan office

Ministry of Energy

Hiroki Hirahata
Chief Advisor
JICA Expert Team

Muhammad Imran
Chief Executive Officer
GENCO Holding Company, Ltd

Riffat Ara Qureshi
General Manager (Training)
Water and Power Development Authority

ANNEX

1. Progress of the Project

The JICA Expert Team has explained the Work Flowchart, overall schedule , the progress made after the first JCC meeting including the first training courses in Japan implemented from February to April 2018, and the upcoming activities based on Attachment 2. The JICA Expert Team requested close collaboration from the Pakistan side for the implementation of project activities, including nomination of training candidates, implementation and monitoring of Action Plans, support for follow up survey by the Team.

The Pakistan side acknowledged the contents of the explanation and agreed to meet the request from the JICA Expert Team.

2. Result of the Second Mission

(1) Outline of the Mission

The JICA Expert Team implemented its second mission on Pakistan from 3rd to 14th September 2018, to achieve the below purposes;

- ✓ Reviewing O&M training activities at TPPs implemented by JICA-trained engineers & technicians,
- ✓ Grasping current situation of O&M, and identifying training needs,
- ✓ Mutual agreement on O&M training program in Japan JAN/FEB 2019,
- ✓ Mutual agreement on selection criteria for next participants (engineers & technicians),
- ✓ Proposing O&M training equipment

The JICA Expert Team made a brief explanation of current situation of each topics based on Attachment 2.

(2) Result of the review of Action Plan Implementation

The JICA Expert Team explained the result of review of Action Plan implementation as follow. Pakistan side took note of it.

- ✓ JICA-trained engineers and technicians implemented their Action Plans on schedule and their activities helped thermal power stations (hereinafter referred to as “TPS”) in Pakistan to improve the O&M capacity.
- ✓ The training materials in Japan were suitable for beginners, junior & poor-skilled members.
- ✓ JICA trained participants have held lectures not only in his own TPS but also in Faisalabad work shop.

(3) Current situation of O&M and Training needs

The JICA Expert Team explained their understanding on the current situation of O&M, and identified training needs in Pakistan as follows. Pakistan side confirmed the contents.

(Current Situation)

- ✓ Based on the policy of Pakistan government to put more focus on renewable energy and on utilization of private sector, no new induction of engineers/technicians has been allowed for GENCOs around for 8 years (no plan of induction training)
- ✓ In WEA, 5 dedicated instructors dispatched by GHCL conduct refresher training courses for engineers through only lecture, while often implementing site visit on the workshop of Faisalabad TPS (no practical exercise).
- ✓ At this moment, WEA cannot enjoy the knowledge & skill obtained in Japan because no WEA-instructors were selected as participants of the 1st O&M training in Japan.

(Training Needs)

- ✓ GHCL requests the 2nd O&M training in Japan should be not advanced mechanical but other field, especially electrical, in terms of covering all the fields of Thermal Power for 3 years.
- ✓ GHCL has O&M training needs for electrical field as well as mechanical in each TPS.
- ✓ In accordance with GHCL's request, JICA experts make the best endeavor to reflect training needs on the 2nd training in Japan, and to keep the level as much as possible.

(4) Recommendation on Future Steps for HRD Enhancement

Based on the result of the mission, JICA Expert Team recommended the measures for enhancing Human Resource Development (hereinafter referred to as "HRD") for O&M of TPS as follows. The Pakistan side took note of it, and both sides agreed that the activities under the Project shall be carried out in the way consistent with these recommendations.

(Precondition)

- ➢ Refresher courses in training centers (WEA/Guddu) and HRD activities in each TPS should be the focus in strengthening HRD capacity in thermal power sector, while induction training should be carried out on necessity basis.

(Refresher Courses)

- ➢ Contents of training program and lecture contents always need to be reviewed and upgraded, so that they match the fluctuating needs of generation companies (including IPPs).
- ➢ While it is natural that refresher courses for middle class officer/staff put focus on theoretical aspects, some practical exercise could be beneficial for trainees as supplemental.
- ➢ Frequency of training is very limited while duration seems sufficient. Therefore, giving more frequent opportunities of training with shorter duration is recommended.

- Job rotation of the dedicated instructors in WEA and Guddu T/C should be short term (ex. 3 years), because the instructors should not be remote from TPS for long term. This would enhance interaction between training centers and TPSs.

(HRD Activities in each TPS)

- Knowledge sharing among colleagues should be official assignment of officers/staff, especially those who have chance to participate in special program including training in Japan under this Project.
- Knowledge sharing activities by officers/staff should be included in performance evaluation/assessment by management.

(Induction Training)

- Consistency between the timeline for shrinking generation capacity of GENCOs and the outlook on work force of GENCOs should be carefully examined in long term.
- Possibility to contribute more aggressively on HRD in private sector (IPP) should be considered.

3. Action Plan

(1) Purpose of Action Plan

The both sides confirmed that the Action Plans for improving HRD for O&M of TPS shall be formulated and implemented under the Project. Action Plan includes analysis on current issues and causes, concrete activities to be implemented in different stages, timeframe, persons in charge, possible obstacles or conditions, and etc. In this Project, Action Plans are expected to be formulated for the purpose of; i) improvement of refresher courses conducted on training centers (WEA or Guddu), or ii) improvement of on-site HRD activities conducted on each TPS.

(2) Roles and Duties on Action Plan

The both sides confirmed the roles and the duties of each stake holders on monitoring of Action Plans as follows;

- Participants of Training in Japan
  - Drafting Monitoring Report to be submitted to JICA Experts
- Senior Management Officials at organizations to which participants belong;
  - -Endorsing the Monitoring Report and Submitting it to JICA Experts through its focal point
  - -Evaluating contribution of the training participants to implementing the action plan and sharing the information to JICA Experts
  - -Arrange teleconference with JICA Experts on necessity basis
- JICA Expert Team;
  - Confirm the progress of the action plan implementation based on the Monitoring Report
  - Arrange teleconference with counterpart organizations on necessity basis to follow up more in detail

4. Second Counterpart Training in Japan

(1) Schedule

The second Counterpart Training in Japan is tentatively planned from 6th January to 9th February 2019 for Engineers, and from 6th to 26th January 2019 for Technicians. (From arrival to departure on Japan)

(2) Overall Contents

The both sides confirmed that the overall tentative contents of the second training in Japan would be as follows;

Engineers	Technicians
✓ Introduction of the latest technology in TPP (inc. USC)	✓ Introduction of the latest technology in TPP (inc. USC)
✓ Experience-based Safety Training	✓ Experiential Safety Training
✓ Human Resource Development	✓ Experiential Quality Training
✓ Quality Management	✓ Basics of Non-Destructive Inspection Skills
✓ Thermal Efficiency Management	✓ Overhauling Motors
✓ Basic Training of Vibration (Balancing)	✓ Electrical Protection Systems (inc. intro. & usage)
✓ Non-Destructive Inspection	✓ Modern Maintenance Techniques of Excitation Systems
✓ Electrical Protection Systems (inc. intro. & usage)	✓ Control Circuit (mainly Protection Relay)
✓ Modern Maintenance Techniques of Excitation Systems	✓ Preventive Maintenance (inc. Generator & Main Trans.)
✓ Control Circuit (mainly Protection Relay)	✓ Fire Protection for Electrical Circuit/Equipment
✓ Preventive Maintenance (inc. Generator & Main Trans.)	✓ Insulation standard for Electrical Circuit/Equipment
✓ Fire Protection for Electrical Circuit/Equipment	✓ Occupational HSE (especially Safety)
✓ Insulation standard for Electrical Circuit/Equipment	✓ Site Visit on TPP and Manufacture's factory
✓ Site Visit on TPP and Manufacture's factory	✓ Prevention of Accidents and Disasters
✓ Lessons Learned from Accidents	✓ Methodology to Formulate Action Plan
✓ Human Error Prevention	
✓ Effective Maintenance for Quality Electric Power Infrastructure	
✓ Methodology to Formulate Action Plan	

The contents of the training include both general subjects related to O&M of TPS (ex. Quality Management, Safety) and technical subjects (ex. Vibration, Control Circuit).

The both sides agreed to make further discussion to decide the main targets of technical subjects in the third (final) year.

(3) Participants

The both sides agreed that the eligible participants for the second training in Japan shall be as follows;

Items	Qualification (Engineers)	Qualification (Technicians)
Number	8 persons	8 persons
Training Term	About 1 month	About 3 weeks
Required Condition	➢ An engineer in TPS or an instructor in WEA ➢ Capable of drafting effective action plan ➢ Willing to make technical contribution to HRD in GENCOs ➢ Electrical expertise	➢ An technician in TPS or an instructor in Guddu T/C ➢ Capable of drafting effective action plan ➢ Willing to make technical contribution to HRD in GENCOs ➢ Electrical expertise
Educational Background	Be a graduate of university	Be a diploma of technical high school or college, or higher
Language	Have a competent command of spoken and written English.	See footnote*
Health	Must be in good health, both physically & mentally, to participate in the program in Japan.	
Undertaking of Participants	➢ Read through "General Information" (GI) of the training to be issued by JICA, and understand the contents ➢ Draft the action plan of his/her organization during the course, and to explain the contents to his/her higher authorities for their endorsement ➢ Make effort to disseminate the knowledge obtained in Japan after coming back to Pakistan	
Undertaking of Mother Organizations	➢ Allow the participants to draft the action plan of the organization, and to let them explain the contents to the higher authorities for endorsement ➢ Implement the action plan ➢ Provide information regarding action plan monitoring to JICA Expert Team through focal points of each organization ➢ Evaluate the contribution of the participants on HRD/knowledge sharing in their organization, and provide information to JICA Expert Team through focal points	

*1: Lecture will be made in Japanese and translated to Urdu. Course materials will be prepared in English, and participants are expected to prepare job reports and action plans in English. Therefore participants are expected to be familiar with written English at least.

The both sides confirmed that the participants are expected to make Action Plans described above to improve capacity of O&M of TPS. In this regard, Japanese side requested the Pakistan side to nominate participants who are capable of drafting Action Plans and also spreading their knowledge to other O&M staff in each TPS.

The members of JCC shall closely coordinate to follow up and supervise the implementation of these Action Plans. Project Directors and Project Managers are requested to provide reports to the JICA Expert Team on the result of the implementation of the Action Plans.

(4) Nomination date

The both sides confirmed the nomination deadline for this second training is

15th November 2018, assuming that GI from JICA Expert Team shall be issued by 1st October 2018. After the nomination from the Pakistan side, the Japanese side will confirm the participants for the second training within 1 week.

5. Provision of O&M training equipment

JICA Expert Team explained three candidates for proving O&M training equipment, the first was “plant operation simulator”, the second was “vibration analysis demonstrator” and the third was “Non Destructive Inspection Demonstrator”. JICA Expert Team explained each training conditions briefly and provided the detail training conditions of each candidate to the Pakistan side.

At the request of JICA expert team, Pakistan side shall clarify the needs about provision of O&M training equipment.

6. Participation in the Training by Management and Supervising Officers

The Pakistan side requested the visit on Japan by management and supervising officers to get briefing on the training received by the participants, so that they can supervise and support the training participants implementing the Action Plans surely and smoothly after they come back to each Thermal Power Station.

The both sides agreed to discuss further on the timing, participants and contents of the possible invitation program so that the opportunity would be fully beneficial for the implementation of the formulated Action Plans, and for achievement of the Project Purpose.

7. Project Monitoring Sheet

The both sides confirmed the contents of the Project Monitoring Sheet Ver. 1 as Attachment 5.

8. Monitoring Indicator

Regarding Project Design Matrix (PDM) agreed on the Record of Discussion dated 22nd May, 2017, JICA Expert Team proposed to revise the Monitoring Indicator so that it could grasp the progress of the Project more appropriately. The draft of revised PDM shall be proposed by JICA Expert Team at the time of submission of Project Monitoring Sheet Ver. 2, which is planned on April 2019.

9. Request from JICA Expert Team

(1) Regular training report from some of JICA-trained technicians in Guddu TPS and Jamshoro TPS

Attachment 1 Attendance List
Attachment 2 Presentation Materials
Attachment 3 Introduction provision of O&M training equipment (“plant operation simulator” and “vibration analysis demonstrator”)
Attachment 4 Minutes of Meetings during the Mission
Attachment 5 Project Monitoring Sheet Ver. 1

meeting title: _____

Capacity Building and Strengthening of Thermal Power Generation
Operation & Maintenance in Pakistan

JCC Attendance List

Date: 14th / September / 2018

Time: 10 : 00 - 11 : 45

Place: GHCL Office

Name	Company	Position	Signature
M. IMRAN	GHCL	CEO	
Mushtaq Ahmad	GHCL	Director General (HR&A)	
Muhammad Jafar	GHCL	Addl. Director	
RIFFAT ARA QURESHI	WAPDA	G. M. Training	
Engr. MAHBOOB FARID	WAPDA	Deputy Director (Training)	
Engr. Abdur Rauf	WAPDA	P/CE WEA	
Hiroki Hisahara	Kansai	General Manager	
Yoshihiro Doi	Kansai	Mech Mgr.	
Haruaki Furukawa	Kansai	Electric Engineer	
IMRAN AHMAD	JICA	SR. PROGRAM OFFICER	
Junki Mori	JICA	Deputy Assistant Director	
Kenji Ogasahara	JICA	Representative	
Yoshihisa Onoe	JICA	Senior Rep.	

meeting title: _____

Name	Company	Position	Signature
Yuki Obe	Kansai	C&I Eng.	
Shigeru Yoshitake	Kansai	Mech. eng.	

SURVEY REPORT and NEXT ACTION

September 2018

Japan International Cooperation Agency (JICA)

The Kansai Electric Power Co., Inc.

Contents

1. Project Summary

This JICA project aims capacity building for O&M at Thermal Power Plants (TPPs) through enhancement of Human Resource Development Capacity.

Project Purpose

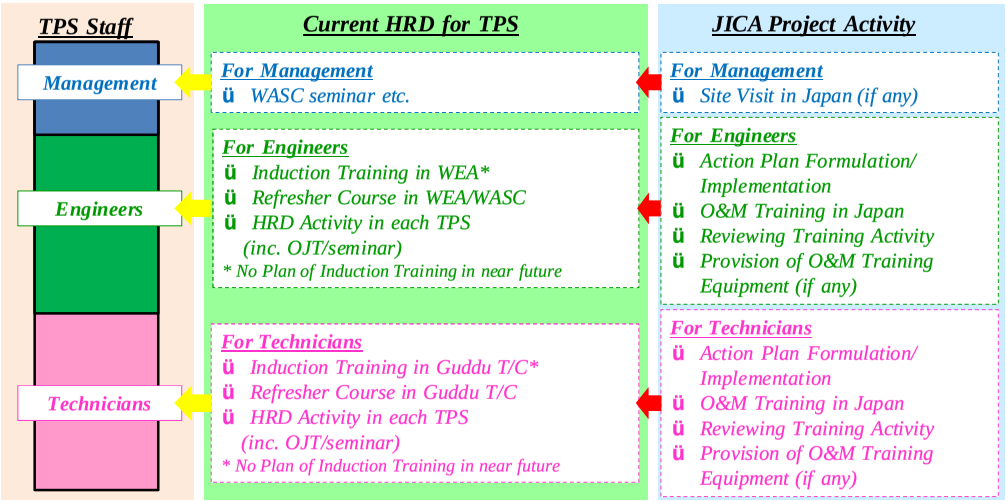
Overall Goal	Technology and technical skills obtained by the project are utilized in actual O&M at GENCOs power stations.
Project Goal	Training capacity on O&M of WEA and GENCOs is strengthened.

Project Output

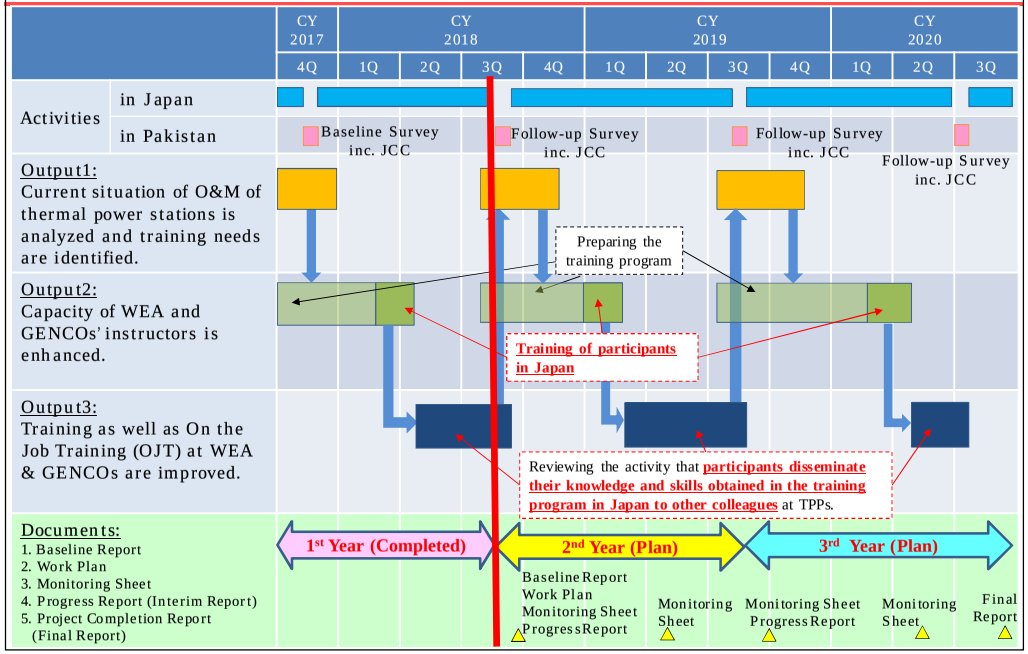
Output 1	Current situation of O&M of thermal power stations is analyzed and training needs are identified.
Output 2	Capacity of WEA and GENCOs' instructors is enhanced.
Output 3	Training as well as On the Job Training (OJT) at WEA & GENCOs are improved.

1. Project Summary: Overall Structure of JICA Project Activity

JICA Project Purpose — ***To Strengthen the Training (HRD) Capacity of WEA & GENCOs (TPS)***



1. Project Summary: Work Flowchart



1. Project Summary: Monitoring Indicators (1st Year Completed)

Items	Monitoring Indicators	Achievement
Overall Goal: Technology and technical skills obtained by the project are utilized in actual O&M at GENCOs power stations.	ü Number of GENCOs power stations which utilize obtained technology and technical skills.	ü 3 TPPs (Jamshoro, Guddu and Muzaffargarh) utilized technology and technical skills obtained in Japan as scheduled.
Project Goal: Training capacity on O&M of WEA and GENCOs is strengthened.	ü More than XX% of GENCOs power stations implement trainings (OJTs) based on the Action Plan prepared by trained instructors.	ü Training is being implemented at the TPP which all trained instructors belong.
	ü Improvement of WEA training contents based on the Action Plan developed by trained instructors.	ü Engineers and technicians are progressing their action plans as almost planed.
Output 1: Current situation of O&M of thermal power stations is analyzed and training needs are identified.	ü Training needs are compiled based on the current situation.	ü JICA expert compiled training needs based on the current situation.
Output 2: Capacity of WEA and GENCOs' instructors is enhanced.	ü Training program is formulated based on the training needs.	ü For 1st training in Japan, JICA expert prepared training program based on the training needs.
	ü Total number of trained instructors.	ü 8 engineers & 8 technicians were trained as participants in 2018.
	ü Total number of training in Japan.	
Output 3: Training as well as OJT at WEA and GENCOs are improved.	ü Achievement level of Action Plans developed by trained instructors.	ü Engineers & technicians are progressing their action plans as almost planed.
	ü The results of checklists.	ü 656 engineers & 229 technicians disseminated at TPS.

1. Project Summary: Training Activity at TPS (1st Year Completed)

For the further dissemination to other colleagues at each TPS, **it is important for TPS manager to supervise the training activity** by JICA-trained engineers/technicians.

Targeted TPS		Number of Participants in Japan	Time of Training Activity	Number of Trainee at each TPS	Reference
Jamshoro	Engineers	2	11	180	Requesting O&M training equipment like NDI (UT) & vibration analyzer etc.
	Technicians	2	6	100	Requesting practical training for pumps & bearings.
Guddu	Engineers	4	24	410	Requesting O&M training equipment like vibration analyzer.
	Technicians	4	12	84	
Muzaffargarh	Engineers	1	7	66	Using potable vibration analyzer which was procured by TPS
	Technicians	2	5	45	
Faisalabad	Engineers	1	0	0	Retired due to poor physical condition.
Total	Engineers	8	42	656	Reported by 7 engineers.
	Technicians	8	23	229	Reported by 6 technicians

*Besides, 2 management members in WEA participated in the 1st training in Japan for technician course.

1. Project Summary: Challenge towards 2nd Year Activities

① Scaling up of the Project output;
- *Capacity Development of individual engineers/technicians*
- *Enhancement of HRD capacity of GENCOs/WEA as a whole*

② Enhancement of Action Plan implementation, including;
- *Enriching the contents of Action Plan*
- *Formulating monitoring structure*
- *Strengthening the commitment from each participating organization*

③ Upgrading of Training Program in Japan based on the feedback

④ Optimization of Training Participants

⑤ Optimum Selection and Utilization of O&M Training Equipment

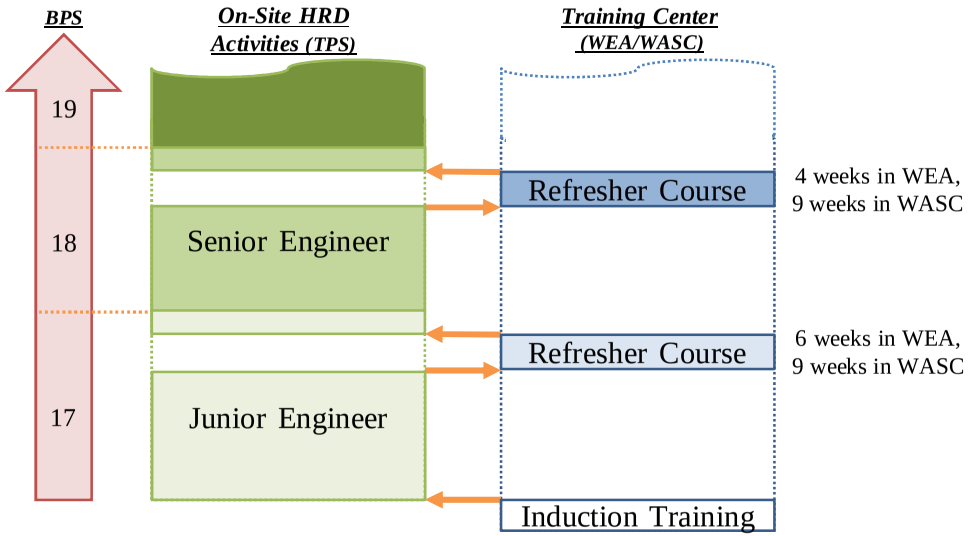
⑥ Revision of Monitoring Indicator

Contents

2. HRD Framework in Pakistan: Structure

In Case of Engineers

*For technicians, Guddu T/C is utilized.
Unlike Japan, no management course for technicians



2. HRD Framework in Pakistan: Current Situation

Training Centers

WEA:

- ü 5 dedicated instructors from GHCL conduct refresher courses through lecture style
- ü No practical training equipment is available (operation simulator is out of order)
- ü Only site visit on workshop of Faisalabad TPS is carried out (no practical exercise)

Guddu T/C:

- ü 7 dedicated instructors conduct refresher course through mainly lecture style
- ü Training equipment is old-fashioned (no practical exercise)

General:

- ü Based on the policy of Pakistan government to put more focus on renewable energy and on utilization of private sector, no new induction of engineers/technicians has been allowed for GENCOs for around 8 years (no plan of induction training)

On-Site HRD Activities

- ü Generally speaking, knowledge sharing among colleagues on the same power station seems to be carried out well in their daily work
- ü However, it is difficult to spare sufficient time for dissemination (ex. setting formal seminars) as they are busy on their assignment

2. HRD Framework in Pakistan: Steps for HRD Enhancement

Precondition:

- Ø ①**Refresher courses in training centers** (WEA/Guddu) and ②**HRD activities in each TPS** should be the focus in strengthening HRD capacity in thermal power sector, while ③**induction training** should be carried out on necessity basis.

①Refresher Courses

- Ø Contents of training program and lecture contents always need to be reviewed and upgraded, so that they match the fluctuating needs of generation companies (including IPPs).
- Ø While it is natural that refresher courses for middle class officer/staff put focus on theoretical aspects, some practical exercise could be beneficial for trainees as supplemental.
- Ø Frequency of training is very limited while duration seems sufficient. Therefore, giving more frequent opportunities of training with shorter duration is recommended.
- Ø Job rotation of the dedicated instructors in WEA and Guddu T/C should be short term (ex. 3 years), because the instructors should not be remote from TPS for long term. This would enhance interaction between training centers and TPSs.

2. HRD Framework in Pakistan: Steps for HRD Enhancement

②HRD Activities in each TPS

- Ø Knowledge sharing among colleagues should be official assignment of officers/staff, especially those who have chance to participate in special program including training in Japan under this Project.
- Ø Knowledge sharing activities by officers/staff should be included in performance evaluation/assessment by management.

③Induction Training

- Ø Consistency between the timeline for shrinking generation capacity of GENCOs and the outlook on work force of GENCOs should be carefully examined in long term.
- Ø Possibility to contribute more aggressively on HRD in private sector (IPP) should be considered.

➡ Some of the items shall be accessed under this Project

Contents

3. Action Plan: Overview of Action Plan

What is Action Plan?

- ü Plan of actions to achieve the Project Purpose
  - ≒ Strengthen HRD capacity of WEA and GENCOs
- ü Contains following information;
  - Analysis on current issues and causes
  - Concrete activities to be implemented in different stages
  - Timeframe
  - Persons in charge
  - Possible Obstacles/Conditions etc.

What should be the target of Action Plan?

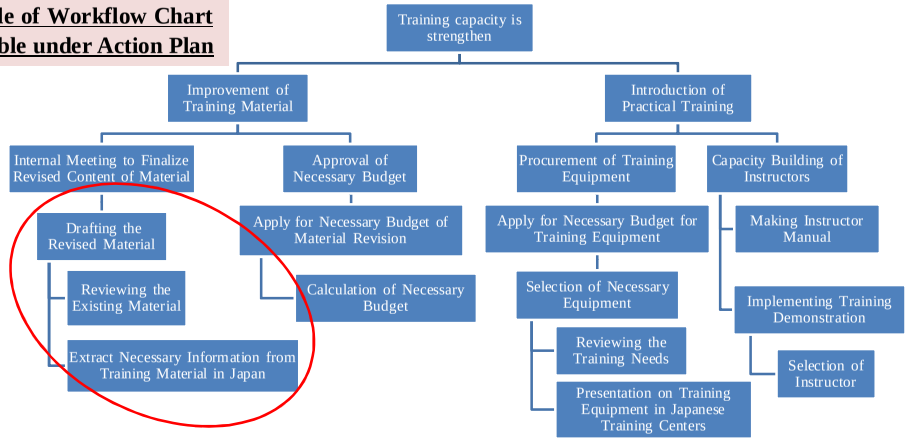
- ü ①Refresher courses in training centers ➡ for training centers
- ü ②HRD Activities in each TPS ➡ for each power station
- ü (③Induction Training, if there were any plan)

How will Action Plans be formulated and implemented?

- ü Drafted by participants of training in Japan, endorsed and implemented by their organizations

3. Action Plan: Example Framework of Action Plan

Example of Workflow Chart and Table under Action Plan



Activity	Timeframe	Person in Charge	Obstacle/Conditions
Reviewing the Existing Material	3 weeks	Participants of Training in Japan	
Extract Necessary Information from Training Material in Japan	2 weeks	Participants of Training in Japan	
Drafting the Revised Material	1 month	Participants of Training in Japan	Needs to be assigned by management

3. Action Plan: Monitoring Structure

Actor	Task
Training Participants	Ø Draft Monitoring Report to be submitted to JICA Expert Team
Counterpart Organizations	Ø Endorse the Monitoring Report and Submitting it to JICA Expert Team through its focal point Ø Evaluate contribution of the training participants on implementing the action plan and sharing the information to JICA Expert Team Ø Arrange teleconference with JICA Expert Team on necessity basis
JICA Expert Team	Ø Confirm the progress of the action plan implementation based on the Monitoring Report Ø Arrange teleconference with counterpart organizations on necessity basis to follow up more in detail

Contents

4. O&M Training in Japan: Feedback on 1st Training

	Main Suggestion	Especially Useful Subjects	Required Additional Subjects
Engineers	Ø We need more technical and skilled training. Ø The program is theoretical but we need practical a lot.	Ø Total Quality Management (TQM) in Japan Ø Basics of Vibration Ø Remaining Life Assessment Ø Gas Turbine Combined Cycle Power Generation Technology	Ø Thermal efficiency analysis and reducing heat rate in thermal power plants Ø Efficient/effective O&M framework for cost-effective & environmentally sustainable power generation. Ø Metallurgy of high efficiency GTCC and coal A-USC/USC TPPs
Technicians	Ø Quality of training is good/excellent.	Ø Valve Maintenance Skills and Overhauling Pumps Ø Site Visit on Manufacture's factory (MHPS)	Ø Practical skill at rotary equipment such as GTCC (inc. gas turbine/steam turbine)

*Required additional subjects as shown in blue (common) & in green (mechanical)

Note: It is pointed out during the mission that WEA cannot enjoy the knowledge & skill included in the 1st training in Japan at this moment, because no WEA-instructors participated

4. O&M Training in Japan: Advanced Mechanical (JICA's suggestion)

Engineers	Technicians
ü Introduction of the latest technology in TPP (inc. USC)	ü Introduction of the latest technology in TPP (inc. USC)
ü Experience-based Safety Training	ü Experiential Safety Training
ü Human Resource Development	ü Welding Procedure Management
ü Quality Management	ü Experiential Quality Training
ü Thermal Efficiency Management	ü Metal Material
ü Basic Training of Vibration (Balancing)	ü Overhauling Rotary Pumps
ü Non-Destructive Inspection	ü Basics of Non-Destructive Inspection Skills
ü GT & High Temperature Parts / Maintenance of GTCC (inc. HRSG/Generator, Shaft Alignment)	ü Maintenance of High Temperature and High Pressure Piping
ü Remaining Life Assessment (advanced)	ü Occupational HSE (especially Safety)
ü Feed Water Treatment	ü General System and Outline of GTCC
ü Site Visit on TPP and Manufacture's factory	ü Site Visit on TPP and Manufacture's factory
ü Lessons Learned from Accidents	ü Prevention of Accidents and Disasters
ü Participation in GTCC Overhaul (Video)	ü Participation in GTCC Overhaul (Video)
ü Human Error Prevention	ü Methodology to Formulate Action Plan
ü Welding Quality Management in Japan (inc. Welding Defect)	
ü Effective Maintenance for Quality Electric Power Infrastructure	
ü Methodology to Formulate Action Plan	

Practical Skill

Action Plan

*New training subjects as shown in blue (common) & in green (mechanical)

4. O&M Training in Japan: Discussed Points on the Mission

Requirement for the Training Contents

- As there are no plan for new induction, the target of this Project is middle class. Therefore, training program should include **advanced level contents.**

Request from GHCL

- 2nd training in Japan should not be advanced mechanical but other field, **especially electrical,** for covering all the fields in 3 years.
- GENCOs have **O&M training needs for electrical field** as well as mechanical, of which information was listed and provided for the Expert team.

Limitation

- As preparation for advanced or practical training program takes time, **electrical course could be somewhat basic.**
- As training would include many topics and would not focus on specific facilities, **the contents have to be somewhat general.**

- In accordance with GHCL's request, JICA Expert Team makes the best endeavor to reflect training needs on the 2nd training in Japan, and to keep the level as much as possible.
- Participants are requested to try to learn even from general or basic topics.

4. O&M Training in Japan: Electrical (Tentative)

Engineers	Technicians
Introduction of the latest technology in TPP (inc. USC)	Introduction of the latest technology in TPP (inc. USC)
Experience-based Safety Training	Experiential Safety Training
Human Resource Development	Experiential Quality Training
Quality Management	Basics of Non-Destructive Inspection Skills
Thermal Efficiency Management	Overhauling Motors
Basic Training of Vibration (Balancing)	Electrical Protection Systems (inc. intro. & usage)
Non-Destructive Inspection	Modern Maintenance Techniques of Excitation Systems
Electrical Protection Systems (inc. intro. & usage)	Control Circuit (mainly Protection Relay)
Modern Maintenance Techniques of Excitation Systems	Preventive Maintenance (inc. Generator & Main Trans.)
Control Circuit (mainly Protection Relay)	Fire Protection for Electrical Circuit/Equipment
Preventive Maintenance (inc. Generator & Main Trans.)	Insulation standard for Electrical Circuit/Equipment
Fire Protection for Electrical Circuit/Equipment	Occupational HSE (especially Safety)
Insulation standard for Electrical Circuit/Equipment	Site Visit on TPP and Manufacture's factory
Site Visit on TPP and Manufacture's factory	Prevention of Accidents and Disasters
Lessons Learned from Accidents	Methodology to Formulate Action Plan
Human Error Prevention	
Effective Maintenance for Quality Electric Power Infrastructure	
Methodology to Formulate Action Plan	

Practical Skill

Electrical Subject

Action Plan

*New training subjects as shown in blue (common) & in green (electrical)

4. O&M Training in Japan: Selection Criteria

Items	Qualification (Engineers)	Qualification (Technicians)
Number	8 persons	8 persons
Training Term	About 1 month	About 3 weeks
Required Condition	Ø An engineer in TPS or an instructor in WEA Ø Capable of drafting effective action plan Ø Willing to make technical contribution to HRD in GENCOs Ø Electrical expertise	Ø An technician in TPS or an instructor in Guddu T/C Ø Capable of drafting effective action plan Ø Willing to make technical contribution to HRD in GENCOs Ø Electrical expertise
Educational Background	Be a graduate of university	Be a diploma of technical high school or college, or higher
Language	Have a competent command of spoken and written English.	See footnote*
Health	Must be in good health, both physically & mentally, to participate in the program in Japan.	

*1:Lecture will be made in Japanese and translated to Urdu. Course materials will be prepared in English, and participants are expected to prepare job reports and action plans in English. Therefore participants are expected to be familiar with written English at least.

4. O&M Training in Japan: Selection Criteria

Items	Qualification (Engineers)	Qualification (Technicians)
Undertaking of Participants	Ø Read through "General Information" (GI) of the training to be issued by JICA, and understand the contents Ø Draft the action plan of his/her organization during the course, and to explain the contents to his/her higher authorities for their endorsement Ø Make effort to disseminate the knowledge obtained in Japan after coming back to Pakistan	
Undertaking of Mother Organizations	Ø Allow the participants to draft the action plan of the organization, and to let them explain the contents to the higher authorities for endorsement Ø Implement the action plan Ø Provide information regarding action plan monitoring to JICA Expert Team through focal points of each organization Ø Evaluate the contribution of the participants on HRD/knowledge sharing in their organization, and provide information to JICA Expert Team through focal points	

Notice:

- For efficient dissemination of the knowledge, instructors in WEA and Guddu T/C with electrical expertise, or candidates for these posts are most welcomed.

Contents

5. Provision of O&M Training Equipment: Finding of this Mission

- ü WEA has the existing power plant operation simulator customized for Muzaffargarh TPS, but now **cannot invite enough trainees because it has been out of order.**
  - Ø WEA requests to replace the existing simulator with **the latest operation simulator.**
- ü GENCOs have suffered from **some shaft-vibration troubles** of various rotary equipment.
- ü Workshop in Faisalabad TPS has dynamic rotor balancing device & NDI for not practical training but **maintenance work.**
  - Ø Some JICA-trained engineers request to provide **NDI and/or vibration analyzer** for efficient dissemination to other colleagues.

5. Provision of O&M Training Equipment: JICA's Suggestion

Without recent freshmen of engineers/technicians in GENCOs, **JICA suggests these training equipment are useful to refresher course**

(*See* the attached document for detail information)

	Power Plant Operation Simulator	Vibration Analysis Demonstrator	NDI Demonstrator (PT/MT/UT)
Image			
Main Purpose	**Replacement of existing simulator (out of order) in WEA** with this generic simulator for GTCC & conventional type (Oil/Gas).	It's useful for JICA-trained engineers to **disseminate the theoretical knowledge obtained in Japan to other colleagues**, in terms of many vibration troubles at TPPs.	It's useful for JICA-trained engineers & technicians **to disseminate the theoretical knowledge and skill obtained in Japan to other colleagues** at TPPs.
Notice	**NOT useful for advanced operator course** because of generic (default spec.).	Some maintenance (lubrication etc.) is required.	Some consumables are required.
Main Target	Operators	Engineers (both mechanical & electrical)	Engineers/technicians (both mechanical & electrical)

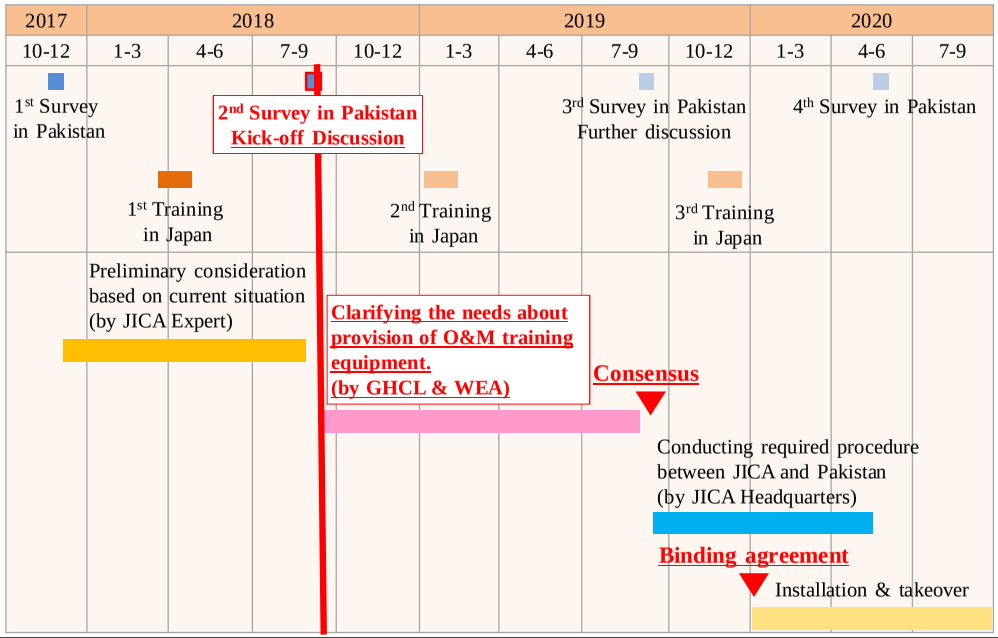
5. Provision of O&M Training Equipment: JICA's Evaluation

Based on JICA's evaluation, **GHCL/WEA are requested to clarify the needs about it.**

		Case 1	Case 2	Case 3	Case 4
Power Plant Operation Simulator		**1 set**	None	None	None
Vibration Analysis Demonstrator*		None	**2 sets**	**1 set**	None
NDI Demonstrator** (PT/UT/MT)		None	None	**4 sets**	**7 sets**
Installed Site		**Simulator** WEA	**Vibration** WEA and Guddu T/C	**Vibration** WEA **NDI** WEA(2) and Guddu T/C(2)	**NDI** WEA(2), Guddu T/C(2) and TPPs(3)
Expected effect	Number of trainees	✓ Limited & far from TPPs	✓✓ Limited &far from TPPs	✓✓✓ Many but far from TPPs	✓✓✓✓ Many & on TPPs
	Training Field	**1** Only Simulator	**1** Only Vibration Analysis Demo.	**2** Both Vibration Analysis Demo. & NDI Demo.	**1** Only NDI Demo.
Evaluation from JICA Expert		✗	✓	✓✓✓	✓✓

*Vibration (1set) contains one Fluid-Film Bearing Rotor Kit. **NDI (1set) contains four PTs , one UT and one MT.

5. Provision of O&M Training Equipment: Schedule (Tentative)



Contents

6. Summary on the Mission for Next Step

ü **Request for Next Step:**

Giving us any comments from Pakistani side for MoM & monitoring sheet **by SEP 21, 2018**, especially,

- Ø O&M training program in Japan, and
- Ø Selection criteria for next participants.

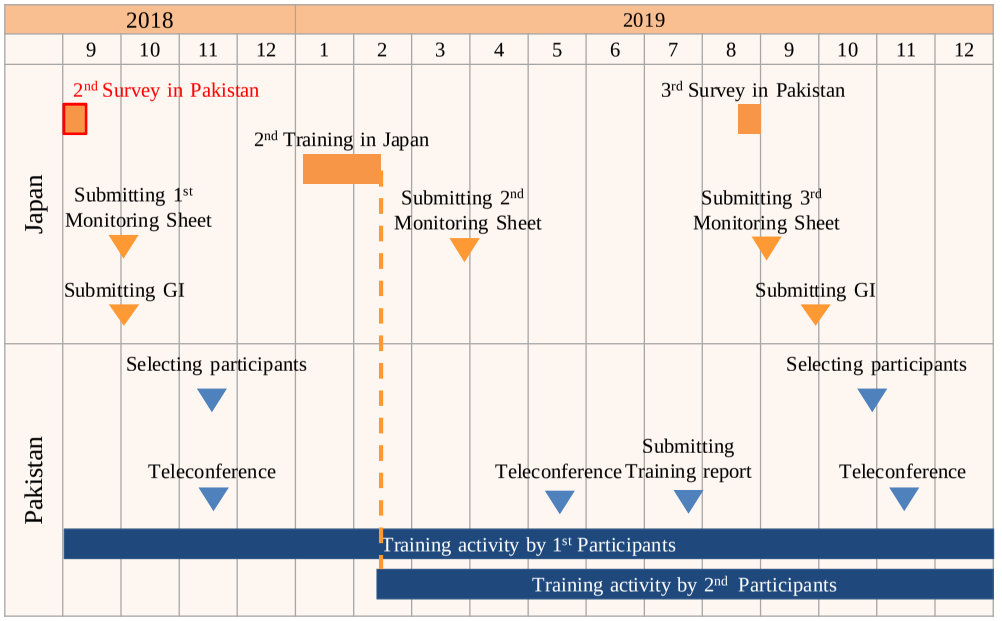
ü **Undertaking by Pakistani Side:**

- Ø Selecting participants based on the selection criteria **by NOV 15, 2018.**
- Ø **Supervising** and reporting O&M training activity at each TPS implemented by JICA-trained engineers & technicians (by TPS manager).
- Ø Clarifying the needs about provision of O&M training equipment.

ü **Undertaking by Japanese Side:**

- Ø Submitting GI about the O&M training in Japan **by OCT 1, 2018.**
- Ø Conducting the O&M training in Japan for each 8 engineers/technicians as participants **(JAN/FEB, 2019).**
- Ø Reviewing training activity by JICA-trained engineers & technicians.

6. Summary on the Mission for Next Step



Hiroki HIRAHATA (Focal Point)
hirahata.hiroki@b5.kepco.co.jp
Thermal Power Division
The Kansai Electric Power Co.,Inc.

Introduction of O&M training equipment (1/2)

Attachment 3

Power Plant Operation Simulator

[Image]

ü **Target trainees**
- All Operators and Junior Maintenance Engineers

ü **Model plant**
- 250MW 1-1-1 Type Gas Turbine Combined Cycle Power Plant
- 200MW Drum Type Conventional Power Plant (Oil/Gas firing)

ü **Learning**
- Basic operation of power plant
- Plant start-up & shut-down
- Troubleshooting

ü **Capabilities of Power Plant Operation Simulator**
- Cold or hot start-up, load swings and shutdown of the plant
- Over 350 malfunctions of plant applicable
(Combustion chamber flame out/ Tube leaks/ Bearing high vibration/ Under excitation etc.)

ü **How to Training**
- Operates with mouse and keyboard while seeing some monitor.
- Several trainees as team are trained through the malfunctions selected by the instructor.

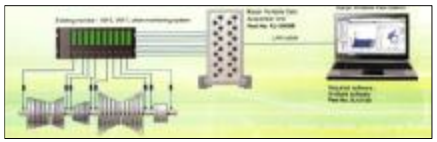
Introduction of O&M training equipment (2/2)

Attachment 3

Vibration Analysis Demonstrator

ü **Target trainees**
- Junior Maintenance Engineers

[Image]



ü **Type of rotor**
- Fluid Film Bearing Rotor

ü **Learning**
- Basic mechanism of vibration
- Knowledge and skill for suppressing vibration
- Troubleshooting

ü **Capabilities of Vibration Analysis demonstrator**
- Measure and Analysis to model rotor's vibration (Maximum speed: 5,000rpm)
- Simulation phenomena is following;
(Physical unbalance/ Oil whirl/ Misalignment/ Thermal unbalance)

ü **How to Training**

Several engineers are trained by an instructor through below methods.
- Simulate shaft-vibration through rotor-unbalancing intentionally.
- Measure, record, and analyze the vibration with the demonstrator.
- Consider how to suppress vibration by attaching balance weight.
- Demonstrate the vibration after attaching balance weight.

(3) Minutes of Meeting for the 3rd JCC

MINUTES OF MEETING
FOR
THE THIRD JOINT COORDINATION COMMITTEE (JCC)
ON
THE PROJECT FOR CAPACITY BUILDING AND STRENGTHENING OF THERMAL POWER GENERATION OPERATION & MAINTENANCE
BETWEEN
JAPAN INTERNATIONAL COOPERATION AGENCY
AND
THE ISLAMIC REPUBLIC OF PAKISTAN

Japan International Cooperation Agency (hereinafter referred to as "JICA") and the Ministry of Energy of the Government of the Islamic Republic of Pakistan (hereinafter referred to as "MOE") and relevant organizations held the third Joint Coordination Committee (hereinafter referred to as “JCC”) on the Project for Capacity Building and Strengthening of Thermal Power Generation Operation and Maintenance (hereinafter referred to as "the Project").

The third JCC on the Project was held on 11th October 2019, at GENCO Holding Company, Ltd. (hereinafter referred to as “GHCL”), Islamabad. As a result of discussions on the third JCC Meeting, the Japanese side and the Pakistan side have confirmed the main items described in Annex.

Islamabad, 11th October, 2019

Yuka Okada Program Officer JICA Industrial Development and Public Policy Department	Zafar Abbas Joint Secretary Ministry of Energy (Power Division)
Hiroki Hirahata Chief Advisor JICA Expert Team	Muhammad Imran Chief Executive Officer GENCO Holding Company, Ltd

ANNEX

1. Progress of the Project

The JICA Expert Team has explained the Work Flowchart, overall schedule, the progress made after the second JCC meeting including the second training courses in Japan implemented from January to February 2019, and the upcoming activities based on Attachment 2. The JICA Expert Team requested close collaboration from the Pakistan side for the implementation of project activities, including nomination of training candidates, implementation and monitoring of Action Plans, support for follow up survey by the JICA Expert Team.

The Pakistan side acknowledged the contents of the explanation and agreed to meet the request from the JICA Expert Team.

2. Results of the Third Mission

(1) Outline of the Mission

The JICA Expert Team implemented its third mission on Pakistan from 30th September to 11th October 2019, to achieve the below purposes;

- ✓ Reviewing O&M training activities at TPSs implemented by JICA-trained engineers and technicians,
- ✓ Grasping the current situation of O&M at TPSs, and confirming the O&M training subjects,
- ✓ Mutual agreement on O&M and HRD training program in Japan January/February 2020,
- ✓ Mutual agreement on selection criteria for next participants (management, engineers and technicians),
- ✓ Proposing O&M training equipment

The JICA Expert Team made a brief explanation of current situation of each topic based on Attachment 2.

(2) Results of the review of Action Plan Implementation

The JICA Expert Team explained the results of review of Action Plan implementation as follow. Pakistan side took note of these.

(Results of the review of Action Plan Implementation)

- ✓ JICA-trained engineers and technicians have implemented their Action Plan almost as previously arranged with support from management, and a series of their dissemination activities can help to improve the O&M capacity at TPSs.
- ✓ Safety culture and mind at their workplace are now being improved through implementation of their Action Plan, but it seems to take time to fully establish them, so the continuous effort is important.
- ✓ JICA-trained engineers and technicians have disseminated their knowledge and skills to their colleagues by utilizing training materials provided by the JICA Expert Team, and the some training subjects such as “boiler water quality control” was effective among the training course in Japan.

- ✓ In terms of more effective dissemination to other colleagues at TPSs, some of them requested the JICA Expert Team to install the same O&M training equipment as had been used at O&M training in Japan.
- ✓ The O&M training in Japan had improved their attitude, way of thinking and approach to problem as follows:
  - ➢ Engineers started keeping record of troubles.
  - ➢ Engineer implemented dissemination activity not only for staffs of his own TPS, but also for staffs of other TPSs (e.x. Jamshoro to Kotri).
  - ➢ Technicians keep maintenance tools and parts tidy and in order during overhaul work. In addition, time management has been improved through Japanese culture and O&M training in Japan.
  - ➢ Technicians made original maintenance reports for repair work related to equipment without OEM manuals, in terms of effectiveness of the similar work.

(3) Current situation of O&M

The JICA Expert Team conducted Issue Analysis as main topic at the second batch O&M training in Japan.

For the purpose of realizing proper maintenance of TPSs, considering each difference between ideal and actual conditions item by item, every participants tried to clarify the countermeasures through internal discussion while being supported by the JICA Expert Team.

In the Mission the JICA Expert Team reconfirmed Issue Analysis and discussed current situation.

The JICA Expert Team would like to request Pakistan side for the further understanding and continuous support for Action Plan implemented by JICA-trained engineers and technicians.

- ✓ Coordinating Engineers and Technicians work to implement their Action Plan as planned.
- ✓ Reinforcing Action Plan implementation through O&M training equipment provided by JICA: Vibration analysis demonstrator and NDI demonstrators.

(4) Suggestion of Training target

The JICA Expert Team explained more suitable O&M condition through the Mission as follows:

- ✓ Based on the result of site survey and the needs of Pakistan side, the JICA Expert Team will focus on general contents, especially I&C (Instruments and Control) Maintenance as next O&M training;
- ✓ The JICA Expert Team consider that the subjects related to Balance of Plant (BOP) control can contribute to enhance I&C maintenance skills for the following reasons;
  - ➢ BOP control has common contents regardless of the manufacturer while main control system is quite different in design concept, logic, etc. depending on the manufacturers; and

- Through site survey in TPSs of Pakistan, JICA expert recognized that there was still room for improvement in basic skills of I&C including BOP control.

✓ For realizing more effective capacity building for O&M at TPSs and developing training plan to effectively utilize the training equipment, management in charge of HRD is strongly expected to participate in next HRD training in Japan and recognize the issue to be solved.

3. Third Counterpart Training in Japan

(1) Schedule

The third Counterpart Training in Japan is tentatively planned from 26th January 2020 to 1st February 2020 for Management, from 13th January to 15th February for Engineer, and from 13th January to 1st February 2020 for Technician. (From arrival to departure on Japan)

(2) Overall Contents

The both sides confirmed that the overall tentative contents of the third training in Japan would be as follows;

(For Management)

Training Course	**Main Purpose**	**Important Points**
Course Orientation	To grasp outline of HRD training course.	Motivating management to participate in this HRD training course.
Job Report Presentation	To grasp actual condition of HRD in Pakistan.	Utilizing actual condition in Pakistan on HRD issue analysis.
Site Visit on KANSAI's TPS	To grasp the latest condition and how to manage the latest TPS directly.	Suggesting an example of ideal condition (TPSs) on HRD issue analysis.
Site Visit on Training Center (For Engineer & Technician)	To grasp roles & responsibilities of T/C directly and encourage engineers and technicians during next O&M training.	Suggesting an example of ideal condition (T/C for technicians) on HRD issue analysis.
Develop Training Plan to effectively utilize Training Equipment	To make a feasible & effective training plan like how to use training equipment that will be provided by JICA.	Maximizing the effectiveness of training equipment considering the actual condition of O&M training in Pakistan.
HRD Issue Analysis	To analyze current issues & causes related to HRD in Pakistan	Considering each difference between actual/ideal condition item by item, and identifying the countermeasure.
Action Plan Presentation	To make effective action plan to improve HRD situation in Pakistan	Implementing action plan as scheduled. (inc. Training Plan on how to use O&M training equipment provided by JICA)

(For Engineer and Technician)

	Engineer	Technician
General	Introduction of the latest technology in TPS (inc. USC)	Introduction of the latest technology in TPS (inc. USC)
	Experience-based Safety Training	Experiential Safety Training
	Human Resource Development	Experiential Quality Training
	Quality Management	Prevention of Accidents and Disasters
	Thermal Efficiency Management	Occupational HSE (especially Safety)
	Tool Box Meeting (for Safety)	Tool Box Meeting (for Safety)
	Lessons Learned from Accidents	
	Human Error Prevention	
	Effective Maintenance for Quality Electric Power Infrastructure	
I&C Maintenance	Monitoring Device	Monitoring Device
	Pneumatic Control Valve and Accessories	Pneumatic Control Valve and Accessories
	Copper Tube Processing and Terminal Treatment	Copper Tube Processing and Terminal Treatment
	Sequence Control	Sequence Control
	Tuning of PID Control	Tuning of PID Control
	Turbine Supervisory Instrument (Vibration Meter, Eccentricity Indicator, Differential Expansion Indicator, Shaft Position Indicator, Speed Indicator)	
	Basic Training of Vibration (Balancing)	
	GTCC Control	
Site Visit	Site Visit on TPS	Site Visit on TPS
	Site Visit on Manufacturer's factory	Site Visit on Manufacturer's factory
JICA Original	Issue Analysis	Issue Analysis
	Methodology to Formulate Action Plan	Methodology to Formulate Action Plan

The contents of the training include both general subjects related to O&M of TPS (ex. Quality Management, Safety) and technical subjects (ex. Sequence Control, Monitoring Device).
The both sides agreed on the purpose of the training subjects.

(3) Participants

The both sides agreed that the eligible participants for the third training in Japan shall be as follows;

(For Management)

Items	Qualification (Management)
Number	**4 persons**
Training Term	**About 1 week**
Current Duties	Be a management level officer working for GHCL, GENCOs, whose assignment are closely related to the project activity, such as: ➢ **Person in charge of Technical HRD at GHCL and GENCOs (especially Guddu T/C and Muzaffargarh T/C)**
Required Condition	Management who can formulate the effective Action Plan and willing to / have an authority to make a substantial contribution to **improvement of GENCO's technical HRD**, and can make **feasible and effective Training Plan, including how to utilize Training Equipment** provided by JICA
Language	Have a competent command of spoken and written English.
Health	Must be in good health, both physically and mentally, to participate in the program in Japan.

(For Engineers and Technicians) *1

Items	Qualification (Engineer)	Qualification (Technician)
Number	**8 persons**	**8 persons**
Training Term	About 5 weeks	About 3 weeks
Current Duties	Be a leading engineer working on thermal power plants, and has expertise related to **I&C engineering in TPSs**, who are capable to be instructors to train other engineers.	Be a leading technician working on thermal power plants, and has expertise related to **I&C work in TPSs**, who are capable to be instructors to train other technicians.
Experience in the relevant field	Middle-class* engineers and technicians in charge of O&M in TPSs. *Ideally, engineers & technicians have experience in TPSs including GTCC.	
Language	**Have a competent command of spoken and written English.**	None*2
Health	Must be in good health, both physically and mentally, to participate in the program in Japan.	
Undertaking of Participants	➢ Read through "General Information" (GI) of the training to be issued by JICA, and understand the contents ➢ Draft the action plan of his/her organization during the course, and to explain the contents to his/her higher authorities for their endorsement ➢ Make effort to disseminate the knowledge obtained in Japan after coming back to Pakistan	

Undertaking of Mother Organizations	➢ Allow the participants to draft the action plan of the organization, and to let them explain the contents to the higher authorities for endorsement ➢ Implement the action plan ➢ Provide information regarding action plan monitoring to the JICA Expert Team through focal points of each organization ➢ Evaluate the contribution of the participants on HRD/knowledge sharing in their organization, and provide information to the JICA Expert Team through focal points

Notice:
For efficient dissemination of the knowledge, instructors in Training Centers with I&C expertise, or candidates for these posts are most welcomed.

*1: JICA Expert Team may refuse the application of candidates who deviate from the criteria.
*2: Lecture will be made in Japanese and translated to English or Urdu. Course materials will be prepared in English, and participants are expected to prepare job reports and action plans in English.

The both sides confirmed that the participants are expected to make Action Plans described above to improve capacity of O&M of TPS. In this regard, Japan side requested the Pakistan side to nominate participants who are capable of drafting Action Plans and also disseminating their knowledge and skills to other colleagues in each TPS.
And also the both sides confirmed that the participants of managements are expected to make Action Plans described above to improve capacity of O&M HRD in TPS, and to make feasible and effective Training Plan, including how to utilize Training Equipment provided by JICA. In this regard, Japan side requested the Pakistan side to nominate participants who are in charge of HRD at GHCL, GENCOs (especially Guddu T/C and Muzaffargarh T/C).

The members of JCC shall closely coordinate to follow up and supervise the implementation of these Action Plans. Project Directors and Project Managers are requested to provide reports to the JICA Expert Team on the result of the implementation of the Action Plans.

(4) Nomination date

The both sides confirmed the managements, engineers and technicians nomination deadline for this third training is 11th November 2019, assuming that GI from the JICA Expert Team shall be issued by 23rd October 2019. After the nomination from the Pakistan side, the Japan side will confirm the participants for the third training within 1 week.

(5) Observance of the application deadline

The training in the last two times had to be changed the entire schedule backward because the submission of application documents was delayed from the Pakistan side. JICA pointed out that the third training will not allowed to change the schedule due to having trouble of external lecturer/organizations and logistic rearrangements (e.g. air flight booking. hotel reservations, transportation arrangements). Pakistan side agreed to keep the deadline strictly for smooth implementation of training.

5. Provision of O&M training equipment

The JICA Expert Team made an explanation about provision of O&M training equipment based on Attachment 2.

The both sides finally agreed that Case 3 (i.e. one (1) set of vibration analysis demonstrator along with four (4) sets of NDI demonstrator) was the best option to train engineers & technicians of GENCOs for fulfilling prevailing O&M requirements of GENCOs.

Pakistan side made feasible Training Plan, including;

- ✓ Training courses in which O&M training equipment is fully utilized (i.e. who, to whom, for what, when, where and how), and
- ✓ Training schedule in which O&M training preparation and the follow-up process after installation are described

At the request of the JICA Expert Team, Pakistan side shall develop the Training Plan through discussion at next HRD training in Japan.

6. Project Monitoring Sheet

The both sides confirmed the contents of Monitoring Indicator and the Project Monitoring Sheet Ver. 3 as Attachment 3.

Attachment 1 Attendance List
Attachment 2 Presentation Materials
Attachment 3 Project Monitoring Sheet Ver. 3
Attachment 4 Minutes of Meetings during the Mission

The Project for Capacity Building and Strengthening of Thermal Power Generation Operation & Maintenance. in the Islamic Republic of Pakistan

JCC Meeting Attendance List

Date: 11 / Oct. / 2019

Time: 14:30 - 16:00

Place: GHCL Meeting Room

No.	Name	Position	Company	Signature
1	IMRAN AHMAD	SR. PROGRAM MANAGER	JICA	[signature]
2	Muhammad Imran	MD & CEO	GHCL	[signature]
3	Mushtaq Ahmad	DGHR&A	GHCL	[signature]
4	Muhammad Jafar	Addl. Director	GHCL	[signature]
5	IFTIKHAR AHMAD	Asst. Director	GHCL	[signature]
6	Yuka Okada	Program Officer	JICA	[signature]
7	Akihiro Takashima	Sr. Rep	〃	[signature]
8	Noriyuki Tsuruoka	Sr. Rep	〃	[signature]
9	Hiroki Nishida	General Manager	Kansai Electric	[signature]
10	Akira Kosakai	Operation & Mech. Engineer. JICA Expert	Kansai Electric	[signature]

JCC Meeting Attendance List

No.	Name	Position	Company	Signature
11	Yoshihiro Doi	Mech Eng. JICA Exp.	Kansai Elec.	[signature]
12	Hidenobu Ichioka	Elec. Engineer JICA Expert	Kansai Electric	[signature]
13	Yuki Obe	I&C Eng. JICA Expert	Kansai Electric	[signature]
14				
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SURVEY REPORT and NEXT ACTION

October 2019

Japan International Cooperation Agency (JICA)

The Kansai Electric Power Co., Inc.

Contents

1. Project Summary: Capacity Building for O&M at TPPs

This JICA project aims to implement capacity building for O&M at Thermal Power Plants (TPPs), in order to make continuous technical support for Pakistani side.

Project Purpose

Overall Goal	Technology and technical skills obtained by the project are utilized in actual O&M at GENCOs power stations.
Project Goal	Training capacity on O&M of WEA and GENCOs is strengthened.

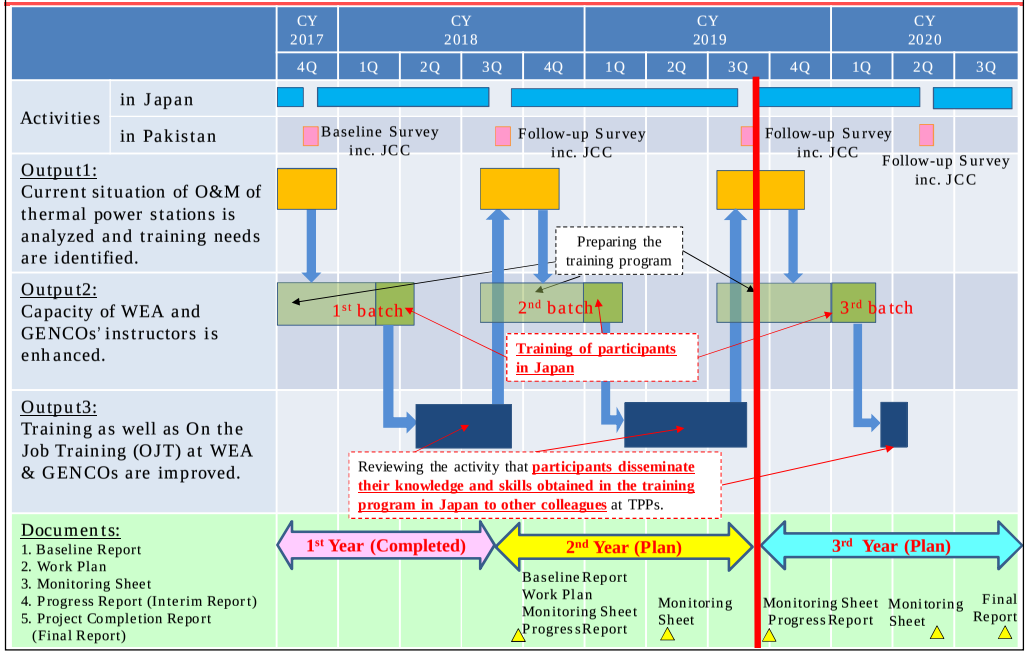
Project Output

Output 1	Current situation of O&M of thermal power stations is analyzed and training needs are identified.
Output 2	Capacity of WEA and GENCOs' instructors is enhanced.
Output 3	Training as well as On the Job Training (OJT) at WEA & GENCOs are improved.

1. Project Summary: Capacity Building for O&M at TPPs

Targeted Type of Power Generation	Conventional Type (Gas, Coal and Oil) and Gas Turbine Combined Cycle (GTCC) including advanced environmental practices in Japan
Project Sites	WEA in Faisalabad and GENCOs' thermal power station in Jamshoro, Guddu, Muzaffargarh, Lakhra, Nandipur etc.
Counterpart	Ministry of Energy (MOE), WAPDA Engineering Academy (WEA), GENCO Holding Company, Ltd (GHCL), and GENCOs
Beneficiaries	O&M instructors of WEA and GENCOs and their trainees
Duration	October 2017 – September 2020 (3 years)

1. Project Summary: Work Flowchart



1. Project Summary: This Follow-up Survey

Date		Events		
1-October	Tue.	GHCL	Kick-off Meeting	
2-October	Wed.	Muzaffargarh TPS	Meeting with management and JICA-trained participants (engineers & technicians) Site Visit for Muzaffargah and Guddu	
3-October	Thu.	Guddu TPS		
4-October	Fri.	Guddu T/C		
7-October	Mon.	Jamshoro TPS		
9-October	Wed.	All members (GHCL)	Pre-Meeting	
11-October	Fri.	All members (MoE/GHCL)	JCC (Joint Coordination Committee)	

Counterpart	Agenda
Management	Ø Presentation (especially next O&M/HRD training in Japan and the selection criteria). Ø Wrap-up meeting (for feedback)
JICA-trained engineers JICA-trained technicians	Ø Reviewing the training activity at TPPs implemented by JICA-trained participants. Ø Grasping current situation of O&M at TPPs and identifying the O&M training needs, through discussion on the issue analysis.

1. Project Summary: Monitoring Indicators

Items	Monitoring Indicators	Achievement
Overall Goal: Technology and technical skills obtained by the project are utilized in actual O&M at GENCOs power stations.	ü Number of GENCOs power stations which utilize obtained technology and technical skills.	ü **4 TPPs (Jamshoro, Guddu, Muzaffargarh and Lakhra)** utilized knowledge and skill obtained in Japan as scheduled.
Project Goal: Training capacity on O&M of WEA and GENCOs is strengthened.	ü 100% of GENCOs power stations where participants come from, implement trainings (OJTs) based on the Action Plan prepared by trained instructors.	ü **Training is being implemented at the 100% of GENCOs TPP:** Jamshoro, Guddu, Muzaffargarh and Lakhra.
	ü Improvement of WEA training contents based on the Action Plan developed by trained instructors.	ü JICA-trained participants implemented their Action Plan **almost as previously arranged with support from management**, regardless of various hard duties in each workplace. ü A series of their dissemination activities can help to **improve the O&M capacity at TPPs.**

1. Project Summary: Monitoring Indicators

Items	Monitoring Indicators	Achievement
Output 1: Current situation of O&M of thermal power stations is analyzed and training needs are identified.	ü Training needs are compiled based on the current situation.	ü JICA expert **compiled training needs based on the current situation of O&M** including request from GHCL: "comprehensive field of TPPs".
Output 2: Capacity of WEA and GENCOs' instructors is enhanced.	ü Training program is formulated based on the training needs.	ü Based on the survey result such as shown in Output1, JICA expert prepared these O&M training program in Japan. 1st batch: **mechanical maintenance** 2nd batch: **electrical maintenance**
	ü Total number of trained instructors.	ü **16 engineers & 16 technicians** trained in Japan for dissemination to other colleagues at TPPs.
Output 3: Training as well as OJT at WEA and GENCOs are improved.	ü Achievement level of Action Plans developed by trained instructors.	ü JICA-trained participants disseminated their knowledge and skills to their colleagues **by utilizing training materials provided by JICA Expert**. ü The O&M training in Japan helped to improve **their attitude, way of thinking and approach to problem.**
	ü The results of checklists.	ü JICA expert made discussion with JICA-trained participants and got their training reports from **14 engineers & 15 technicians.**

1. Project Summary: Action Plan Implementation

Through this follow-up survey, about action plan implementation, we've understood that some TPPs are well-operated. For more effective review, **presentation about their APs (especially their dissemination activities) made by JICA-trained participants** is required.

	Action Plan	Muzaffargarh (E:3, T:3)	Guddu (E:7, T:7)	Jamshoro (E:3, T:4)	Lakhra (E:1, T:2)	GHCL (E:1, T:0)	Total (E:15, T:16)
Engineers	General Contents (Safety/Quality etc.)	100% 3 / 3	100% 7 / 7	100% 3 / 3	100% 1 / 1	0% 0 / 1	93% 14 / 15
Engineers	Maintenance (Mechanical/Electrical)	100% 3 / 3	100% 7 / 7	67% 2 / 3	100% 1 / 1	0% 0 / 1	87% 13 / 15
Technicians	General Contents (Safety/Quality etc.)	100% 3 / 3	57% 4 / 7	100% 4 / 4	100% 2 / 2	-	81% 13 / 16
Technicians	Maintenance (Mechanical/Electrical)	100% 3 / 3	86% 6 / 7	100% 4 / 4	100% 2 / 2	-	94% 15 / 16

Well-operated

Well-operated

Contents

2. O&M Training in Japan: Overall Framework

Job Report Presentation: Participatory (Active)
To grasp actual condition of O&M at TPPs.

Lecture & practical training at KANSAI's Training Center: Passive
To learn each essence on the training program and how to teach them to others efficiently.

Site visit to Kansai's TPPs and Japanese manufacturer's factory: Passive
To understand high-level safety & quality management at their sites directly.

Workshop for Issue Analysis:
Participatory (Active)
To analyze current issues, in logical manner, especially on the cause & effect basis.

Action Plan Presentation: Participatory (Active)
To make action plan for disseminating their knowledge & skills obtained in the training program in Japan to other colleagues.

2. O&M Training in Japan: 2nd Batch in 2019

	Engineers	Technicians
General	ü Introduction of the latest technology in TPP (inc. USC)	ü Introduction of the latest technology in TPP (inc. USC)
	ü Experience-based Safety Training → 12	ü Experiential Safety Training
	ü Human Resource Development → 13	ü Experiential Quality Training
	ü Quality Management	ü Prevention of Accidents and Disasters
	ü Thermal Efficiency Management	ü Occupational HSE (especially Safety)
	ü Lessons Learned from Accidents	
	ü Human Error Prevention	
	ü Effective Maintenance for Quality Electric Power Infrastructure	
Electrical Maintenance	ü Preventive Maintenance of Electrical Equipment (inc. Generator, Transformer, High Voltage Motor)	ü Preventive Maintenance of Electrical Equipment (inc. Generator, Transformer, High Voltage Motor)
	ü Preventive Maintenance of CB & Excitation System	ü Overhauling Motors (Maintenance Procedure)
	ü Maintenance of Electrical Cables	ü Maintenance of Electrical Cables
	ü Protection System & Insulation	ü Protection System & Insulation
	ü Basic Training of Vibration (Balancing)	
	ü Non-Destructive Inspection	
Site Visit	ü Site Visit on TPP and Manufacture's factory → 14	ü Site Visit on TPP and Manufacture's factory → 14
JICA Original	ü Issue Analysis	ü Issue Analysis
	ü Methodology to Formulate Action Plan → 15	ü Methodology to Formulate Action Plan → 15

2. O&M Training in Japan: Course Examples (1)

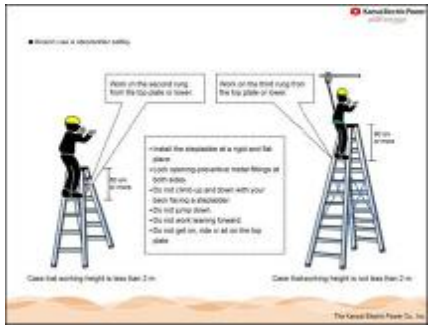
Example: Experience-based Safety Training (Practical Training)

Training Item

Safety training using following;

1. Ladder
2. Safety belt
3. Electric shock
4. Be caught by rotation
5. Helmet

Training Materials



Effects of Training:

- ü Can understand the importance of labor safety and equipment safety
- ü Can improve capability to properly use safety equipment ready for emergency situations

2. O&M Training in Japan: Course Examples (2)

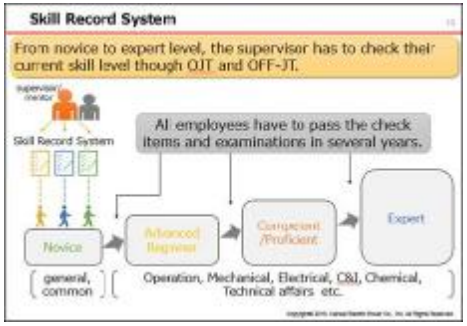
Example: Human Resource Development in Kansai (Lecture)

Training Item

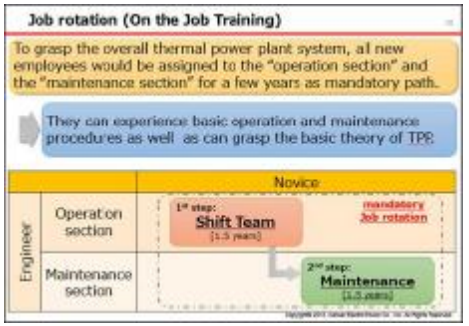
Introduction of KANSAI's Human Resource Development

- Overall HRD structure
- Induction Training
- Refresher Training
- Training Philosophy and Contents

Training Materials (1)



Training Materials (2)



Effects of Training:

- ü Can grasp HRD current situation in Japanese electrical power company
- ü Can find out the hints for improving HRD structure in Pakistan

2. O&M Training in Japan: Course Examples (3)

Example: Tour of Himeji No.2 TPP (Site Visit)

About Himeji No.2 TPP

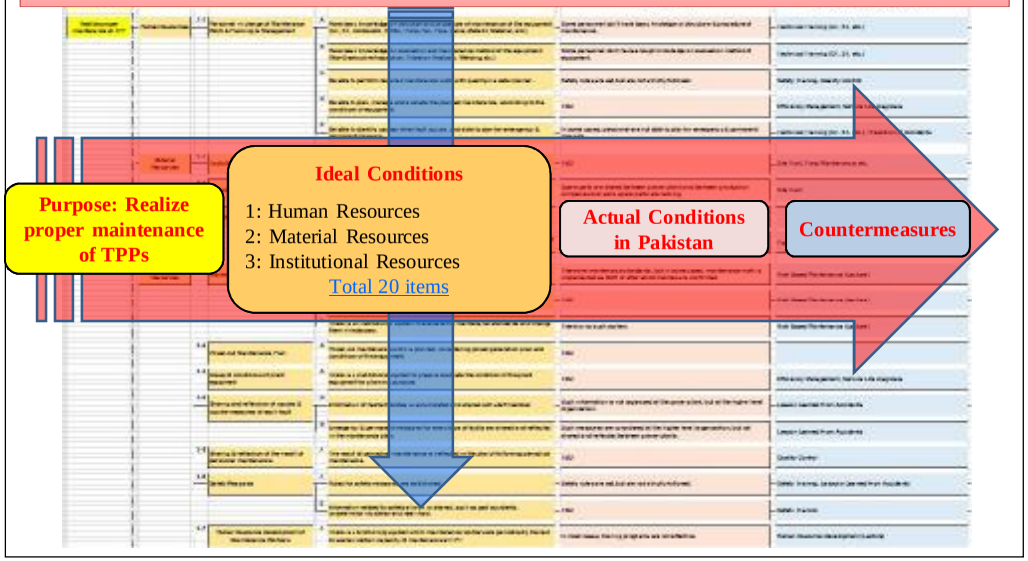
1. Largest TPP of KANSAI (4,119 MW)
2. Introduced latest GTCC technology, and achieved high thermal efficiency of 60%
3. LNG terminal is adjacent to TPP, and integratedly operated

Effects of Training:

- ü Can grasp O&M current situation in Japanese electrical power company
- ü Can understand the 5S methodology ("Sort", "Set In order", "Shine", "Standardize" and "Sustain") and its effects on quality of work
- ü Can understand how to well-operate aged-facilities

2. O&M Training in Japan: O&M Issue Analysis

Participants and JICA Expert Team **comprehensively analyzed O&M issues** of TPPs in Pakistan and **identified the countermeasures.**



2. O&M Training in Japan: Action Plan Presentation

Implementing their action plan in TPPs enables **not only participants but also their colleagues** to improve their O&M knowledge & skills.

About Action Plan

- ü Participants will be core instructors, and disseminate the knowledge and skills learned during O&M Training in Japan when they come back to Pakistan.
- ü Participants made and presented Action Plan which illustrates the detailed actions to improve quality of work, such as On-the-Job Training at their TPP.

Introduction of Participant's Action Plan

Engineer

1. Maintenance of Electrical Equipment (Generator, Transformer, etc.)
2. Maintenance Planning (Quality Control, Efficiency Management, etc.)
3. **Techniques and Skills (Vibration, NDI, etc.)**
4. Safety and Accidents Prevention
5. Suggestions / Initiatives (CMMS, Training Equipment, etc.)

Technician

1. Basic & Advance Study of Electrical Equipment (Generator, Motor, Transformer, etc.)
2. Implementation of Safety for Worker & Workplace (Prevention of Accidents and Disasters, Labor Safety, Experiential Safety Training, etc.)

2. O&M Training in Japan: Other Activities

We provided the participants with comprehensive O&M training as well as **opportunities to learn Japanese culture.**

- **Japanese Language Lesson:**

日本語

- **Home-Visit Program for Engineers**

- **Sightseeing in Kyoto: for Engineers & Technicians**

2. HRD Training in Japan: Overview

- Ø We provided management with Human Resource Development (HRD) training in Japan **to realize more effective capacity building for O&M at TPPs**.
- Ø HRD training consisted of Job Report Presentation, Visit on Kansai's Training Centers for engineers and technicians, Issue Analysis and Action Plan Presentation as follows:
  - **Introduction of proper OJT in GENCOs**
  - **Enhancement of Training Facilities in Regional Training Centre**
  - **Establishment of exclusive Training Facility Centre for Thermal Engineers**

Human Resource Development (HRD) Issue Analysis

Site Visit on Training Center (For Engineers)

2. HRD Training in Japan: Overview

Demonstration of Training Equipment (Plant Simulator)

Demonstration of Training Equipment (NDI kit)

Demonstration of Training Equipment (Vibration Rotor kit)

Action Plan Presentation

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3. Action Plan Implementation: Format

■Detailed Plan of OJT for Objective 1: To Improve Skills of Engineers through On the Job Training (OJT)

NO.	Training Subject	Purpose	Training Item		Effect	Important Points	Trainer	Where	How	Tools	Achievements		2018 OCT	2018 NOV	2018 DEC	2019 JAN	2019 FEB	2019 MAR	2019 APR	2019 MAY	2019 JUN	2019 JUL	2019 AUG	2019 SEP	Remarks
1	Service Life Diagnosis	1) To understand the outline of Service Life Evaluation 2) To understand the various type of deterioration events of Thermal Power plant 3) To understand the evaluation methods and their process 4) To understand important check points for evaluation	1-1	Purpose of Service Life Evaluation	(1) (2)	- Why Service Life Evaluation is important	JICA-trained participant	TPP	Lecture	- Textbook (provided by JICA) - O&M Manual (provided by manufacturers)	Plan	No. of times			1										
												No. of participants			5										
											Result	No. of times													
												No. of participants													
			1-2	Main Deterioration Events and their Mechanism of Deterioration	(2)	- What are the main damage factors - How each damage factor causes what kind of damage on where.	JICA-trained participant	TPP	Lecture	- Textbook (provided by JICA) - O&M Manual (provided by manufacturers)	Plan	No. of times			1										
												No. of participants			5										
											Result	No. of times													
												No. of participants													
			1-3	Service Life Diagnosis Methods	(2) (3)	- Where & how to check the damage, according to the kinds of damage	JICA-trained participant	TPP	Lecture	- Textbook (provided by JICA) - Manual (provided by manufacturers)	Plan	No. of times			1										
												No. of participants			5										
											Result	No. of times													
												No. of participants													
2	Vibration	1) To understand the mechanism of vibration 2) To understand the important checking points.	2-1	Basics of Vibration	(1)	- How vibrations occur.	JICA-trained participant	TPP	Lecture	- Textbook (provided by JICA)	Plan	No. of times				1									
												No. of participants				5									
											Result	No. of times													
												No. of participants													
			2-2	Analysis of Vibration	(1) (2)	- How to read and follow up the vibration trend and take action.	JICA-trained participant	TPP	Practical training	- Textbook (provided by JICA)	Plan	No. of times				1									
												No. of participants				5									
											Result	No. of times													
												No. of participants													

3. Action Plan Implementation: Findings of the Mission

(Actual Conditions)

- JICA-trained engineers & technicians implemented their Action Plan **almost as previously arranged with support from management**, and a series of their dissemination activities can help to **improve the O&M capacity at TPPs.**
- **Safety culture and mind at their workplace are now being improved through implementation of their Action Plan**, but it seems to take time to fully establish them, so the continuous effort is important.

3. Action Plan Implementation: Findings of the Mission

(Actual Conditions)

- JICA-trained engineers & technicians disseminated their knowledge and skills to their colleagues **by utilizing training materials provided by JICA Expert Team**, and the some training subjects such as **"boiler water quality control"** was effective among the training course in Japan.
- In terms of more effective dissemination to other colleagues at TPPs, some of them requested us to **install the same O&M training equipment as had been used at O&M training in Japan.**

3. Action Plan Implementation: Findings of the Mission

(Actual Conditions)

- The O&M training in Japan helped to improve their attitude, way of thinking and approach to problem as follows:
  - Engineers started **keeping record of troubles.**
  - Engineer implemented dissemination activity not only for staff of his own TPS, but also for staff of other TPSs (e.x. **Jamshoro to Kotri**).
  - Technicians **keep maintenance tools/parts tidy & in order** during overhaul work. In addition, **time management** has been improved through Japanese culture and O&M training in Japan.
  - Technicians **made original maintenance reports for repair work** related to equipment without OEM manuals, in terms of effectiveness of the similar work.

3. Action Plan Implementation: Findings of the Mission

(Actual Conditions)

- On the other hand, their various duties in each workplace often seem to restrict them to implement the Action Plan.
- Regarding the existing training facilities in Muzaffargarh and Guddu, **both of them have some good potential of strengthening O&M capacity building at TPPs**, in case of overall refurbishment.

(Suggestion from JICA Expert Team)

- JICA Expert Team would like to request Pakistan side for **the further understanding and continuous support for the Action Plan implemented by JICA-trained engineers & technicians**.
  - Coordinating Engineers/Technicians work to implement their Action Plan as planned.
  - Reinforcing the Action Plan implementation through O&M training equipment provided by JICA: Vibration analysis demonstrator and NDI demonstrator.

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4. Next O&M Training in Japan: Findings of the Mission

Based on the result of site survey and the needs of Pakistan side, we will focus on general contents, especially **I&C (Instruments and Control) Maintenance**.

- Pakistan side already informed JICA expert of I&C training subjects they would like us to include in the next training course.
- In terms of **the effectiveness of training** and **capacity of training center etc.,** JICA expert **scrutinized these subjects** one by one, and **decided the curriculum of next O&M training in Japan.**

(I&C training image) tuning vibration sensor

(I&C training image) tuning eccentricity indicator

4. Next O&M Training in Japan: Findings of the Mission

We consider that the subjects related to Balance of Plant (BOP) control can contribute to enhance I&C maintenance skills for the following reasons.

- Ø **BOP control has common contents regardless of the manufacturer** while main control system is quite different in design concept, logic, etc. depending on the manufacturers.
- Ø Through site survey in TPPs of Pakistan, JICA expert recognized that **there was still room for improvement in basic skills of I&C including BOP control.**

No.	I&C subjects requested from Pakistan side	Next Training
1	Industrial process technologies used to perform common Measurements	✓
2	Signal Conditioning	✓
3	Transmitters and Transducers	✓
4	Field and Panel mounted Indicators, Temperature, Pressure and Level Indicating Switches, Chart and Recorders	✓
5	Turbine Supervisory Instruments	✓
6	Calibration Procedure	✓
7	Process Control	✓
8	Final Control Elements (Control Valves and Dampers)	✓
9	Hands-on practice on Training kits of different Controllers	
10	Tuning of PID Constants	✓

No.	I&C subjects requested from Pakistan side	Next Training
11	Modern industrial Control Systems - PLC	
12	Modern industrial Control Systems - DCS	
13	I&C Diagrams and Drawings	
14	Boiler Control and Burner Management System	
15	Turbine & Generator Protection and Turbine Control System	
16	Vibration Monitoring System and Condition Monitoring System	✓
17	Fire Protection System	
18	Environment Quality Control	
19	I&C Maintenance Standards and Prudent Industrial Practices	
20	I&C Safety considerations	

4. Next O&M Training in Japan: for Engineers & Technicians

	Engineers	Technicians
General	ü Introduction of the latest technology in TPP (inc. USC) ü Experience-based Safety Training ü Human Resource Development ü Quality Management ü Thermal Efficiency Management ü Tool Box Meeting (for Safety) ü Lessons Learned from Accidents ü Human Error Prevention ü Effective Maintenance for Quality Electric Power Infrastructure	ü Introduction of the latest technology in TPP (inc. USC) ü Experiential Safety Training ü Experiential Quality Training ü Prevention of Accidents and Disasters ü Occupational HSE (especially Safety) ü Tool Box Meeting (for Safety)
I&C Maintenance	ü Monitoring Device (Pressure, Temperature, Level, Flow Rate) ü Pneumatic Control Valve and Accessories ü Copper Tube Processing and Terminal Treatment ü Sequence Control ü Tuning of PID Control ü Turbine Supervisory Instrument (Vibration Meter, Eccentricity Indicator, Differential Expansion Indicator, Shaft Position Indicator, Speed Indicator) ü Basic Training of Vibration (Balancing) ü GTCC Control	ü Monitoring Device (Pressure, Temperature, Level, Flow Rate) ü Pneumatic Control Valve and Accessories ü Copper Tube Processing and Terminal Treatment ü Sequence Control ü Tuning of PID Control * Subjects including practical training are shown in red.
Site Visit	ü Site Visit on TPP ü Site Visit on Manufacturer's factory	ü Site Visit on TPP ü Site Visit on Manufacturer's factory
JICA Original	ü Issue Analysis ü Methodology to Formulate Action Plan	ü Issue Analysis ü Methodology to Formulate Action Plan

4. Next O&M Training in Japan: Selection Criteria

In terms of maximizing the effectiveness of the training, **it is crucial to select candidates that meet the following criteria.***1

Items	Qualification (Engineers)	Qualification (Technicians)
Number	8 persons	8 persons
Training Term	About 5 weeks	About 3 weeks
Current Duties	Be a leading engineer working on thermal power plants, and has expertise related to **I&C engineering in TPPs**, who are capable to be instructors to train other engineers.	Be a leading technician working on thermal power plants, and has expertise related to **I&C work in TPPs**, who are capable to be instructors to train other technicians.
Experience in the relevant field	Middle-class* engineers and technicians in charge of O&M in TPPs. *Ideally, engineers & technicians have experience in TPPs including GTCC.	
Language	Have a competent command of spoken and written English.	None*2
Health	Must be in good health, both physically and mentally, to participate in the program in Japan.	

***1: JICA expert may refuse the application of candidates who deviate from the criteria.**

*2: Lecture will be made in Japanese and translated to English or Urdu. Course materials will be prepared in English, and participants are expected to prepare job reports and action plans in English.

4. Next O&M Training in Japan: Selection Criteria

Items	Qualification (Engineers)	Qualification (Technicians)
Undertaking of Participants	Ø Read through "General Information" (GI) of the training to be issued by JICA, and understand the contents Ø Draft the action plan of his/her organization during the course, and to explain the contents to his/her higher authorities for their endorsement Ø Make effort to disseminate the knowledge obtained in Japan after coming back to Pakistan	
Undertaking of Mother Organizations	Ø Allow the participants to draft the action plan of the organization, and to let them explain the contents to the higher authorities for endorsement Ø Implement the action plan Ø Provide information regarding action plan monitoring to JICA Expert Team through focal points of each organization Ø Evaluate the contribution of the participants on HRD/knowledge sharing in their organization, and provide information to JICA Expert Team through focal points	

Notice:

- For efficient dissemination of the knowledge, **instructors in Training Centers with I&C expertise, or candidates for these posts** are most welcomed.

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5. Next HRD Training in Japan: Findings of the Mission

Our understanding about current HRD in Pakistan

(For Training System)

- **There is probably room for improving HRD more effectively & more systematically** because training function still remains in WEA although TPPs are managed under GHCL.
- GHCL is considering to **upgrade their training facilities at Muzaffargarh TPS and Guddu TPS**.
- **It seems be substantially depending on only OJT** because of no scheduled and no periodical training and technical skill evaluation system.

(For Needs of Training Equipment)

- GHCL is keeping in view **the aging factor of GENCOs power plant** , especially wherein **vibration problem of rotary equipment is on increasing trend**.

Suggestion from JICA Expert Team

- For the purpose of **realizing more effective O&M capacity building at TPPs** and **effectively utilizing the training equipment provide by JICA,** management is strongly expected to participate in next HRD training in Japan and recognize the issue to be solved.

5. Provision of O&M Training Equipment: Candidates

Purpose: Reinforcing the Action Plan implemented by JICA-trained engineers/technicians **from not only theoretical but also practical viewpoint.**

	Generic Operator Training Simulator	Vibration Analysis Demonstrator	NDI Demonstrator [PT/MT/UT]
Image			
General description	This Generic OTS is a computer-based training system which uses dynamic simulation model of TPPs. Its associated course and exercise allows for general introductory training with usual start-up & shut-down and emergency case.	This is the device for demonstration of the variable vibration failures in rotating machinery. Its associated course and exercise allows for theoretical and practical training in vibration causes & effects, balancing and data collection.	NDI is a wide group of analysis techniques to evaluate the properties of a material, component or system without causing damage. Its associated course/exercise allows for theoretical and practical training in correct inspection and record.

5. Provision of O&M Training Equipment: Final Decision

Pakistan side has finally agreed to the recommendation from JICA expert: **Case 3**

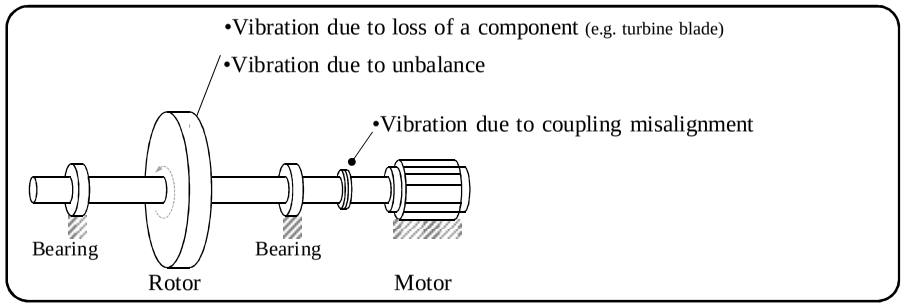
		Case 1	Case 2	Case 3	Case 4
Power Plant Operation Simulator		1 set	None	None	None
Vibration Analysis Demonstrator*		None	2 sets	1 set	None
NDI Demonstrator** (PT/UT/MT)		None	None	4 sets	7 sets
Expected effect	Number of trainees	✓ Limited & far from TPPs	✓✓ Limited &far from TPPs	✓✓✓ Many but far from TPPs	✓✓✓✓ Many & on TPPs
	Training Field	1 Only Simulator	1 Only Vibration Analysis Demo.	2 Both Vibration Analysis Demo. & NDI Demo.	1 Only NDI Demo.
Evaluation from JICA Expert		✗	✓	✓✓✓	✓✓

*Vibration (1set) contains one Fluid-Film Bearing Rotor Kit. **NDI (1set) contains four PTs , one UT and one MT.

5. Vibration Analysis Demonstrator (Tentative)

(1) Specification:

This demonstrator can simulate following phenomena and trainees can observe the typical vibration curve and analyze the root causes.



These phenomena are required **relatively high level knowledge** to understand.

(2) Target:

Middle to expert level engineers (mechanical & electrical)

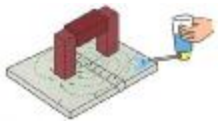
5. NDI Demonstrator (Tentative)

(1) Specification [PT/MT/UT]:

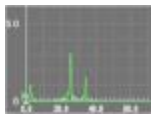
This demonstrator can provide principles, correct inspection procedure, how to ensure the quality and how to record correctly.

Dye penetrant inspection

Magnetic particle testing



Ultrasonic testing



These phenomena are **NOT required high level knowledge** to understand.

(2) Target:

Novice to middle level engineers/technicians (mechanical & electrical)

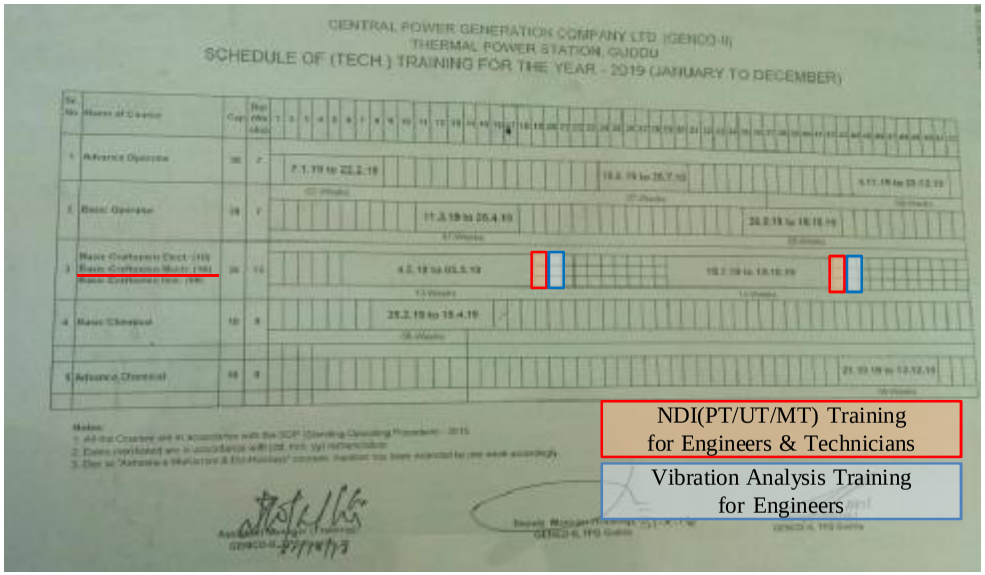
5. Feasible Training Plan (Tentative)

	Courses	Trainer (Non-dedicated)	Trainee/unit	Learning objectives	Duration (days)	Frequency (per year)	Location
1	Vibration Analysis Training for Engineers	Engineer Trained by JICA	**11 Persons** TPS Mzg - 2 TPS Guddu - 3 TPS Jamshoro - 2 GTPS Fsd - 2 CTW Fsd - 2 (BPS-17/18/19)	1. VIBRATION ANALYSIS OF ROTORY MACHINES 2. BALANCING OF ROTORS	5	2*	Guddu T/C*
2	NDI (PT/UT/MT) Training for Engineers	Engineer Trained by JICA	**11 Persons** TPS Mzg - 2 TPS Guddu - 3 TPS Jamshoro - 2 GTPS Fsd - 2 CTW Fsd - 2 (BPS-17/18)	1. PENETRANT TESTING (PT) TECHNIQUE 2. MAGNETIC PARTICAL TESTING (MPT) TECHNIQUE 3. ULTRASONIC TESTING (UT) TECHNIQUE	5	2*	Guddu T/C*
3	NDI (PT/UT/MT) Training for Technicians	Technician Trained by JICA	**11 Persons** TPS Mzg - 2 TPS Guddu - 3 TPS Jamshoro - 2 GTPS Fsd - 2 CTW Fsd - 2 (BPS-14/15/16)	1. PENETRANT TESTING (PT) TECHNIQUE 2. MAGNETIC PARTICAL TESTING (MPT) TECHNIQUE 3. ULTRASONIC TESTING (UT) TECHNIQUE	5	2*	Guddu T/C*

***Note: The Vibration Analysis & NDI Training are designed to add on existing course: basic craftsmen training at Guddu T/C**

5. Feasible Training Plan (Tentative)

GENCO-II (Guddu TPS): Training Schedule 2019 (JAN to DEC)



5. Next HRD Training in Japan: for Management

Training Course	Main Purpose	Important Points
Course Orientation	To grasp outline of HRD training course.	Motivating management to participate in this HRD training course.
Job Report Presentation	To grasp actual condition of HRD in Pakistan.	Utilizing **actual condition** in Pakistan for HRD issue analysis.
Site Visit on KANSAI's Thermal Power Station	To grasp the latest condition and how to manage the latest TPP directly.	Suggesting **an example of ideal condition** (TPPs) on HRD issue analysis.
Site Visit on Training Center (For Engineer & Technician)	To grasp roles & responsibilities of T/C directly and encourage engineers and technicians during next O&M training.	Suggesting **an example of ideal condition** (T/C for technicians) on HRD issue analysis.
Develop Training Plan to effectively utilize Training Equipment	To make feasible and effective Training Plan, including how to use O&M training equipment provided by JICA.	**Maximizing the effectiveness of training equipment** considering **actual condition** in Pakistan.
HRD Issue Analysis	To analyze current issues & causes related to HRD in Pakistan	Based on each difference between **actual condition** and **ideal condition** item by item, **identifying the countermeasure.**
Action Plan Presentation	To make effective action plan to improve HRD situation in Pakistan	Implementing action plan as scheduled (inc. Training Plan on how to use O&M training equipment provided by JICA)

5. Next HRD Training in Japan: Selection Criteria

Items	Qualification (Management)
Number	4 persons
Training Term	About 1 week
Current Duties	Be a management level officer working for GHCL, GENCOs, WEA (WAPDA), whose assignment are closely related to the project activity, such as: Ø **Person in charge of technical HRD at GHCL and GENCOs (especially Guddu T/C and Muzaffargarh T/C)**
Required Condition	Management who can formulate the effective Action Plan and willing to / have an authority to make a substantial contribution to **improvement of GENCO's technical HRD**, and can make **feasible and effective Training Plan, including how to utilize Training Equipment** provided by JICA
Language	Have a competent command of spoken and written English.
Health	Must be in good health, both physically and mentally, to participate in the program in Japan.

Contents

6. Summary on the Mission for Next Step

ü **Request for Next Step:**

Giving us any comments from Pakistan side for Minute of Meeting on JCC **by OCT 14, 2019**

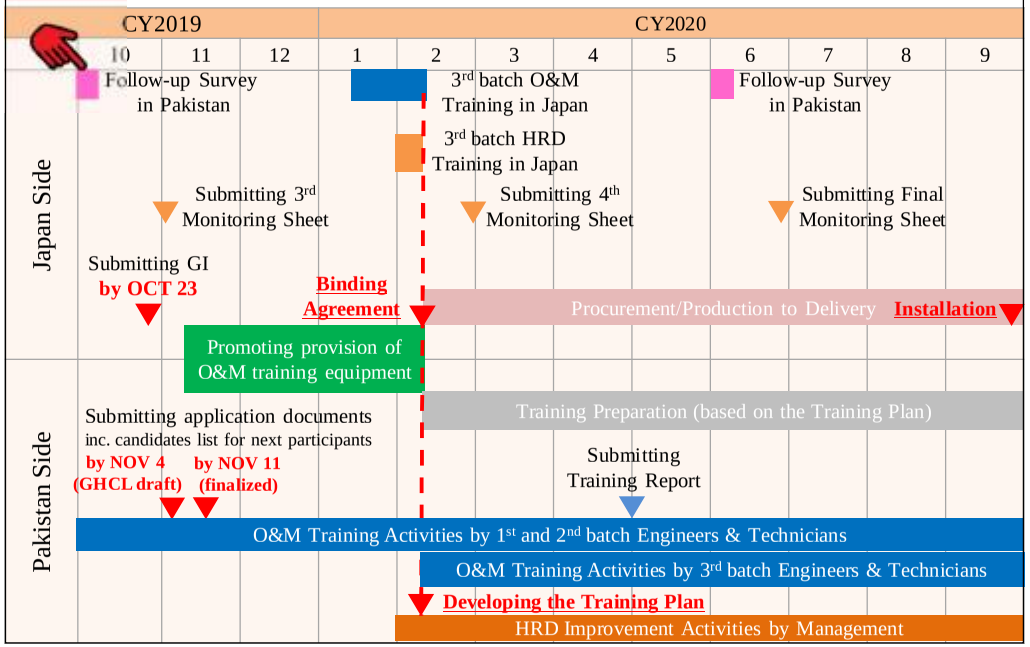
ü **Undertaking by Pakistan Side:**

- Ø Submitting application documents inc. candidates list for next participants **by NOV 4 (GHCL draft) and NOV 11 (finalized) 2019 respectively.**
- Ø Supervising and reporting O&M training activities at TPPs implemented by JICA-trained engineers & technicians (by TPP manager).
- Ø Implementing HRD improvement activities at TPPs (inc. developing the Training Plan of O&M training equipment).

ü **Undertaking by Japan Side:**

- Ø Submitting GI about O&M and HRD training in Japan **by OCT 23, 2019.**
- Ø Conducting O&M and HRD training in Japan **(JAN/FEB, 2020).**
- Ø Reviewing action plan implemented by JICA-trained participants.
- Ø Promoting provision of O&M training equipment (by JICA Headquarters).

6. Summary on the Mission for Next Step



Hiroki HIRAHATA (Focal Point)
hirahata.hiroki@b5.kepco.co.jp
Thermal Power Division
The Kansai Electric Power Co.,Inc.

(4) Minutes of Meeting for the 4th JCC

MINUTES OF MEETING
FOR
THE FOURTH JOINT COORDINATION COMMITTEE (JCC)
ON
THE PROJECT FOR CAPACITY BUILDING AND STRENGTHENING OF THERMAL POWER GENERATION OPERATION & MAINTENANCE
BETWEEN
JAPAN INTERNATIONAL COOPERATION AGENCY
AND
THE ISLAMIC REPUBLIC OF PAKISTAN

The Japan International Cooperation Agency (hereinafter referred to as "JICA") and the Ministry of Energy of the Government of the Islamic Republic of Pakistan (hereinafter referred to as "MOE") and relevant organizations held the fourth Joint Coordination Committee (hereinafter referred to as "JCC") on the Project for Capacity Building and Strengthening of Thermal Power Generation Operation and Maintenance (hereinafter referred to as "the Project").

The fourth JCC on the Project was held on 19th November 2020, through video conference chaired by Mr. Ahmad Taimoor Nasir. As a result of discussions on the fourth JCC Meeting, the Japanese side and the Pakistan side have confirmed the main items described in Annex.

Signed this (DD/MM/YYYY) : 22/12/2020

Mr. YUZURIO Susumu
Senior Director
Energy and Mining Group
Infrastructure Management Division
Japan International Cooperation Agency

Ahmad Taimoor Nasir
Joint Secretary
Ministry of Energy (Power Division)

Habara Hidefumi
Chief Advisor
JICA Expert Team

Muhammad Imran
Chief Executive Officer
GENCO Holding Company, Ltd

ANNEX

1. Progress of the Project

The JICA Expert Team and GENCO Holding Company, Ltd (hereinafter referred to as "GHCL") explained the progress of the Project using presentation report as attachment 2. Both sides agreed that the project purpose have almost achieved considering monitoring indicators such as improvement of training contents. However, the output 3, "training as well as OJT at GENCOs are improved.", were negatively affected due to unexpected disruption caused by the Covid-19 pandemic since activities relevant to the output were supposed to be carried out mainly in the last half of the Project. The Project members confirmed that:

- About 54% of trainees (engineers and technicians) who participated in the training in Japan could not implement a part of the Action Plan prepared by engineers and technicians who have participated in engineering and technical trainings in Japan.
- The implementation of the Human Resource Development Action Plan (hereinafter referred to as HRD Action Plan), which was developed by managers who have participated in management trainings in Japan, was in progress.

The HRD Action Plan constitutes an integral part of the Project, and its execution plays crucial roles in enhancing impact and sustainability of the Project. Though the Project members, both in Japanese side and Pakistan sides, made utmost efforts to continue their activities remotely after this March, some of them found it difficult to conduct as planned due to COVID-19.

Both sides confirmed that it is necessary for the management of thermal power stations (hereinafter referred to as "TPS") to create enabling environment, in terms of staffs, finance, and equipment and facilities, for proper implementation of the Action Plan as planned in a systematic manner in order to further strengthen the training capacity on O&M in TPSs.

For this purpose, the participants of JCC discussed how to recover the delay and deficit of the Project outputs as follows:

2. Review of Action Plan Implementation

The JICA Expert Team explained the result of review of Action Plan implementation as follows. Pakistan side confirmed the contents.

(1) Actual Conditions

- ✓ Before the pandemic of Covid-19, JICA-trained engineers & technicians almost implemented their Action Plan as previously arranged with support from management, and a series of their dissemination activities can help improve the O&M capacity at TPSs.
- ✓ According to the reports from JICA-trained participants, they conducted 721 trainings for a total of 5,752 O&M personnel at TPSs.
- ✓ The results of questionnaire from those who participated in the training conducted by JICA-trained participants shows that the training was highly evaluated and improved their O&M ability at TPSs.
- ✓ JICA-trained participants disseminated their knowledge and skills to

their colleagues not only by utilizing training materials provided by JICA Expert Team, but also by creating and arranging the materials by themselves.

- ✓ JICA Expert Team recognize that the training ability in TPSs is steadily increasing by using the enhanced training material instead of conventional verbal technical transfer.
- ✓ One engineer implemented dissemination activity not only for staff of his own TPS, but also for staff of other TPSs (e.x. Jamshoro to Kotri).
- ✓ The trainings conducted by JICA-trained participants are not limited to the lecture, they are provided in a more practical and easy-to-understand way, such as practical training using wasted materials in TPS, and OJT style.
- ✓ In addition to technical skills, JICA-trained participants also provide training on safety and quality learned in the training in Japan.
- ✓ Especially for TBM (Tool Box Meeting), this safety measure was already incorporated into usual operation in some TPSs, and it contributes to raising safety awareness of O&M personnel and building safety culture in the workplace.
- ✓ The spread of the Covid-19 continues to affect the implementation of the Action Plan, but with the utmost efforts of the participants and the support from their management, they keep implementing their dissemination activities to the extent possible.
- ✓ Action Plan made by the participant of the HRD training in Japan, Mr. Mushtaq Ahmad, efficiently accelerated the establishment of the training center for GENCOs in Muzaffargarh TPS.
- ✓ Engineers and technicians who participated in the training in Japan, are also assigned to the trainers in this training center.
- ✓ On the other hand, some JICA-trained engineers & technicians could not perform Action Plan activities satisfactorily due to the spread of the Covid-19, their busy work and lack of understanding in their colleagues and/or management.
- ✓ Regarding the existing training facilities, though the refurbishment of new training center is in progress, there is still room for improvement in practical training equipment.

(2) Request from the Project members

- ✓ The JICA Expert Team requested the management of GHCL/GENCOs (Project Director) for the further understanding and continuous support for Action Plan developed by JICA-trained engineers & technicians.
  - ➢ Coordinating with Engineers/Technicians to implement their Action Plan as planned.
  - ➢ Promoting the Action Plan implementation through utilizing O&M training equipment to be provided by JICA: Vibration analysis demonstrator and Non-destructive inspection (hereinafter referred to as "NDI") demonstrator.

The Project Team from the Pakistan side presented the progress of the HRD Action Plan including as follows:

- ➢ Enhancement of Training facilities in Regional training center in Guddu

- Establishment of Exclusive training center at TPS Muzaffargarh
- Development of syllabus for training courses

They explained the effects and usefulness of the Project and expressed their commitment for promoting the Action Plan implementation utilizing the practical training equipment (Vibration analysis demonstrator and NDI demonstrator) to be provided by JICA for further strengthen the capacity on O&M in TPSs.

3. Analysis of current situation of O&M through Issue Analysis

The JICA Expert Team explained the result of analysis of current situation for further improvement of O&M at TPSs as follows. Pakistan side confirmed the contents.

(1) The JICA Expert Team comprehensively analyzed the O&M issues of TPSs in Pakistan and identified the countermeasures (not limited to Action Plan).

(2) As for the O&M issues that JICA-trained engineers & technicians can deal with, almost all of the countermeasures are covered by the O&M training course in Japan and their Action Plan.

(3) On the other hand, JICA Expert Team recognize that, through reviewing the Project progress, the following points need to be improved.

- ✓ GHCL should keep on monitoring the conditions of aging equipment of GENCO's power plant, especially increasing cases of vibration problem of rotary equipment.
- ✓ Organizational issues such as identifying training needs and designing trainings curricula, securing budget and equipment for practical training, etc. for effective and systematic human resources development. Implementation of HRD Action Plan is essential in this regard.

4. Delivery of Training Equipment

Pakistan side requested the delivery of training equipment be earlier than planned. JICA explained that though it would try to hasten the procurement, it would be difficult to shorten the duration as the equipment is a made-to-order, thus suppliers need a certain duration to design, manufacture and deliver it. The Pakistan side agree to it.

5. Amendment of Project Design Matrix (PDM) and Plan of Operation

Based on the Minutes of the Meeting agreed on 2nd October 2020, WAPDA Engineering Academy (WEA) is removed from Project Purpose, Outputs 2, Activities 2-5 &3-3, Objectively Verifiable Indicators, Means of Verification and Important Assumptions in Project Design Matrix (PDM) and Plan of Operation as shown in the Project monitoring sheet of attachment 3.

6. Next Phase of the Project

Based on the result of review of action plan and analysis of current situation, the Project members confirmed the next phase of the Project as follows:

- ✓ Training equipment (Vibration analysis demonstrator and NDI demonstrator) will be provided to Pakistan side under this Project.
- ✓ In order to secure sufficient time to develop GENCO's training abilities by using the equipment, the Project will be extended to March

2022 by Minutes of Meetings signed on 2nd October 2020. (The extended duration may be revised if necessary.)

JICA Expert Team explained the tentative training plan, the draft schedule of the Project and the undertakings by both Japanese and Pakistan side. Both sides agreed to proceed the Project accordingly.

JICA Expert Team also requested MOE to promptly sign the Minutes of Meetings of this fourth JCC and the past JCC meetings for smooth progress of the Project and MOE agreed that.

7. Conclusion

Based on the implementation of the Project for around 3 years, the Project members concluded that the Project is practical and effective to improve O&M capacity. JICA Expert Team suggested that the Pakistan side implement the Action Plan for further improvement of O&M at TPSs with strong support from their management.

The Project members and the Chairperson of JCC also confirmed the necessity of the further development GENCO's training abilities by using the training equipment to be provided under this Project mentioned above for complementing delays and deficit of output originally planned due to the Covid-19.

Attachment 1 Attendance List
Attachment 2 Presentation Materials
Attachment 3 Project Monitoring Sheet Ver. 5 (draft)
Attachment 4 Minutes of Meetings during the Mission

Attendance List

Meeting of the 4th Joint Coordination Committee (JCC) on
"The Project for Capacity Building and Strengthening of Thermal Power Generation Operation & Maintenance"

Date: 19th November, 2020

Time: 1:00 pm – 3:00 pm (PKT)

Method: Microsoft Teams Web Conference

No.	Name	Position	Company
1	Ahmed Taimoor Nasir	Joint Secretary, Chairperson of JCC	Ministry of Energy (Power Division)
2	Muhammad Imran Mian	Chief Executive Officer / MD, Project Director	GENCO Holding Company, Ltd
3	Mushtaq Ahmad	Advisor (HR & Admin)	GENCO Holding Company, Ltd
4	Muhammad Jafar	Additional Director (Technical), Focal Point of the project	GENCO Holding Company, Ltd
5	Iftikhar Ahmad	Assistant Director (Technical)	GENCO Holding Company, Ltd
6	Yuzurio Susumu	Sr. Director	JICA Headquarters
7	Konishi Hideaki	Sr. Advisor	JICA Headquarters
9	Okada Yuka	Program officer	JICA Headquarters
11	Tsuruoka Noriyuki	Sr. Representative	JICA Pakistan Office
12	Imran Ahmed	Sr. Program Manager	JICA Pakistan Office
13	Habara Hidefumi	JICA Expert Team	Kansai Electric

14	Kozakai Akira	JICA Expert Team	Kansai Electric
15	Horita Takashi	JICA Expert Team	Kansai Electric
16	Doi Yoshihiro	JICA Expert Team	Kansai Electric
17	Ichioka Hidenobu	JICA Expert Team	Kansai Electric
18	Obe Yuki	JICA Expert Team	Kansai Electric

OVERVIEW of INTERIM REPORT

November 2020

Japan International Cooperation Agency (JICA)
The Kansai Electric Power Co., Inc.

Contents

1. Project Summary: Capacity Building for O&M at TPSs

This JICA project aims to implement capacity building for O&M at Thermal Power Stations (TPSs), in order to make continuous technical support for Pakistani side.

Project Purpose

Overall Goal	Technology and technical skills obtained by the project are utilized in actual O&M at GENCOs power stations.
Project Goal	Training capacity on O&M of GENCOs is strengthened.

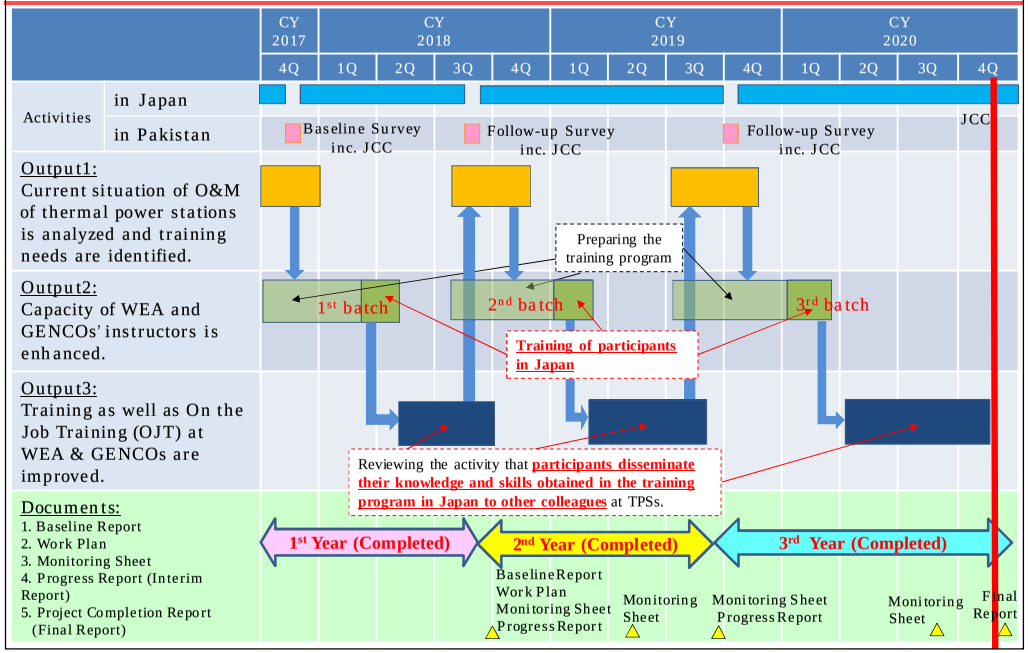
Project Output

Output 1	Current situation of O&M of thermal power stations is analyzed and training needs are identified.
Output 2	Capacity of GENCOs' instructors is enhanced.
Output 3	Training as well as On the Job Training (OJT) at GENCOs are improved.

1. Project Summary: Capacity Building for O&M at TPSs

Targeted Type of Power Generation	Conventional Type (Gas, Coal and Oil) and Gas Turbine Combined Cycle (GTCC) including advanced environmental practices in Japan
Project Sites	GENCOs' thermal power station in Jamshoro, Guddu, Muzaffargarh, Lakhra, Nandipur etc.
Counterpart	Ministry of Energy (MOE), GENCO Holding Company, Ltd (GHCL), and GENCOs
Beneficiaries	O&M instructors of GENCOs and their trainees
Duration	October 2017 – September 2020 (3 years)

1. Project Summary: Work Flowchart (before amendment of R/D)



1. Project Summary: Monitoring Indicators

Items	Monitoring Indicators	Achievement
Overall Goal: Technology and technical skills obtained by the project are utilized in actual O&M at GENCOs power stations.	ü Number of GENCOs power stations which utilize obtained technology and technical skills.	ü **6 TPSs (Jamshoro, Kotri, Guddu, Muzaffargarh, Nandipur and Lakhra)** utilized knowledge and skill obtained in Japan as scheduled.
Project Goal: Training capacity on O&M of WEA and GENCOs is strengthened.	ü 100% of GENCOs power stations where participants come from, implement trainings (OJTs) based on the Action Plan prepared by trained instructors.	ü **Training is being implemented at the 100% of GENCOs TPS:** Jamshoro, Kotri, Guddu, Muzaffargarh, Nandipur and Lakhra.
	ü Improvement of WEA training contents based on the Action Plan developed by trained instructors.	ü JICA-trained participants implemented their Action Plan **almost as previously arranged with support from management**, regardless of various hard duties in each workplace. ü A series of their dissemination activities can help to **improve the O&M capacity at TPSs.**

1. Project Summary: Monitoring Indicators

Items	Monitoring Indicators	Achievement
Output 1: Current situation of O&M of thermal power stations is analyzed and training needs are identified.	ü Training needs are compiled based on the current situation.	ü JICA expert **compiled training needs based on the current situation of O&M** including request from GHCL/GENCOs: "comprehensive field of TPSs".
Output 2: Capacity of WEA and GENCOs' instructors is enhanced.	ü Training program is formulated based on the training needs.	ü Based on the survey result such as shown in Output1, JICA expert prepared these O&M training program in Japan. 1st batch: **mechanical maintenance** 2nd batch: **electrical maintenance** 3rd batch: **C&I maintenance**
	ü Total number of trained instructors.	ü **24 engineers & 24 technicians** trained in Japan for dissemination to other colleagues at TPSs.
Output 3: Training as well as OJT at WEA and GENCOs are improved.	ü Achievement level of Action Plans developed by trained instructors.	ü JICA-trained participants disseminated their knowledge and skills to their colleagues **by utilizing training materials provided by JICA Expert**. ü The O&M training in Japan helped to improve **their attitude, way of thinking and approach to problem.**
	ü The results of checklists.	ü JICA expert made discussion with JICA-trained participants and got their training

1. Project Summary: Action Plan Implementation

Through past on-site survey and this remote survey, about action plan implementation, we've understood that some TPSs are well-operated. For more effective review, **presentation about their APs (especially their dissemination activities) made by JICA-trained participants** is required.

	TPSs (Instructor)	Jamshoro (E:4, T:4)	Kotri (E:0, T:2)	Guddu (E:11, T:9)	Muzaffargarh (E:4, T:6)	Nandipur (E:1, T:0)	Lakhra (E:1, T:3)	GHCL (E:2, T:0)	Total (E:23, T:24)
Engineers	No of Training (General / Technical)	26	-	232	45	6	35	4	348
	No of participants	332	-	2,492	204	30	156	13	3,227
Technicians	No of Training (General / Technical)	81	11	204	44	-	33	-	373
	No of participants	359	98	1,580	259	-	229	-	2,525
Total	No of Training (General / Technical)	107	11	436	89	6	68	4	721
	No of participants	691	98	4,072	463	30	385	13	5,752

1. Project Summary: Project Evaluation (1/3)

Evaluation based on DAC (Development Assistance Committee) Evaluation Criteria

Criteria	Evaluation Results
Relevance	ü **High** ü In the GENCOs, **it is an urgent task to efficiently operate and maintain thermal power generation**, which is consistent with the goal of the Project. ü As for the approach of the Project, **it is appropriate that O&M personnel in leading positions are trained as instructors through O&M training in Japan including practical training, and the trained instructors implement dissemination activities at their power stations.** ü The Project is consistent with Japanese Official Development Assistance (ODA) policy for Pakistan.
Effectiveness	ü **High** ü Achievement of Project Outputs - **The Output 1 and 2 have been achieved.** As for the Output 3, there are the unimplemented Action Plans by some participants due to Covid-19 pandemic so far, but **the trainings conducted by the participants were highly evaluated, so it is considered that Output 3 has been mostly achieved.** ü Achievement of Project Purpose - As per the questionnaire surveys for management and participants, **the implementation of Action Plans by participants has led to the improvement of O&M performance at TPSs, so it is considered that the Project Purpose has been achieved.** ü As per the beneficiaries of the Project, **each participant has been able to disseminate the knowledge and skills learned during O&M Training in Japan to 5,752 colleagues** in the Project.

1. Project Summary: Project Evaluation (2/3)

Evaluation based on DAC (Development Assistance Committee) Evaluation Criteria

Criteria	Evaluation Results
Impact	ü **High** ü **Improvements of training capacity on O&M at TPSs have been confirmed.** In addition, as per the questionnaire surveys for management and participants, **improvements of O&M performance at TPSs have already been confirmed.** Therefore, **it is highly possible that Overall Goal will be achieved.** ü The participants not only have implemented training to disseminate the knowledge and skills learned during O&M Training in Japan, but have worked on the improvement activities through 4S (Sort, Set in order, Shine and Standardize) activities and TBM (Tool Box Meeting) learned in Japan. **The improvement activities have a positive impact on the safety and quality at TPSs.**
Efficiency	ü **Relatively High** ü As for the inputs of the Japanese side, **the dispatch of the Japanese experts was not conducted as planned** due to the cancellation of the 4th survey (the 3rd follow-up survey). However, **those activities could be carried out by substituting email or web conference, which was appropriate to produce the outputs as planned.** As for the inputs of the Pakistan side, **the scheduled 3rd management training was canceled and the 3rd training period for engineers was shortened due to insufficient coordination.** ü Since the Project was conducted as the same program including other countries, **synergistic effects could be achieved by laterally applying the activity results of each project.** In addition, the efficiency of the Project was able to be improved.

1. Project Summary: Project Evaluation (3/3)

Evaluation based on DAC (Development Assistance Committee) Evaluation Criteria

Criteria	Evaluation Results
Sustainability	ü **Relatively High** ü In order to sustain the Project effects after the Project is completed, **it is necessary to sustainably implement the Action Plan by participants and to train further instructors.** In addition, as per the questionnaire surveys for management and participants, **it is necessary to continuously implement TOT (Training of Trainer) and enhance training facilities** in order to sustainably implement the Action Plan by participants. ü The HRD Action Plan prepared by management includes these items that enhance the sustainability of the Project, and it is considered that **it is essential to implement the HRD Action Plan by management as listed below in order to enhance sustainability.** **- Utilization of JICA trained engineers/technicians for instructor** **- Making a framework of On Job Training (OJT)** **- Enhancement of training centers/facilities** **(each TPSs / Guddu Training Center / Muzaffargarh Training Center)** ü Implementation of the HRD Action Plan by management is currently in progress.

Contents

2. O&M Training in Japan: Overall Framework

Job Report Presentation: Participatory (Active)
To grasp actual condition of O&M at TPSs.

Lecture & practical training at KANSAI's Training Center: Passive
To learn each essence on the training program and how to teach them to others efficiently.

Site visit to Kansai's TPSs and Japanese manufacturer's factory: Passive
To understand high-level safety & quality management at their sites directly.

Workshop for Issue Analysis:
Participatory (Active)
To analyze current issues, in logical manner, especially on the cause & effect basis.

Action Plan Presentation: Participatory (Active)
To make action plan for disseminating their knowledge & skills obtained in the training program in Japan to other colleagues.

2. O&M Training in Japan: 3rd Batch in 2020

	Engineers	Technicians
General	ü Introduction of the latest technology in TPS (inc. USC) ü Experience-based Safety Training ü Human Resource Development ü Quality Management ü Thermal Efficiency Management ü Tool Box Meeting (for Safety) ü Lessons Learned from Accidents ü Human Error Prevention ü Effective Maintenance for Quality Electric Power Infrastructure	ü Introduction of the latest technology in TPS (inc. USC) ü Experiential Safety Training ü Experiential Quality Training ü Prevention of Accidents and Disasters ü Occupational HSE (especially Safety) ü Tool Box Meeting (for Safety)
I&C Maintenance	ü Monitoring Device (Pressure, Temperature, Level, Flow Rate) ü Pneumatic Control Valve and Accessories ü Copper Tube Processing and Terminal Treatment ü Sequence Control ü Tuning of PID Control ü Turbine Supervisory Instrument (Vibration Meter, Eccentricity Indicator, Differential Expansion Indicator, Shaft Position Indicator, Speed Indicator) ü Basic Training of Vibration (Balancing) ü GTCC Control	ü Monitoring Device (Pressure, Temperature, Level, Flow Rate) ü Pneumatic Control Valve and Accessories ü Copper Tube Processing and Terminal Treatment ü Sequence Control ü Tuning of PID Control
Site Visit	ü Site Visit on TPS ü Site Visit on Manufacturer's factory	ü Site Visit on TPS ü Site Visit on Manufacturer's factory
JICA Original	ü Issue Analysis ü Methodology to Formulate Action Plan	ü Issue Analysis ü Methodology to Formulate Action Plan

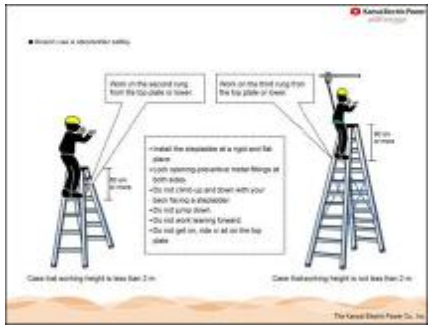
2. O&M Training in Japan: Course Examples (1)

Example: Experience-based Safety Training (Practical Training)

Training Item

Safety training using following;
1. Ladder
2. Safety belt
3. Electric shock
4. Be caught by rotation
5. Helmet

Training Materials



Effects of Training:

ü Can understand the importance of labor safety and equipment safety
ü Can improve capability to properly use safety equipment ready for emergency situations

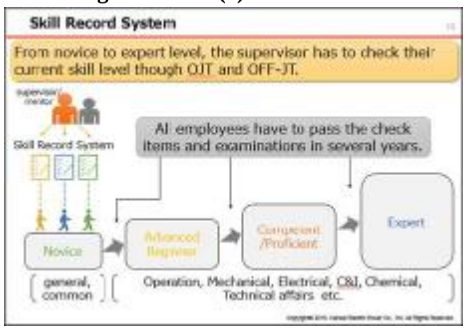
2. O&M Training in Japan: Course Examples (2)

Example: Human Resource Development in Kansai (Lecture)

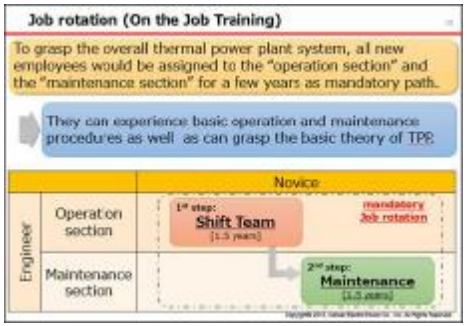
Training Item

Introduction of KANSAI's Human Resource Development
- Overall HRD structure
- Induction Training
- Refresher Training
- Training Philosophy and Contents

Training Materials (1)



Training Materials (2)



Effects of Training:

ü Can grasp HRD current situation in Japanese electrical power company
ü Can find out the hints for improving HRD structure in Pakistan

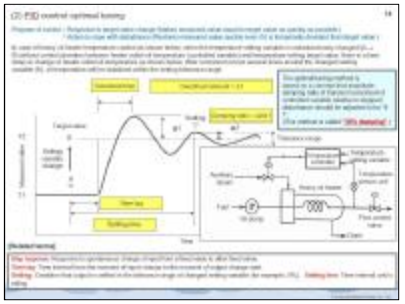
2. O&M Training in Japan: Course Examples (3)

Example: Tuning of PID Control (Practical Training)

Training Item

1. Function of basic parameters (Kp, Ki, Kd) of control
2. How to tuning parameters optimally
3. How to investigate the cause.
4. How to take the countermeasures

Training Materials



Effects of Training:

- ü **Can understand basic control theory (PID control) and how to implement tuning**
- ü **Can improve capability to properly investigate the causes of the trouble and set the optimal tuning**

2. O&M Training in Japan: Course Examples (3)

Example: Tour of Himeji No.2 TPS (Site Visit)

About Himeji No.2 TPS

1. Largest TPS of KANSAI (4,119 MW)
2. Introduced latest GTCC technology, and achieved high thermal efficiency of 60%
3. LNG terminal is adjacent to TPS, and integratedly operated

Effects of Training:

- ü **Can grasp O&M current situation in Japanese electrical power company**
- ü **Can understand the 5S methodology ("Sort", "Set In order", "Shine", "Standardize" and "Sustain") and its effects on quality of work**
- ü **Can understand how to well-operate aged-facilities**

2. O&M Training in Japan: Action Plan Presentation

Implementing their action plan in TPSs enables **not only participants but also their colleagues** to improve their O&M knowledge & skills.

About Action Plan

- ü Participants will be core instructors, and disseminate the knowledge and skills learned during O&M Training in Japan when they come back to Pakistan.
- ü Participants made and presented Action Plan which illustrates the detailed actions to improve quality of work, such as On-the-Job Training at their TPS.

Introduction of Participant's Action Plan

Engineer

1. Training for technical staff on TPSs
   - ü I&C Maintenance
     - i. Monitoring Device
     - ii. GTCC Control System
     - iii. Turbine Supervisory Instrument
   - ü General Contents
     1. Tool Box Meeting (TBM)
2. Activity on actual work
   - ü Tool Box Meeting (TBM) before actual work

Technician

1. Training for technical staff on TPSs (Monitoring Device, Control Valve, Control Cable, etc.)
2. Activity on actual work
   - ü Apply practical knowledge/maintenance skill learned in Japan to actual work.

2. O&M Training in Japan: Other Activities

We provided the participants with comprehensive O&M training as well as **opportunities to learn Japanese culture.**

- **Japanese Language Lesson:**

日本語

- **Home-Visit Program for Engineers**

- **Sightseeing in Kyoto: for Engineers & Technicians**

Contents

3. Action Plan Implementation: Format

■Detailed Plan of OJT for Objective 1: To Improve Skills of Engineers through On the Job Training (OJT)

NO.	Training Subject	Purpose	Training Item		Effect	Important Points	Trainer	Where	How	Tools	Achievements		2018 OCT	2018 NOV	2018 DEC	2019 JAN	2019 FEB	2019 MAR	2019 APR	2019 MAY	2019 JUN	2019 JUL	2019 AUG	2019 SEP	Remarks
1	Service Life Diagnosis	1) To understand the outline of Service Life Evaluation 2) To understand the various type of deterioration events of Thermal Power plant 3) To understand the evaluation methods and their process 4) To understand important check points for evaluation	1-1	Purpose of Service Life Evaluation	(1) (2)	- Why Service Life Evaluation is important	JICA-trained participant	TPP	Lecture	- Textbook (provided by JICA) - O& M Manual (provided by manufacturers)	Plan	No. of times			1										
												No. of participants			5										
											Result	No. of times													
												No. of participants													
			1-2	Main Deterioration Events and their Mechanism of Deterioration	(2)	- What are the main damage factors - How each damage factor causes what kind of damage on where.	JICA-trained participant	TPP	Lecture	- Textbook (provided by JICA) - O& M Manual (provided by manufacturers)	Plan	No. of times			1										
												No. of participants			5										
											Result	No. of times													
												No. of participants													
			1-3	Service Life Diagnosis Methods	(2) (3)	- Where & how to check the damage, according to the kinds of damage	JICA-trained participant	TPP	Lecture	- Textbook (provided by JICA) - Manual (provided by manufacturers)	Plan	No. of times			1										
												No. of participants			5										
											Result	No. of times													
												No. of participants													
2	Vibration	1) To understand the mechanism of vibration 2) To understand the important checking points.	2-1	Basics of Vibration	(1)	- How vibrations occur.	JICA-trained participant	TPP	Lecture	- Textbook (provided by JICA)	Plan	No. of times				1									
												No. of participants				5									
											Result	No. of times													
												No. of participants													
			2-2	Analysis of Vibration	(1) (2)	- How to read and follow up the vibration trend and take action.	JICA-trained participant	TPP	Practical training	- Textbook (provided by JICA)	Plan	No. of times				1									
												No. of participants				5									
											Result	No. of times													
												No. of participants													

3. Action Plan Implementation: Findings

(Actual Conditions)

- **Before the pandemic of Covid-19**, JICA-trained engineers & technicians almost implemented their Action Plan **as previously arranged with support from management**, and a series of their dissemination activities can help to **improve the O&M capacity at TPSs.**
- According to the reports from JICA-trained participants, they conducted **721 trainings for a total of 5,752 O&M personnel** at TPSs.
- The results of questionnaire from those who participated in the training conducted by JICA-trained participants shows that **the training was highly evaluated and improved their O&M ability at TPSs.**



3. Action Plan Implementation: Findings

(Actual Conditions)

- JICA-trained participants disseminated their knowledge and skills to their colleagues **not only by utilizing training materials provided by JICA Expert Team, but also by creating and arranging the materials by themselves.**
- JICA Expert Team recognize that **the training ability in TPSs is steadily increasing by using the training material of high-quality** instead of conventional verbal technical transfer.
- One engineer implemented dissemination activity not only for staff of his own TPS, but also for staff of other TPSs (e.x. **Jamshoro to Kotri**).



3. Action Plan Implementation: Findings

(Actual Conditions)

- The trainings conducted by JICA-trained participants are not limited to the lecture, **they are provided in a more practical and easy-to-understand way**, such as practical training using wasted materials in TPS, and OJT style.






3. Action Plan Implementation: Findings

(Actual Conditions)

- In addition to technical skills, JICA-trained participants also provide **training on safety and quality** learned in the training in Japan.
- Especially for TBM (Tool Box Meeting), **this safety measure was already incorporated into usual operation in some TPSs**, and it contributes to raise safety awareness of O&M personnel and building safety culture in the workplace.




3. Action Plan Implementation: Findings

(Actual Conditions)

- **The spread of the Covid-19 continues to affect the implementation of the Action Plan**, but with **the utmost efforts of the participants and the support from their management**, they keep implementing their dissemination activities to the extent possible.






3. Action Plan Implementation: Findings

(Actual Conditions)

- Action Plan made by the participant of the HRD training in Japan, Mr. Mustag, efficiently accelerated **the establishment of the training center for GENCOs** in Muzaffargarh TPS.
- Engineers and technicians **who participated in the training in Japan**, are also **assigned to the trainers in this training center.**




3. Action Plan Implementation: Findings

(Actual Conditions)

- On the other hand, some JICA-trained engineers & technicians could not perform Action Plan activities satisfactorily due to the spread of the Covid-19, their busy work and lack of understanding in their colleagues and/or management.
- Regarding the existing training facilities, though the refurbishment of new training center is in progress, there is still **room for improvement in practical training equipment.**

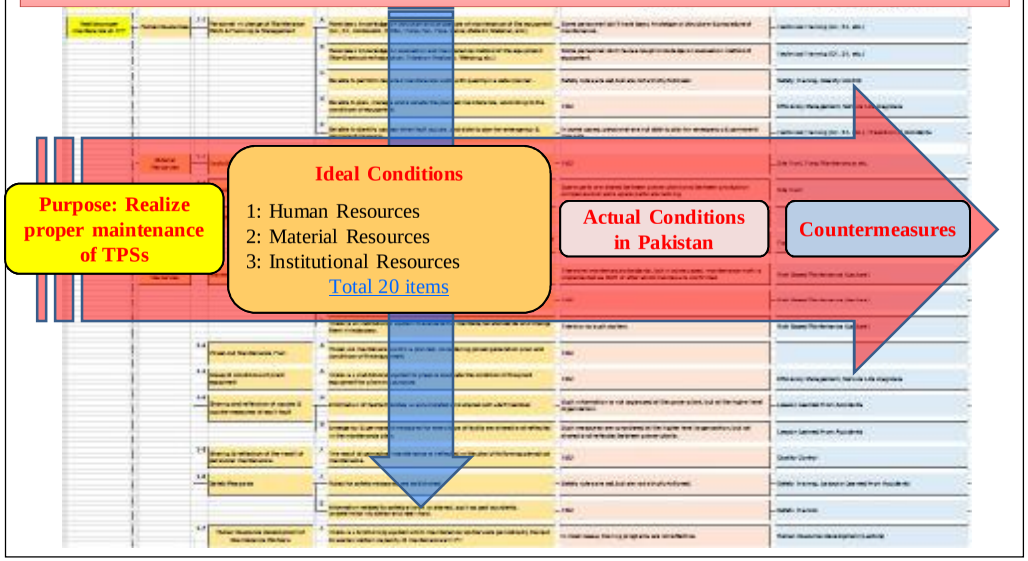
(Suggestion from JICA Expert Team)

- JICA Expert Team would like to request Pakistan side for **the further understanding and continuous support for the Action Plan implemented by JICA-trained engineers & technicians.**
  - Coordinating Engineers/Technicians work to implement their Action Plan as planned.
  - Reinforcing the Action Plan implementation through O&M training equipment provided by JICA: **Vibration analysis demonstrator and NDI demonstrator.**

Contents

4. Issue Analysis of O&M in TPS

Participants and JICA Expert Team **comprehensively analyzed O&M issues** of TPSs in Pakistan and **identified the countermeasures.**



5. Issue Analysis of O&M in TPS: Human Resources

Category	Ideal Condition	Actual Condition	Countermeasure
Human Resources	Every personnel has basic knowledge on structure and maintenance procedure of the equipment.	(E) Engineers have basic technical knowledge, but to meet latest technology equipment. They need updated technology trainings. (T) About 40% of technicians have basic knowledge or structure and procedure of maintenance of the equipment.	Dissemination from Participants (E/T) about **Mechanical, Electrical and C&I maintenance subjects.**
	Every personnel has basic knowledge on evaluation and maintenance method of the equipment.	(E) Yes, we have basic knowledge of the equipment, callibration, tuning, testing etc. (T) About 40% of technicians have enough skill regarding evaluation and maintenance methods.	Dissemination from Participants (E/T) about **NDI, Remaining Life Assessment, balancing etc.**
	Every personnel can perform required maintenance work with quality in a safe manner.	(E) We used to take care of safety measures while carrying out maintenance work in order to avoid any mishap. But need improvement. (T) About 10% of technicians can perform maintenance work in a safe manner and about 30% of technicians can perform it in a quality manner.	Dissemination from Participants (E/T) about **Safety/Quality Training etc.**
	Be able to plan, manage and evaluate the planned maintenance, according to the conditions of equipment.	(E) Yes, we have the ability. (T) Technicians can perform work according to the planned maintenance schedule.	Dissemination from Participants (E/T) about **Mechanical, Electrical and C&I maintenance subjects.**
	It's possible to identify causes when fault occurs, and plan for emergency & permanent measure.	(E) Yes, we have ability to diagnose faults and plan for emergency & permanent measures. (T) About 80% of technicians can identify causes and perform emargency measures. Technicians request senior engineers to plan the permanent measures and senior engineers will arrange the permanent measures.	Dissemination from Participants (E/T) about **Mechanical, Electrical and C&I maintenance subjects.** More practical training using the training equipment (Vibration and NDI demonstrator)

5. Issue Analysis of O&M in TPS: Material Resources

Category	Ideal Condition	Actual Condition	Countermeasure
Material Resources	Tools and Jigs necessary for maintenance are neatly stored in designated areas, well managed and available on demand.	(E) Although tools and jigs are kept in safe place, but need to manage in proper order. (T) Tools and Jigs necessary for maintenance are neatly stored in designated areas, well managed and available on demand.	Dissemination from Participants (E/T) about **5S methodology, etc.** If needed, **management may be responsible to procure it.**
	Consumables & Spare parts are stored, well managed and available on demand.	(E) Consumables and spare parts are kept and available in store but need to be properly stacked and recorded. (T) Consumables & Spare parts are stored, well managed and available on demand.	Dissemination from Participants (E/T) about **5S methodology, etc.** If needed, **management may be responsible to procure it.**
	All manuals of each equipment are available on demand.	(E) All the manuals od related equipment are available as and when required. (T) All manuals of each equipment are available on demand.	Making exiting manuals set in order. (E/T). If needed, **management may request the supplier/vender for additional manual.**
	Work procedures for each maintenance of each equipment are written, well kept and available on demand.	(E) The trouble shooting are available in the manuals, but work procedure of their maintenance is not defined separately. (T) Work procedures for each maintenance of each equipment are written, well kept and available on demand.	Making exiting procedures set in order. (E/T). If needed, **management may request the supplier/vender for additional manual.**

5. Issue Analysis of O&M in TPS: Institutional Resources

Category	Ideal Condition	Actual Condition	Countermeasure
Institutional Resources (1)	Each equipment has prescribed maintenance standards such as frequency, details of maintenance work.	(E) Most of the equipment have the prescribed maintenance standards. (T) Each equipment has prescribed maintenance standards such as frequency, details of maintenance work.	Dissemination from Participants (E) about **Risk Based Maintenance etc.**
	Each equipment has standard check points.	(E) Yes. We have check points. (T) Each equipment has standard check points.	Dissemination from Participants (E) about **Risk Based Maintenance etc.**
	There is an institutional system to evaluate the maintenance standards and change them if necessary.	(E) We do not have any institutional system to evaluate the maintenance standards. But we follow the OEM's recommendations. (T) There is an institutional system to evaluate the maintenance standards and change them if necessary.	Dissemination from Participants (E) about **Risk Based Maintenance etc.**
	Power-cut maintenance work is planned, considering power generation plan and conditions of the equipment.	(E) Yes. We have power cut maintenance work plan in reasoning with power regulators. (T) Power-cut maintenance work is planned, considering power generation plan and conditions of the equipment.	Not included in O&M training in Japan, but **management should take the initiative in coordination with transmission division.**
	There is a institutional system to grasp & evaluate the condition of the plant equipment for planning purpose.	(E) We do have this system available at our new plant and work is underway for rest of plants. (T) There is a institutional system to grasp & evaluate the condition of the plant equipment for planning purpose.	Dissemination from Participants (E) about **Thermal Efficiency Management, etc.** More practical training using the training equipment (Vibration and NDI demonstrator)

5. Issue Analysis of O&M in TPS: Institutional Resources

Category	Ideal Condition	Actual Condition	Countermeasure
Institutional Resources (2)	Information of faults/troubles is accumulated and shared with staff member.	(E) Trouble reports are accumulated and there counter measures are discussed with staff. And recorded in progress registers also. (T) Information of faults/troubles is accumulated and shared with staff member.	Dissemination from Participants (E) about **Lesson Learned from Accidents etc.** Information sharing on technical failures/troubles by engineers & technicians.
	Emergency & permanent measures for every type of faults are shared and reflected in the maintenance plan.	(E) Yes, shared and reflected. (T) Emergency & permanent measures for every type of faults are shared and reflected in the maintenance plan.	Dissemination from Participants (E) about **Lesson Learned from Accidents etc.** Information sharing on technical failures/troubles by engineers & technicians.
	The result of periodical maintenance is reflected in the plan of following periodical maintenance.	(E) The result of periodical maintenance is reflected as per instruction of OEM. (T) The result of periodical maintenance is reflected in the plan of following periodical maintenance.	Dissemination from Participants (E/T) about **Quality Control etc.**
	Rules for safety measures are established.	(E) Shared verbally. (T) Rules for safety measures are established.	Dissemination from Participants (E/T) about **Safety Training**, but **management should take the initiative in the organization.**
	Information related to safety at work is shared, such as past accidents, unsafe/minor incidents and near miss.	(E) We have training facilities to train workers in TPS. (T) Information related to safety at work is shared, such as past accidents, unsafe/minor incidents and near miss.	Dissemination from Participants (E/T) about **Safety Training** Information sharing on labor accidents by engineers & technicians.
	There is a functioning system which maintenance workers are periodically trained to sustain certain capacity of maintenance.	(E) In most cases, training programs are not effective. (T) There is a functioning system which maintenance workers are periodically trained to sustain certain capacity of maintenance at TPS.	Dissemination from Participants (E/T) about **Human Resource Development.** More practical training using the training equipment (Vibration and NDI demonstrator)

5. Issue Analysis of O&M in TPS: Findings

(Findings from JICA Expert Team)

- As for the O&M issues that JICA-trained engineers & technicians can deal with, **almost all of the countermeasures are covered with O&M training course in Japan and their Action Plan.**
- On the other hand, JICA Expert Team recognizes through the Project that the following points to be improved.
  - GHCL is keeping in view the aging factor of GENCO's power station, especially wherein **vibration problem of rotary equipment is on increasing trend.**
  - Although O&M skills are being improved though JICA-trained engineers' & technicians' dissemination activities, there is still room for **improvement in organizational HRD system** such as the **lack of practical trainings**, mismatch in training needs and contents.

Contents

5. Next Phase of the Project: Amendment of R/D

Pakistan side and JICA Expert Team already **amended Record of Discussion on the Project in September 2020.**

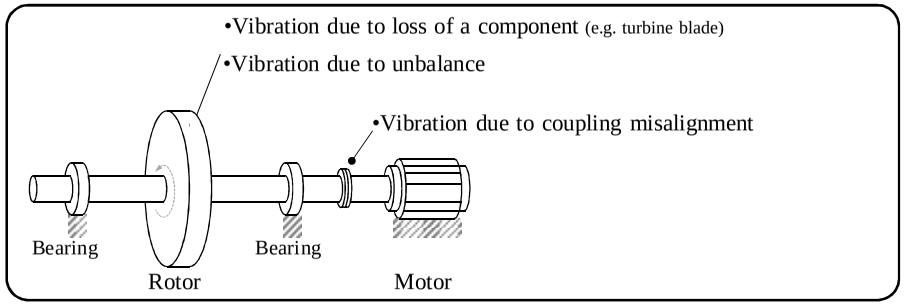
ü In order to secure sufficient time **to develop GENCO's training abilities by using the equipment** (Vibration analysis demonstrator, Non-destructive inspection demonstrator) to be provided under this Project, **the Project was extended to March 2022.**

	Vibration Analysis Demonstrator	NDI Demonstrator [PT/MT/UT]
Image		
Description	This is the device for demonstration of the variable vibration failures in rotating machinery. Its associated course and exercise allows for theoretical and practical training in vibration causes & effects, balancing and data collection.	NDI is a wide group of analysis techniques to evaluate the properties of a material, component or system without causing damage. Its associated course/exercise allows for theoretical and practical training in correct inspection and record.

5. Next Phase of the Project: Vibration Analysis Demonstrator

(1) Specification:

This demonstrator can simulate following phenomena and trainees can observe the typical vibration curve and analyze the root causes.



These phenomena are required **relatively high level knowledge** to understand.

(2) Target:

Middle to expert level engineers (mechanical & electrical)

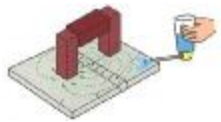
5. Next Phase of the Project: NDI Demonstrator

(1) Specification [PT/MT/UT]:

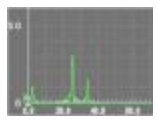
This demonstrator can provide principles, correct inspection procedure, how to ensure the quality and how to record correctly.

Dye penetrant inspection

Magnetic particle testing



Ultrasonic testing



These phenomena are **NOT required high level knowledge** to understand.

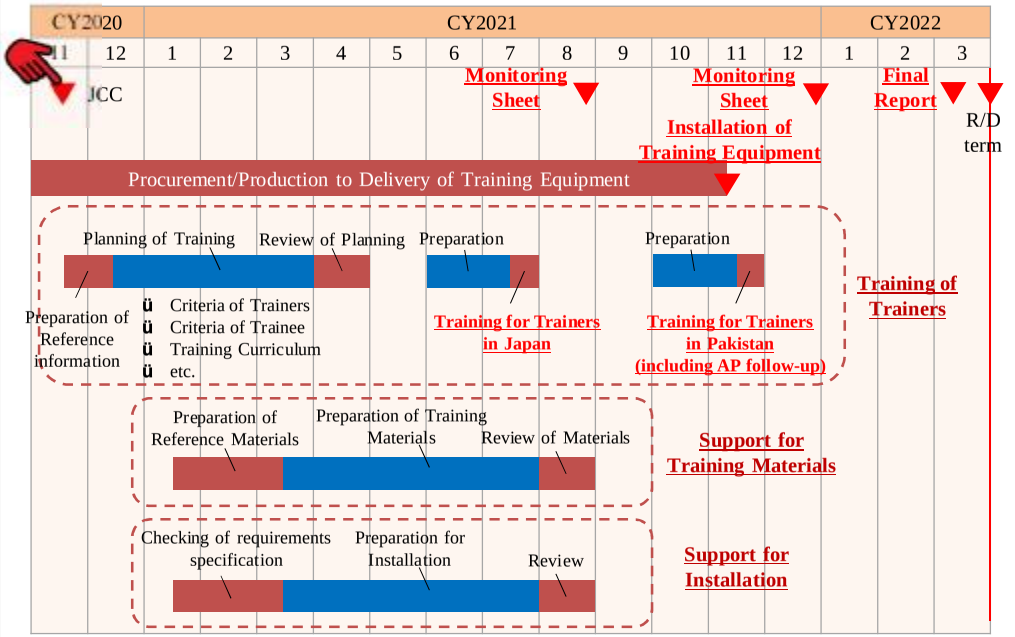
(2) Target:

Novice to middle level engineers/technicians (mechanical & electrical)

5. Next Phase of the Project: Feasible Training Plan (Tentative)

	Courses	Trainer (Non-dedicated)	Trainee/unit	Learning objectives	Duration (days)	Frequency (per year)	Location
1	Vibration Analysis Training for Engineers	Engineer Trained by JICA	**11 Persons** TPS Mzg - 2 TPS Guddu - 3 TPS Jamshoro - 2 GTPS Fsd - 2 CTW Fsd - 2 (BPS-17/18/19)	1. VIBRATION ANALYSIS OF ROTORY MACHINES 2. BALANCING OF ROTORS	5	TBD	TBD
2	NDI (PT/UT/MT) Training for Engineers	Engineer Trained by JICA	**11 Persons** TPS Mzg - 2 TPS Guddu - 3 TPS Jamshoro - 2 GTPS Fsd - 2 CTW Fsd - 2 (BPS-17/18)	1. PENETRANT TESTING (PT) TECHNIQUE 2. MAGNETIC PARTICAL TESTING (MPT) TECHNIQUE 3. ULTRASONIC TESTING (UT) TECHNIQUE	5	TBD	TBD
3	NDI (PT/UT/MT) Training for Technicians	Technician Trained by JICA	**11 Persons** TPS Mzg - 2 TPS Guddu - 3 TPS Jamshoro - 2 GTPS Fsd - 2 CTW Fsd - 2 (BPS-14/15/16)	1. PENETRANT TESTING (PT) TECHNIQUE 2. MAGNETIC PARTICAL TESTING (MPT) TECHNIQUE 3. ULTRASONIC TESTING (UT) TECHNIQUE	5	TBD	TBD

5. Next Phase of the Project: Draft Schedule



Contents

6. Summary for Next Step

ü **Request for Next Step:**

Giving us any comments from Pakistan side for Minute of Meeting on JCC **by NOV 30, 2020**

ü **Undertaking by Pakistan Side:**

Ø **Supporting, promoting and supervising JICA-trained Participants' Action Plan implementation by Management.**

Ø Planning of Training in Pakistan using the equipment (Vibration analysis demonstrator and NDI demonstrator) **by MAR, 2021**

- ü Selection of location for the equipment installation
- ü Selection of candidates for Trainers
- ü Making training curriculum for vibration analysis and NDI

Ø Making Training Materials (textbooks, manuals, etc.) **by JUL, 2021**

Ø Preparing for installation of the equipment **by JUL, 2021**

ü **Undertaking by Japan Side:**

Ø Installing the equipment (Vibration analysis demonstrator and NDI demonstrator) **by NOV, 2021**

Ø Supporting the above activities by Pakistan side

Ø Conducting training for trainers in Japan and Pakistan

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Thermal Power Division
The Kansai Electric Power Co.,Inc.

Action Plan

Capacity Building & Structuring of Thermal Power Generation Operation & Maintenance, Pakistan

November 2020

Progress on of HRD action plan- Pakistan

- Enhancement of Training facilities in Regional training center – Guddu .
- Establishment of Exclusive training center at TPS Muzaffargarh- GENCO-III
- Development of syllabus for training courses

Enhancement of Training facilities in Regional training center –Guddu .

- JICA Trained Engineers / Technicians are technically skilled and certified professionals, responsible for the operation, maintenance repair of boiler system and other electrical, mechanical systems and instrumentation.
- At Regional Training Center main focus of the Technicians training is;
  - To Ensure that all safety protocols are followed strictly.
  - Operation processes are followed to maximize efficiency.
  - Detail functions of Operation & Maintenance (O&M) indoctrinated.
  - Class lectures & practical engagement of participants pertaining to O&M activities are imparted.
  - Provision of Training aids & equipments by JICA as per agreed plan will further strengthen the Training activities.

Enhancement of Training facilities in Regional training center –Guddu. 1st Batch 2018

Sr. No.	Name of Engineers / Technicians	Designation	Presently working at CPGCL	Topics
1	Mr. Gul Munir Abbasi	Deputy Manager	600MW GT (Mechanical)	Hazard awareness.
2	Mr. Asadullah Babar	Deputy Manager	747MW (Mechanical)	Centrifugal Pumps.
3	Mr. Shahbaz Illahi	Deputy Manager	747MW (Operation)	Fire Preventive Measures.
4	Mr. Muhammad Moosa	Foreman	747MW (Mechanical)	Structure of bearings
5	Mr. Nasim Khan	Assistant Manager	415MW (Mechanical)	Dynamic Pumps / Positive Displacement Pumps.
6	Mr. Ijaz Ahmed	Foreman	600MW (Mechanical)	Functions of Bearing.
7	Mr. Abdul Hameed	Fitter	747MW (Mechanical)	Valves, Functions & Types.

Enhancement of Training facilities in Regional training center –Guddu. 2nd Batch 2019

Sr. No.	Name of Engineers / Technicians	Designation	Presently working at CPGCL	Topics
8	Mr. Abdul Ghafar Noonari	Addl. Manager	747MW (Maintenance)	Cable & Terminal treatment.
9	Mr. Mugheesul Munir	Deputy Manager	(MIS) Department.	Maintenance of measuring & monitoring devices.
10	Mr. Mehmoodul Hassan	Assistant Manager	(F&C) Department.	Preventive maintenance of high voltage motors.
11	Mr. Moula Bux Golato	Foreman	747MW (Electrical)	Preventive Maintenance of Transformers.
12	Mr. Mohd Saleem Arain	Test Inspector	600MW (Instrument)	Start up sequence of Gas Turbine.

Enhancement of Training facilities in Regional training center –Guddu. 3rd Batch 2020

Sr. No.	Name of Engineers / Technicians	Designation	Presently working at CPGCL	Topics
13	Saeed Ahmed Shaikh	Addl. Manager	415MW (Instrument)	Turbine Supervisory instruments.
15	Niamatulla Khan	Assistant Manager	747MW (Instrument)	Thermocouple classification.
16	Suhail Ahmed Qureshi	Assistant Manager	600MW (Instrument)	Pressure gauge calibration.
17	Mohd Adnan Basheer	Assistant Manager	747MW (Instrument)	Seal toppings.
18	Anwar Ali Bugti	Foreman	600MW (Instrument)	Copper pipe flaring.
19	Toheed Ahmed	Fitter	415MW (Instrument)	Working pressure switches.

Establishment of Exclusive training center at TPS Muzaffargarh- GENCO-III

Establishment of Exclusive training center at TPS Muzaffargarh- GENCO-III

- In November, 2019, GHCL Training Centre has been established at TPS Muzaffargarh mainly to impart training to Engineers.
- The aim of establishment of GHCL Training Center, Muzaffargarh was to bridge the gap between desired performance and the current performance of employees in GENCOs
- The Training Center has successfully conducted Training of Junior Engineer & other Technical & Support Staff.
- The course contents were professionally designed and successfully carried out with the help of GENCOs Engineers & Management.

Utilization Of JICA Trained Staff

- A comprehensive schedule of Lectures / Presentations was framed at GHCL Training Centre to utilize the expertise of JICA trained Engineers / Technicians in the fields of Mechanical, Electrical and Instrumentations.
- Training activities were adversely affected by COVID-19, however, in August 2020 activities were re-scheduled with strict compliance of SOPs.
- In the 1st Phase the JICA trained staff in the field of Mechanical, Electrical and Instrumentations have conducted the training sessions.

Utilization Of JICA Trained Staff

The Training were conducted at GHCL Training Center, Muzaffargarh from February 2020 to July 2020,

Name	Discipline	Topics
Mr. Allah Nawaz, Electrician	Electrical	Turbine Supervisory Instrument, Maintenance of Transformers, Maintenance of T/F Cooling System
Engr. Faisal Naeem, Junior Engineer	I&C	Turbine Supervisory Instrument, Maintenance of Measuring and Monitoring Devices, Fundamental of DP Cell
Mr. Shahid Masood, Foreman	I&C	Pressure Gauge Calibration, Copper Pipe Flaring & Seal Topping, Calibration of Pressure Gauge
Mr. Muhammad Ijaz, Fitter	I&C	Cable & Terminal Treatment, Thermocouple Classification & Type, Working Pressure Switches
Mr. Muhammad Asadullah, ASA	I&C	Structure Type Working of Pressure Gauge, Thermo Structure Operation and Types, Temperature Measuring Instrument
Mr. Muhammad Arif, Fitter	Mechanical	Valve Maintenance Skills, Structure of Bearings,
Engr. Zahid Ali Bugti, Senior Engineer	Electrical	Cable / Terminal Processing / Conduct, Five Preventative Measures of Electrical Equipments
Mr. Pervaiz Iqbal, Fitter	Mechanical	NDT Inspection, Rotary Equipment Alignment

Allah Nawaz, Electrician

JICA Trained Staff Conducting On Job Training Sessions

Faisal Naeem, Junior Engineer

JICA Trained Staff Conducting On Job Training Sessions

Shahid Masood,
Foreman

JICA Trained Staff Conducting On Job Training Sessions

13

Muhammad Arif,
Fitter

JICA Trained Staff Conducting On Job Training Sessions

14

Zahid Ali Bugti,
Sr. Engineer

JICA Trained Staff Conducting On Job Training Sessions

15

Pervaiz Iqbal,
Fitter

JICA Trained Staff Conducting On Job Training Sessions

16

Utilization Of JICA Trained Staff

The 1st Training Batch, 2018 was conducted at Regional Training Center, Guddu

Name	Discipline	Topics
Gul Munir Abbasi, Deputy Manager		Hazard awareness
Asadullah Babar, Deputy Manager		Centrifugal Pumps
Shahbaz Illahi, Deputy Manager		Fire Preventive Measures
Muhammad Moosa, Foreman		Structure of bearings
Nasim Khan, Assistant Manager		Dynamic Pumps / Positive Displacement Pumps
Ijaz Ahmed, Foreman		Functions of Bearing
Abdul Hameed, Fitter		Valves, Functions & Types

Utilization Of JICA Trained Staff

The 2nd Training Batch, 2019 was conducted at Regional Training Center, Guddu

Name	Discipline	Topics
Abdul Ghafar Noonari, Addl. Manager		Cable & Terminal treatment
Mughees ul Munir, Deputy Manager		Maintenance of measuring & monitoring devices
Mehmoodul Hassan, Assistant Manager		Preventive maintenance of high voltage motors
Moula Bux Golato, Foreman		Preventive Maintenance of Transformers
Mohd Saleem Arain, Test Inspector		Start up sequence of Gas Turbine

Utilization Of JICA Trained Staff

The 3rd Training Batch, 2020 was conducted at Regional Training Center, Guddu

Name	Discipline	Topics
Saeed Ahmed Shaikh, Addl. Manager		Turbine Supervisory Instruments
Niamatulla Khan, Assistant Manager		Thermocouple Classification
Suhail Ahmed Qureshi, Assistant Manager		Pressure Gauge Calibration
Mohd Adnan Basheer, Assistant Manager		Seal Toppings
Anwar Ali Bugti, Foreman		Copper Pipe Flaring
Toheed Ahmed, Fitter		Working Pressure Switches

Sector Specific Course

- The 1st session of Pre-Promotion Training for Junior Engineers (BPS-17) was conducted from November 4, 2019 to December 13, 2019
- 08 Junior Engineers from all GENCOs and GHCL have participated in this course
- The course contents were developed and designed keeping in view the Training Needs.
- The course was successfully carried out by JICA trained Engineers/ Guest Speakers including Plant Managers & Deputy Manager of GENCOs.

Sector Specific Course – Contents

- Measurement Transformers
- Drawing Literacy / Auto CAD
- Reactive Capability of Generator
- Performance KPIs
- Organizational Behaviors
- Heat Rate Dynamics in Power Plants
- Generator & Transformer Protection
- Total Quality Management
- Bearings
- Total Quality Management and Technical Discussion on Boiler Tube Failure
- Energy Efficiency
- Hierarchy Levels of Measurement
- Electrical Management
- Excitation System
- Chemistry of Thermal Power Plant
- Factors Affecting the Vacuum System of Steam Turbine
- Performance Heat Rate

Sector Specific Course

Participants of 1st Sector Specific Course at GHCL Training Center, Muzaffargarh

Mandatory Training Courses

Mandatory Training Courses

- The 1st session of mandatory Promotion Technical Training for Junior Engineers (BPS-17) was conducted in November, 2019 to December, 2019.
- The newly developed training center is also being utilized for conducting mandatory training courses for promotion of various level of Engineers.
- The 1st session of Mandatory Training Courses of School Staff was conducted from August 10, 2020 to August 28, 2020
- The 1st session of Mandatory Training Courses of Administrative Staff was conducted from September 21, 2020 to October 09, 2020
- The course was attended by employees from all GENCOs.

Mandatory Training of Teaching Staff of Schools running in the residential colonies of Thermal Power Houses – Course Contents (General Office Management Skills)

- Enhancing moral concepts of the Holy Prophet (PBUH) as the Greatest Teacher of all times
- Education Staff Service Rules
- The Concept of Educational Administration
- Communication Skills
- Leave Rules/TA DA Rules
- Co-Curricular Activities
- E&D Rules / Conduct Rules
- Team Building
- Important Clauses of Book of Financial Powers
- How to Manage Student Behavior
- Leaders role in organizations.
- Computer Hardware & Software
- Types of Computers Memories and Function
- Main Features of MS Word
- Main Features of MS Excel
- Main Features of MS Power Point

Mandatory Training of School Staff

Participants of 1st Mandatory Training of School Staff at GHCL Training Center, Muzaffargarh

Mandatory Training of Admin Staff – Course Contents

- Introduction to Administration
- Management information System
- General Accounting Practices
- Book of Financial Powers
- Drafting Skills
- Budgeting Practices in GENCOs.
- Secretarial Practices & Office Procedures
- Seniority Promotion & Deputation Rules
- Basics of Management
- Discipline & Performance
- Social Corporate Responsibility
- Communication Skills
- Introduction to Computers
- Important Features of MS Word
- Advance Practices in Microsoft Excel
- Preparation of Presentations
- Retirement Rules & its application.
- Leave and Medical Attendance Rules
- Presentation Skills

Mandatory Training of Admin Staff

Participants of 1st Mandatory Training of Admin Staff at GHCL Training Center, Muzaffargarh

Development of Syllabus for Training Courses

Development of Syllabus for Training Courses

- Syllabus has been developed for following upcoming courses to be held GHCL Training Center, Muzaffargarh
  - Refresher Course (Pre-Promotion) for Managers (Engineers)
  - Refresher Course (Pre-Promotion) for Senior Engineer
  - Sector Specific Course (Pre-Promotion) for Junior Engineers
- Syllabus being developed for the following courses;
  - Senior Management Course (Senior Level Officers Engineers/ Non- Engineers)
  - Middle Management Course (Mid Career Officers Engineers/ Non- Engineers)
  - Junior Management Course (Start up career officers Engineers/ Non-Engineers)

Provision of Training Equipments

- In the 2nd follow-up survey 2019, it was agreed by JICA for provision of following Training Equipments for GHCL Training Center & Regional Training Center Guddu.
  - Vibration Analysis Demonstrator 01 set
  - Non- Destructive Instrument (NDI) Demonstrator 04 Sets
- JICA may provide these training equipments to strengthen training activities in GENCOs.

Thank You!

MINUTES OF MEETING
FOR
THE FIRST JOINT COORDINATION COMMITTEE (JCC)
ON
THE PROJECT FOR CAPACITY BUILDING AND STRENGTHENING OF THERMAL POWER GENERATION OPERATION & MAINTENANCE
BETWEEN
JAPAN INTERNATIONAL COOPERATION AGENCY
AND
THE ISLAMIC REPUBLIC OF PAKISTAN

Japan International Cooperation Agency (hereinafter referred to as "JICA") and the Ministry of Energy (Power Division) of the Government of the Islamic Republic of Pakistan (hereinafter referred to as "MOE") and relevant organizations established a Joint Coordination Committee (hereinafter referred to as "JCC") for the effective and successful implementation of the Project for Capacity Building and Strengthening of Thermal Power Generation Operation and Maintenance (hereinafter referred to as "the Project").

The first JCC on the Project was held on 24th November 2017, at GENCO Holding Company, Ltd. (hereinafter referred to as "GHCL"), Islamabad. As a result of discussions on the 1st JCC Meeting, the Japanese side and the Pakistan side have confirmed the main items described in Annex.

Islamabad, 24th November, 2017

小笠原健二 for

Yoshihisa Onoe
Senior Representative
JICA Pakistan office

Zafar Abbas
Joint Secretary (Transmission)
MOE

平畑 弘樹

Hiroki Hirahata
Chief Advisor
JICA Expert Team

Muhammad Imran
Chief Executive Officer
GENCO Holding Company, Ltd

Muhammad Khalid
Additional Director General
GENCO Holding Company, Ltd

Riffat Ara Qureshi
General Manager (Training)
Water and Power Development Authority

ANNEX

1. Project Organization

(1) Delegation of Authority

The both sides confirmed that role and responsibility held by the Ministry of Water and Power (hereinafter referred to as "MOWP") at the time of signing of the Record of Discussion dated 22nd May, 2017(hereinafter referred to as "RD"), has been transferred to MOE. MOE shall bear and implement all undertakings of MOWP which has been confirmed by the both sides on RD.

(2) Formation of JCC

Based on RD, JCC was established in order to facilitate inter-organizational coordination. JCC will be held at least once a year and whenever deems it necessary. JCC with the following structure in accordance with RD, will review the progress, revise the overall plan when necessary, approve an annual work plan, conduct evaluation of the Project, and exchange opinions on major issues that arise during the implementation of the Project.

a. Chairperson:
Joint Secretary (Transmission) of MOE is the Project Chairperson who supervises overall implementation of the Project in consultation with CEO, GHCL and Member (Power), Water and Power Development Authority (hereinafter referred to as "WAPDA").

b. Members:
(a) Pakistan side
- Project Directors
  Principal of WAPDA Engineering Academy (hereinafter referred to as "WEA") under General Manager (Training) WAPDA, and Additional Director General of GHCL are the Project Directors who are responsible for overall administration and implementation of the Project.

- Project Managers
  Additional Director General of WEA, and Additional Director of GHCL are the Project Managers who are responsible for managerial and technical matters as well as coordination of the Project.

- Other concerned member(s) of WEA and GHCL.

(b) Japanese side
- Short-term Visiting Experts (KANSAI)
- Representative(s) of JICA Pakistan Office
- Other concerned member(s) of JICA

(3) Functions of JCC

The functions of the JCC are as follows;
a. To supervise the annual work plan of the project in line with the Plan of Operation.
b. To review the annual and overall progress of the project and to evaluate

the accomplishment of the annual targets and achievement of the objectives.

c. To find out proper ways and means for solution of the major issues arising from or in connection with the project.

2. Project Outline

(1) Work Plan

The JICA Expert Team has explained the scope of works, overall schedule and the activities to be conducted in the project based on Attachment 3. The JICA Experts Team requested close collaboration from the Pakistan side for the implementation of project activities, including nomination of training candidates, implementation and monitoring of Action Plans, support for follow up survey by the Team, and organizing of the JCC, which is to be held at least once a year during the project period.

The Pakistan side acknowledged the contents of the explanation and the request from the JICA Expert Team, and agreed the plan in principle.

(2) Project Activities

The both sides confirmed that the activities to be implemented under the Project include training courses in Japan, and also follow up of action plans to be formulated during training in Japan by the participants. The details of each activity are explained below.

(3) Roles and Duties of Human Resource Development

The both sides confirmed the roles and duties of each organization of Pakistan side on human resource development related to operation and maintenance (hereinafter referred to as "O&M") of thermal power stations (hereinafter referred to as "TPS") are as follow;

- MOE: Overall supervision
- WEA (WAPDA): To conduct Off-JT mainly for engineers
- Guddu Training Center: To conduct Off-JT mainly for technicians
- GENCOs: To hold on-site trainings including OJT in each TPS.

3. Result of the First Mission

(1) Outline of the Mission

The JICA Expert Team implemented its first mission on Pakistan from 13th to 24th November 2017 started by the kickoff meeting held in Lahore on 14th November, to collect data and information on current situation of O&M in TPS. The JICA Expert Team made a brief explanation of analysis on current situation based on Attachment 3. Further analysis shall be done based on close examination of the answers for the questionnaires attained through the mission, and shall be provided in the form of the baseline survey report within 3 month after the first mission.

(2) Major Facing Issues

The JICA Expert Team explained its observations on major facing issues on O&M of public TPS in Pakistan as follow. Pakistan side took note of it.

- Enhancement of Health Safety and Environment, especially safety
- Development of original rules and manuals based on Total Quality

Management (hereinafter referred to as "TQM")

- Enhancement of human resource development in each TPS, through on-site training including OJT

4. Action Plan

(1) Purpose of Action Plan

The both sides confirmed that the Action Plans for improving human resource development for O&M of TPS shall be formulated and implemented under the Project in accordance with RD.

An Action Plan includes a goal, issues to be tackled, analysis on causes of the issues, activities to be conducted, target groups, a time frame, and etc. In this Project, Action Plans are expected to be formulated for the purpose of; i) improvement of training conducted on training centers (WEA or Guddu), or ii) improvement of on-site training conducted on each TPS.

The both sides reconfirmed that the Project Purpose agreed on RD is to strengthen training capacity of WEA and GENCOs on O&M of TPS, and agreed that it is critical for the Project to improve training conducted in Pakistan through Action Plans, not only to enhance knowledge of each participants of training in Japan.

(2) Roles and Duties on Action Plan

The both sides confirmed the roles and the duties of each stake holders on formulation, implementation, monitoring and following up of Action Plans as follows;

- Participants of Training in Japan

(Instructors):

- To develop an Action Plan for improving training conducted in training centers during the training in Japan
- To report the contents to colleagues as well as higher authorities of the training center to get an approval
- To participate in implementation of the approved Action Plan by the training center

(On-site engineers/technicians):

- To develop an Action Plan for improving on-site training including OJT, during the training in Japan
- To report the contents to colleagues as well as higher authorities of TPS and GENCO to get an approval
- To participate in implementation of the approved Action Plan by TPS or GENCO

- Training Centers/GENCOs/TPS;
  - To give an approval for the Action Plan when it is appropriate, and to make comments or revisions on the Action Plan if necessary.
  - To implement the approved Action Plan.
  - To report the situation of the Action Plan to JICA Expert Team through Project Directors and Project Managers.
- JICA Expert Team;
  - To give advice on formulation of Action Plans in the training in Japan.
  - To share knowledge on human resource development for O&M of TPS in Japan.
  - To monitor the implementation of Action Plans based on the reports

from each organization.
- To follow the result of Action Plans through on-site survey and to provide necessary advice or lecture when appropriate.

➢ JCC;
- To review the result of formulated Action Plans.

5. First Counterpart Training in Japan

(1) Schedule

The first Counterpart Training in Japan is tentatively planned from 22nd March to 27th April, 2018 for Engineers, and from 18th February to 10th March for Technicians, 2018. (From arrival to departure on Japan)

(2) Goal

The goal of the first training in Japan is to deepen understanding of participants on O&M of TPS, and to share Japanese experience and knowledge useful to develop Action Plans.

(3) Overall Contents

The both sides confirmed that the overall contents of the first training in Japan shall be as follows;

Expected Output	Training Subjects/Agendas	Training Methods	For Engineers	For Technicians
Enhance capacity of WEA and GENCO's instructors	Introduction of the latest technology in thermal power generation such as GTCC and USC (Ultra Super Critical)	Lecture	O	O
	Total Quality Management (TQM) in thermal power generation performance	Lecture	O	
	Human resource development in thermal power generation	Lecture	O	
	GTCC maintenance technology	Lecture	O	
	HSE (Health, Safety and Environment)	Lecture Exercise	O	O
	Onsite Repair Work	Lecture Exercise		O
	Non-destructive inspection with remaining life assessment	Lecture Exercise	O	O
	Site visit on thermal power plant and manufacturer's factory	Site Visit	O	O
Improve training and OJT at targeted thermal power plants	Methodology to formulate action plan	Lecture	O	O
	Presentation about action plan	Discussion	O	O

The JICA Expert Team explained the purpose of the training subjects/agendas.

The contents of the training include both general subjects related to O&M of TPS (ex. TQM, HSE) and technical subjects (ex. GTCC maintenance technology).For technical subjects, the both sides confirmed that mechanical engineering related to GTCC will be the main target in the first year, as GTCC

is expected to take important role on power generation by public sector under policy of the Pakistan side. The both sides agreed to make further discussion to decide the main targets of technical subjects in the second and the third year.

(4) Participants

The both sides agreed that the eligible participants for the first training in Japan shall be as follows;

Items	Qualification (Engineers)	Qualification (Technicians)
Number	10 persons per annual	10 persons per annual
Training Term	About 1 month	About 3 weeks
Current Duties	Be a Leading engineer working on thermal power plants or instructors of WEA, and has expertise related to mechanical engineering (especially GTCC)* who are capable to be instructors to train other engineers. *Training program (e.x. electrical and C&I engineering) would be under discussion on 2nd and 3rd year.	Be a Leading technician or instructors of Guddu training center working on thermal power plants, and has expertise related to mechanical work (especially GTCC)* , who are capable to be instructors to train other technicians. *Training program (e.x. electrical and C&I work) would be under discussion on 2nd and 3rd year.
Experience in the relevant field	Have more than 5 years' experience in the field O&M of thermal power plants ideally.	
Educational Background	Be a graduate of university	Be a diploma of technical high school or college, or higher
Language	Have a competent command of spoken and written English.	None*1
Health	Must be in good health, both physically and mentally, to participate in the program in Japan.	

*1: Lecture will be made in Japanese and translated into English or Urdu (under consideration). Course materials will be prepared in English, and participants are expected to prepare job reports and action plans in English.

The both sides confirmed that the participants are expected to make Action Plans described above to improve capacity of O&M of TPS. In this regard, Japanese side requested the Pakistan side to nominate participants who are capable of drafting Action Plans and also spreading their knowledge to other O&M staff through Off-JT or on-site training in each TPS.

The members of JCC shall closely coordinate to follow up the implementation of these Action Plans. Project Directors and Project Managers are requested to provide reports to the JICA Expert Team on the result of the implementation of the Action Plans.

(5) Nomination date

The both sides confirmed the nomination date for this first training is 15th December, 2017. After the nomination from the Pakistan side, the Japanese side will confirm the participants for the first training within 1 week. It is recommended to provide a list of a few alternative nominees in addition to 10 principle nominees, in case the principle nominees cannot participate in the training in Japan.

The Pakistan side will submit the application forms of the confirmed participants to JICA Pakistan Office within 2 weeks after confirmation of the participants and request for providing application forms by the Japanese side.

6. Participation in the Training by Management/Supervising Officers

The Pakistan side reiterated the request stipulated in the RD that, at the conclusion of each training, management/supervising officers be invited in the concluding sessions to get briefing on the training received by the participants, so that they can supervise and support the training participants implementing the Action Plans surely and smoothly after they come back to each Thermal Power Station. JICA explained that JICA would consider the possibility of invitations and will provide the result to the Pakistan side, though invitation especially during the technician training starting from February 2018 will be quite challenging, mainly due to time required for necessary approvals.

However Pakistani side proposed that nominated management staff from GHCL, WAPDA and MOE (Power Division) may join the concluding session or later part of the training as nominated participants.

The both sides agreed to discuss further on the participants and contents of the possible invitation program so that the opportunity would be fully beneficial for the implementation of the formulated Action Plans, and for achievement of the Project Purpose agreed upon RD.

7. Request from JICA Expert Team

(1) Answer for the questionnaire of Guddu Training Center (Soft data).
(2) Answer for the questionnaire of GHCL (Soft data).
(3) Soft data of the answers for the questionnaires of Lakhra TPS and WEA. (Hard copies submitted)
(4) Provision of the name of Project Manager and Project Director of GHCL

Attachment 1 Attendance List (Kickoff Meeting)
Attachment 2 Attendance List (JCC)
Attachment 3 Presentation Materials

MINUTES OF MEETING
FOR
THE SECOND JOINT COORDINATION COMMITTEE (JCC)
ON
THE PROJECT FOR CAPACITY BUILDING AND STRENGTHENING OF THERMAL POWER GENERATION OPERATION & MAINTENANCE
BETWEEN
JAPAN INTERNATIONAL COOPERATION AGENCY
AND
THE ISLAMIC REPUBLIC OF PAKISTAN

Japan International Cooperation Agency (hereinafter referred to as "JICA") and the Ministry of Energy of the Government of the Islamic Republic of Pakistan (hereinafter referred to as "MOE") and relevant organizations held the second Joint Coordination Committee (hereinafter referred to as "JCC") on the Project for Capacity Building and Strengthening of Thermal Power Generation Operation and Maintenance (hereinafter referred to as "the Project").

The second JCC on the Project was held on 14th September 2018, at GENCO Holding Company, Ltd. (hereinafter referred to as "GHCL"), Islamabad. As a result of discussions on the second JCC Meeting, the Japanese side and the Pakistan side have confirmed the main items described in Annex.

Islamabad, 14th September, 2018

Yoshihisa Onoe Senior Representative JICA Pakistan office	Ministry of Energy
Hiroki Hirahata Chief Advisor JICA Expert Team	Muhammad Imran Chief Executive Officer GENCO Holding Company, Ltd
	Riffat Ara Qureshi General Manager (Training) Water and Power Development Authority

ANNEX

1. Progress of the Project

The JICA Expert Team has explained the Work Flowchart, overall schedule , the progress made after the first JCC meeting including the first training courses in Japan implemented from February to April 2018, and the upcoming activities based on Attachment 2. The JICA Expert Team requested close collaboration from the Pakistan side for the implementation of project activities, including nomination of training candidates, implementation and monitoring of Action Plans, support for follow up survey by the Team.

The Pakistan side acknowledged the contents of the explanation and agreed to meet the request from the JICA Expert Team.

2. Result of the Second Mission

(1) Outline of the Mission

The JICA Expert Team implemented its second mission on Pakistan from 3rd to 14th September 2018, to achieve the below purposes;

- ✓ Reviewing O&M training activities at TPPs implemented by JICA-trained engineers & technicians,
- ✓ Grasping current situation of O&M, and identifying training needs,
- ✓ Mutual agreement on O&M training program in Japan JAN/FEB 2019,
- ✓ Mutual agreement on selection criteria for next participants (engineers & technicians),
- ✓ Proposing O&M training equipment

The JICA Expert Team made a brief explanation of current situation of each topics based on Attachment 2.

(2) Result of the review of Action Plan Implementation

The JICA Expert Team explained the result of review of Action Plan implementation as follow. Pakistan side took note of it.

- ✓ JICA-trained engineers and technicians implemented their Action Plans on schedule and their activities helped thermal power stations (hereinafter referred to as "TPS") in Pakistan to improve the O&M capacity.
- ✓ The training materials in Japan were suitable for beginners, junior & poor-skilled members.
- ✓ JICA trained participants have held lectures not only in his own TPS but also in Faisalabad work shop.

(3) Current situation of O&M and Training needs

The JICA Expert Team explained their understanding on the current situation of O&M, and identified training needs in Pakistan as follows. Pakistan side confirmed the contents.

(Current Situation)

- ✓ Based on the policy of Pakistan government to put more focus on renewable energy and on utilization of private sector, no new induction of engineers/technicians has been allowed for GENCOs around for 8 years (no plan of induction training)
- ✓ In WEA, 5 dedicated instructors dispatched by GHCL conduct refresher training courses for engineers through only lecture, while often implementing site visit on the workshop of Faisalabad TPS (no practical exercise).
- ✓ At this moment, WEA cannot enjoy the knowledge & skill obtained in Japan because no WEA-instructors were selected as participants of the 1st O&M training in Japan.

(Training Needs)

- ✓ GHCL requests the 2nd O&M training in Japan should be not advanced mechanical but other field, especially electrical, in terms of covering all the fields of Thermal Power for 3 years.
- ✓ GHCL has O&M training needs for electrical field as well as mechanical in each TPS.
- ✓ In accordance with GHCL's request, JICA experts make the best endeavor to reflect training needs on the 2nd training in Japan, and to keep the level as much as possible.

(4) Recommendation on Future Steps for HRD Enhancement

Based on the result of the mission, JICA Expert Team recommended the measures for enhancing Human Resource Development (hereinafter referred to as "HRD") for O&M of TPS as follows. The Pakistan side took note of it, and both sides agreed that the activities under the Project shall be carried out in the way consistent with these recommendations.

(Precondition)

- ➢ Refresher courses in training centers (WEA/Guddu) and HRD activities in each TPS should be the focus in strengthening HRD capacity in thermal power sector, while induction training should be carried out on necessity basis.

(Refresher Courses)

- ➢ Contents of training program and lecture contents always need to be reviewed and upgraded, so that they match the fluctuating needs of generation companies (including IPPs).
- ➢ While it is natural that refresher courses for middle class officer/staff put focus on theoretical aspects, some practical exercise could be beneficial for trainees as supplemental.
- ➢ Frequency of training is very limited while duration seems sufficient. Therefore, giving more frequent opportunities of training with shorter duration is recommended.

- ➢ Job rotation of the dedicated instructors in WEA and Guddu T/C should be short term (ex. 3 years), because the instructors should not be remote from TPS for long term. This would enhance interaction between training centers and TPSs.

(HRD Activities in each TPS)

- ➢ Knowledge sharing among colleagues should be official assignment of officers/staff, especially those who have chance to participate in special program including training in Japan under this Project.
- ➢ Knowledge sharing activities by officers/staff should be included in performance evaluation/assessment by management.

(Induction Training)

- ➢ Consistency between the timeline for shrinking generation capacity of GENCOs and the outlook on work force of GENCOs should be carefully examined in long term.
- ➢ Possibility to contribute more aggressively on HRD in private sector (IPP) should be considered.

3. Action Plan

(1) Purpose of Action Plan

The both sides confirmed that the Action Plans for improving HRD for O&M of TPS shall be formulated and implemented under the Project. Action Plan includes analysis on current issues and causes, concrete activities to be implemented in different stages, timeframe, persons in charge, possible obstacles or conditions, and etc. In this Project, Action Plans are expected to be formulated for the purpose of; i) improvement of refresher courses conducted on training centers (WEA or Guddu), or ii) improvement of on-site HRD activities conducted on each TPS.

(2) Roles and Duties on Action Plan

The both sides confirmed the roles and the duties of each stake holders on monitoring of Action Plans as follows;

- ➢ Participants of Training in Japan
  - Drafting Monitoring Report to be submitted to JICA Experts
- ➢ Senior Management Officials at organizations to which participants belong;
  - -Endorsing the Monitoring Report and Submitting it to JICA Experts through its focal point
  - -Evaluating contribution of the training participants to implementing the action plan and sharing the information to JICA Experts
  - -Arrange teleconference with JICA Experts on necessity basis
- ➢ JICA Expert Team;
  - Confirm the progress of the action plan implementation based on the Monitoring Report

  Arrange teleconference with counterpart organizations on necessity basis to follow up more in detail

4. Second Counterpart Training in Japan

(1) Schedule

The second Counterpart Training in Japan is tentatively planned from 6th January to 9th February 2019 for Engineers, and from 6th to 26th January 2019 for Technicians. (From arrival to departure on Japan)

(2) Overall Contents

The both sides confirmed that the overall tentative contents of the second training in Japan would be as follows;

Engineers	Technicians
✓ Introduction of the latest technology in TPP (inc. USC)	✓ Introduction of the latest technology in TPP (inc. USC)
✓ Experience-based Safety Training	✓ Essential Safety Training
✓ Human Resource Development	✓ Operational Quality Training
✓ Quality Management	✓ Basics of Non-Destructive Inspection Skills
✓ Thermal Efficiency Management	✓ Overhauling Means
✓ Basic Training of Vibration (Balancing)	✓ Electrical Protection Systems (inc. trains & assign)
✓ Non-Destructive Inspection	✓ Modern Maintenance Techniques of Excitation Systems
✓ Electrical Protection Systems (inc. trains & assign)	✓ Control Circuit (mainly Protective Relay)
✓ Modern Maintenance Techniques of Excitation Systems	✓ Preventive Maintenance (inc. Lubricant & Wear Debris)
✓ Control Circuit (mainly Protective Relay)	✓ Fire Protection for Electrical Circuit/Equipment
✓ Preventive Maintenance (inc. Lubricant & Wear Debris)	✓ Insulation standard for Electrical Circuit/Equipment
✓ Fire Protection for Electrical Circuit/Equipment	✓ Components HSE (especially Safety)
✓ Insulation standard for Electrical Circuit/Equipment	✓ Site Visit to TPP and Manufacture's factory
✓ Site Visit to TPP and Manufacture's factory	✓ Prevention of Accidents and Diseases
✓ Lessons Learned from Accidents	✓ Methodology to Formulate Action Plan
✓ Human Error Prevention	
✓ Effective Maintenance for Quality Electric Power Infrastructure ✓ Methodology to Formulate Action Plan	

The contents of the training include both general subjects related to O&M of TPS (ex. Quality Management, Safety) and technical subjects (ex. Vibration, Control Circuit).

The both sides agreed to make further discussion to decide the main targets of technical subjects in the third (final) year.

(3) Participants

The both sides agreed that the eligible participants for the second training in Japan shall be as follows;

Items	Qualification (Engineers)	Qualification (Technicians)
Number	8 persons	8 persons
Training Term	About 1 month	About 3 weeks
Required Condition	➢ An engineer in TPS or an instructor in WEA ➢ Capable of drafting effective action plan ➢ Willing to make technical contribution to HRD in GENCOs ➢ Electrical expertise	➢ An technician in TPS or an instructor in Guddu TC ➢ Capable of drafting effective action plan ➢ Willing to make technical contribution to HRD in GENCOs ➢ Electrical expertise
Educational Background	Be a graduate of university	Be a diploma of technical high school or college, or higher
Language	Have a competent command of spoken and written English	See footnote*
Health	Must be in good health, both physically & mentally, to participate in the program in Japan.	
Undertaking of Participants	➢ Read through "General Information" (GI) of the training to be issued by JICA, and understand the contents ➢ Draft the action plan of his/her organization during the course, and to explain the contents to his/her higher authorities for their endorsement ➢ Make effort to disseminate the knowledge obtained in Japan after coming back to Pakistan	
Undertaking of Mother Organizations	➢ Allow the participants to draft the action plan of the organization, and to let them explain the contents to the higher authorities for endorsement ➢ Implement the action plan ➢ Provide information regarding action plan monitoring to JICA Expert Team through focal points of each organization ➢ Evaluate the contribution of the participants on HRD/knowledge sharing in their organization, and provide information to JICA Expert Team through focal points	

*1: Lecture will be made in Japanese and translated to Urdu. Course materials will be prepared in English, and participants are expected to prepare job reports and action plans in English. Therefore participants are expected to be familiar with written English at least.

The both sides confirmed that the participants are expected to make Action Plans described above to improve capacity of O&M of TPS. In this regard, Japanese side requested the Pakistan side to nominate participants who are capable of drafting Action Plans and also spreading their knowledge to other O&M staff in each TPS.

The members of JCC shall closely coordinate to follow up and supervise the implementation of these Action Plans. Project Directors and Project Managers are requested to provide reports to the JICA Expert Team on the result of the implementation of the Action Plans.

(4) Nomination date

The both sides confirmed the nomination deadline for this second training is

15th November 2018, assuming that GI from JICA Expert Team shall be issued by 1st October 2018. After the nomination from the Pakistan side, the Japanese side will confirm the participants for the second training within 1 week.

5. Provision of O&M training equipment

JICA Expert Team explained three candidates for proving O&M training equipment, the first was "plant operation simulator", the second was "vibration analysis demonstrator" and the third was "Non Destructive Inspection Demonstrator". JICA Expert Team explained each training conditions briefly and provided the detail training conditions of each candidate to the Pakistan side.

At the request of JICA expert team, Pakistan side shall clarify the needs about provision of O&M training equipment.

6. Participation in the Training by Management and Supervising Officers

The Pakistan side requested the visit on Japan by management and supervising officers to get briefing on the training received by the participants, so that they can supervise and support the training participants implementing the Action Plans surely and smoothly after they come back to each Thermal Power Station.

The both sides agreed to discuss further on the timing, participants and contents of the possible invitation program so that the opportunity would be fully beneficial for the implementation of the formulated Action Plans, and for achievement of the Project Purpose.

7. Project Monitoring Sheet

The both sides confirmed the contents of the Project Monitoring Sheet Ver. 1 as Attachment 5.

8. Monitoring Indicator

Regarding Project Design Matrix (PDM) agreed on the Record of Discussion dated 22nd May, 2017, JICA Expert Team proposed to revise the Monitoring Indicator so that it could grasp the progress of the Project more appropriately. The draft of revised PDM shall be proposed by JICA Expert Team at the time of submission of Project Monitoring Sheet Ver. 2, which is planned on April 2019.

9. Request from JICA Expert Team

(1) Regular training report from some of JICA-trained technicians in Guddu TPS and Jamshoro TPS

Attachment 1 Attendance List
Attachment 2 Presentation Materials
Attachment 3 Introduction provision of O&M training equipment ("plant operation simulator" and "vibration analysis demonstrator")
Attachment 4 Minutes of Meetings during the Mission
Attachment 5 Project Monitoring Sheet Ver. 1

MINUTES OF MEETING
FOR
THE THIRD JOINT COORDINATION COMMITTEE (JCC)
ON
THE PROJECT FOR CAPACITY BUILDING AND STRENGTHENING OF THERMAL POWER GENERATION OPERATION & MAINTENANCE
BETWEEN
JAPAN INTERNATIONAL COOPERATION AGENCY
AND
THE ISLAMIC REPUBLIC OF PAKISTAN

Japan International Cooperation Agency (hereinafter referred to as "JICA") and the Ministry of Energy of the Government of the Islamic Republic of Pakistan (hereinafter referred to as "MOE") and relevant organizations held the third Joint Coordination Committee (hereinafter referred to as "JCC") on the Project for Capacity Building and Strengthening of Thermal Power Generation Operation and Maintenance (hereinafter referred to as "the Project").

The third JCC on the Project was held on 11th October 2019, at GENCO Holding Company, Ltd. (hereinafter referred to as "GHCL"), Islamabad. As a result of discussions on the third JCC Meeting, the Japanese side and the Pakistan side have confirmed the main items described in Annex.

Islamabad, 11th October, 2019

Yuka Okada Program Officer JICA Industrial Development and Public Policy Department	Zafar Abbas Joint Secretary Ministry of Energy (Power Division)
Hiroki Hirahata Chief Advisor JICA Expert Team	Muhammad Imran Chief Executive Officer GENCO Holding Company, Ltd

ANNEX

1. Progress of the Project

The JICA Expert Team has explained the Work Flowchart, overall schedule, the progress made after the second JCC meeting including the second training courses in Japan implemented from January to February 2019, and the upcoming activities based on Attachment 2. The JICA Expert Team requested close collaboration from the Pakistan side for the implementation of project activities, including nomination of training candidates, implementation and monitoring of Action Plans, support for follow up survey by the JICA Expert Team.

The Pakistan side acknowledged the contents of the explanation and agreed to meet the request from the JICA Expert Team.

2. Results of the Third Mission

(1) Outline of the Mission

The JICA Expert Team implemented its third mission on Pakistan from 30th September to 11th October 2019, to achieve the below purposes;

- ✓ Reviewing O&M training activities at TPSs implemented by JICA-trained engineers and technicians,
- ✓ Grasping the current situation of O&M at TPSs, and confirming the O&M training subjects,
- ✓ Mutual agreement on O&M and HRD training program in Japan January/February 2020,
- ✓ Mutual agreement on selection criteria for next participants (management, engineers and technicians),
- ✓ Proposing O&M training equipment

The JICA Expert Team made a brief explanation of current situation of each topic based on Attachment 2.

(2) Results of the review of Action Plan Implementation

The JICA Expert Team explained the results of review of Action Plan implementation as follow. Pakistan side took note of these.

(Results of the review of Action Plan Implementation)

- ✓ JICA-trained engineers and technicians have implemented their Action Plan almost as previously arranged with support from management, and a series of their dissemination activities can help to improve the O&M capacity at TPSs.
- ✓ Safety culture and mind at their workplace are now being improved through implementation of their Action Plan, but it seems to take time to fully establish them, so the continuous effort is important.
- ✓ JICA-trained engineers and technicians have disseminated their knowledge and skills to their colleagues by utilizing training materials provided by the JICA Expert Team, and the some training subjects such as "boiler water quality control" was effective among the training course in Japan.

- ✓ In terms of more effective dissemination to other colleagues at TPSs, some of them requested the JICA Expert Team to install the same O&M training equipment as had been used at O&M training in Japan.
- ✓ The O&M training in Japan had improved their attitude, way of thinking and approach to problem as follows:
  - ➢ Engineers started keeping record of troubles.
  - ➢ Engineer implemented dissemination activity not only for staffs of his own TPS, but also for staffs of other TPSs (e.x. Jamshoro to Kotri).
  - ➢ Technicians keep maintenance tools and parts tidy and in order during overhaul work. In addition, time management has been improved through Japanese culture and O&M training in Japan.
  - ➢ Technicians made original maintenance reports for repair work related to equipment without OEM manuals, in terms of effectiveness of the similar work.

(3) Current situation of O&M

The JICA Expert Team conducted Issue Analysis as main topic at the second batch O&M training in Japan.

For the purpose of realizing proper maintenance of TPSs, considering each difference between ideal and actual conditions item by item, every participants tried to clarify the countermeasures through internal discussion while being supported by the JICA Expert Team.

In the Mission the JICA Expert Team reconfirmed Issue Analysis and discussed current situation.

The JICA Expert Team would like to request Pakistan side for the further understanding and continuous support for Action Plan implemented by JICA-trained engineers and technicians.

- ✓ Coordinating Engineers and Technicians work to implement their Action Plan as planned.
- ✓ Reinforcing Action Plan implementation through O&M training equipment provided by JICA: Vibration analysis demonstrator and NDI demonstrators.

(4) Suggestion of Training target

The JICA Expert Team explained more suitable O&M condition through the Mission as follows:

- ✓ Based on the result of site survey and the needs of Pakistan side, the JICA Expert Team will focus on general contents, especially I&C (Instruments and Control) Maintenance as next O&M training;
- ✓ The JICA Expert Team consider that the subjects related to Balance of Plant (BOP) control can contribute to enhance I&C maintenance skills for the following reasons;
  - ➢ BOP control has common contents regardless of the manufacturer while main control system is quite different in design concept, logic, etc. depending on the manufacturers; and

  - ➢ Through site survey in TPSs of Pakistan, JICA expert recognized that there was still room for improvement in basic skills of I&C including BOP control.
- ✓ For realizing more effective capacity building for O&M at TPSs and developing training plan to effectively utilize the training equipment, management in charge of HRD is strongly expected to participate in next HRD training in Japan and recognize the issue to be solved.

3. Third Counterpart Training in Japan

(1) Schedule

The third Counterpart Training in Japan is tentatively planned from 26th January 2020 to 1st February 2020 for Management, from 13th January to 15th February for Engineer, and from 13th January to 1st February 2020 for Technician. (From arrival to departure on Japan)

(2) Overall Contents

The both sides confirmed that the overall tentative contents of the third training in Japan would be as follows;

(For Management)

Training Course	Main Purpose	Important Points
Course Orientation	To grasp outline of HRD training course.	Motivating management to participate in this HRD training course.
Job Report Presentation	To grasp actual condition of HRD in Pakistan.	Utilizing actual condition in Pakistan on HRD issue analysis.
Site Visit on KANSAI's TPS	To grasp the latest condition and how to manage the latest TPS directly.	Suggesting an example of ideal condition (TPSs) on HRD issue analysis.
Site Visit on Training Center (For Engineer & Technician)	To grasp roles & responsibilities of T/C directly and encourage engineers and technicians during next O&M training.	Suggesting an example of ideal condition (T/C for technicians) on HRD issue analysis.
Develop Training Plan to effectively utilize Training Equipment	To make a feasible & effective training plan like how to use training equipment that will be provided by JICA.	Maximizing the effectiveness of training equipment considering the actual condition of O&M training in Pakistan.
HRD Issue Analysis	To analyze current issues & causes related to HRD in Pakistan	Considering each difference between actual/ideal condition item by item, and identifying the countermeasure.
Action Plan Presentation	To make effective action plan to improve HRD situation in Pakistan	Implementing action plan as scheduled. (inc. Training Plan on how to use O&M training equipment provided by JICA)

(For Engineer and Technician)

	Engineer	Technician
General	Introduction of the latest technology in TPS (inc. USC)	Introduction of the latest technology in TPS (inc. USC)
	Experience-based Safety Training	Experiential Safety Training
	Human Resource Development	Experiential Quality Training
	Quality Management	Prevention of Accidents and Disasters
	Thermal Efficiency Management	Occupational HSE (especially Safety)
	Tool Box Meeting (for Safety)	Tool Box Meeting (for Safety)
	Lessons Learned from Accidents	
	Human Error Prevention	
	Effective Maintenance for Quality Electric Power Infrastructure	
I&C Maintenance	Monitoring Device	Monitoring Device
	Pneumatic Control Valve and Accessories	Pneumatic Control Valve and Accessories
	Copper Tube Processing and Terminal Treatment	Copper Tube Processing and Terminal Treatment
	Sequence Control	Sequence Control
	Tuning of PID Control	Tuning of PID Control
	Turbine Supervisory Instrument (Vibration Meter, Eccentricity Indicator, Differential Expansion Indicator, Shaft Position Indicator, Speed Indicator)	
	Basic Training of Vibration (Balancing)	
	GTCC Control	
Site Visit	Site Visit on TPS	Site Visit on TPS
	Site Visit on Manufacturer's factory	Site Visit on Manufacturer's factory
JICA Original	Issue Analysis	Issue Analysis
	Methodology to Formulate Action Plan	Methodology to Formulate Action Plan

The contents of the training include both general subjects related to O&M of TPS (ex. Quality Management, Safety) and technical subjects (ex. Sequence Control, Monitoring Device).
The both sides agreed on the purpose of the training subjects.

(3) Participants

The both sides agreed that the eligible participants for the third training in Japan shall be as follows;

(For Management)

Items	Qualification (Management)
Number	**4 persons**
Training Term	**About 1 week**
Current Duties	Be a management level officer working for GHCL, GENCOs, whose assignment are closely related to the project activity, such as: ➢ **Person in charge of Technical HRD at GHCL and GENCOs (especially Guddu T/C and Muzaffargarh T/C)**
Required Condition	Management who can formulate the effective Action Plan and willing to / have an authority to make a substantial contribution to **improvement of GENCO's technical HRD**, and can make **feasible and effective Training Plan, including how to utilize Training Equipment** provided by JICA
Language	Have a competent command of spoken and written English.
Health	Must be in good health, both physically and mentally, to participate in the program in Japan.

(For Engineers and Technicians) *1

Items	Qualification (Engineer)	Qualification (Technician)
Number	**8 persons**	**8 persons**
Training Term	About 5 weeks	About 3 weeks
Current Duties	Be a leading engineer working on thermal power plants, and has expertise related to **I&C engineering in TPSs**, who are capable to be instructors to train other engineers.	Be a leading technician working on thermal power plants, and has expertise related to **I&C work in TPSs,** who are capable to be instructors to train other technicians.
Experience in the relevant field	Middle-class* engineers and technicians in charge of O&M in TPSs. *Ideally, engineers & technicians have experience in TPSs including GTCC.	
Language	**Have a competent command of spoken and written English.**	None*2
Health	Must be in good health, both physically and mentally, to participate in the program in Japan.	
Undertaking of Participants	➢ Read through "General Information" (GI) of the training to be issued by JICA, and understand the contents ➢ Draft the action plan of his/her organization during the course, and to explain the contents to his/her higher authorities for their endorsement ➢ Make effort to disseminate the knowledge obtained in Japan after coming back to Pakistan	

Undertaking of Mother Organizations	➢ Allow the participants to draft the action plan of the organization, and to let them explain the contents to the higher authorities for endorsement ➢ Implement the action plan ➢ Provide information regarding action plan monitoring to the JICA Expert Team through focal points of each organization ➢ Evaluate the contribution of the participants on HRD/knowledge sharing in their organization, and provide information to the JICA Expert Team through focal points

Notice:
For efficient dissemination of the knowledge, instructors in Training Centers with I&C expertise, or candidates for these posts are most welcomed.

*1: JICA Expert Team may refuse the application of candidates who deviate from the criteria.
*2: Lecture will be made in Japanese and translated to English or Urdu. Course materials will be prepared in English, and participants are expected to prepare job reports and action plans in English.

The both sides confirmed that the participants are expected to make Action Plans described above to improve capacity of O&M of TPS. In this regard, Japan side requested the Pakistan side to nominate participants who are capable of drafting Action Plans and also disseminating their knowledge and skills to other colleagues in each TPS.
And also the both sides confirmed that the participants of managements are expected to make Action Plans described above to improve capacity of O&M HRD in TPS, and to make feasible and effective Training Plan, including how to utilize Training Equipment provided by JICA. In this regard, Japan side requested the Pakistan side to nominate participants who are in charge of HRD at GHCL, GENCOs (especially Guddu T/C and Muzaffargarh T/C).

The members of JCC shall closely coordinate to follow up and supervise the implementation of these Action Plans. Project Directors and Project Managers are requested to provide reports to the JICA Expert Team on the result of the implementation of the Action Plans.

(4) Nomination date
The both sides confirmed the managements, engineers and technicians nomination deadline for this third training is 11th November 2019, assuming that GI from the JICA Expert Team shall be issued by 23rd October 2019. After the nomination from the Pakistan side, the Japan side will confirm the participants for the third training within 1 week.

(5) Observance of the application deadline
The training in the last two times had to be changed the entire schedule backward because the submission of application documents was delayed from the Pakistan side. JICA pointed out that the third training will not allowed to change the schedule due to having trouble of external lecturer/organizations and logistic rearrangements (e.g. air flight booking. hotel reservations, transportation arrangements). Pakistan side agreed to keep the deadline strictly for smooth implementation of training.

5. Provision of O&M training equipment
The JICA Expert Team made an explanation about provision of O&M training equipment based on Attachment 2.
The both sides finally agreed that Case 3 (i.e. one (1) set of vibration analysis demonstrator along with four (4) sets of NDI demonstrator) was the best option to train engineers & technicians of GENCOs for fulfilling prevailing O&M requirements of GENCOs.
Pakistan side made feasible Training Plan, including;
- ✓ Training courses in which O&M training equipment is fully utilized (i.e. who, to whom, for what, when, where and how), and
- ✓ Training schedule in which O&M training preparation and the follow-up process after installation are described

At the request of the JICA Expert Team, Pakistan side shall develop the Training Plan through discussion at next HRD training in Japan.

6. Project Monitoring Sheet
The both sides confirmed the contents of Monitoring Indicator and the Project Monitoring Sheet Ver. 3 as Attachment 3.

Attachment 1 Attendance List
Attachment 2 Presentation Materials
Attachment 3 Project Monitoring Sheet Ver. 3
Attachment 4 Minutes of Meetings during the Mission

(5) Minutes of Meeting for the 5th JCC

MINUTES OF MEETING
FOR
THE FINAL JOINT COORDINATION COMMITTEE (JCC)
ON
THE PROJECT FOR CAPACITY BUILDING AND STRENGTHENING OF THERMAL POWER GENERATION OPERATION & MAINTENANCE
BETWEEN
THE JAPAN INTERNATIONAL COOPERATION AGENCY
AND
THE ISLAMIC REPUBLIC OF PAKISTAN

The Japan International Cooperation Agency (hereinafter referred to as "JICA") and the Ministry of Energy of the Government of the Islamic Republic of Pakistan (hereinafter referred to as "MOE") and relevant organizations held the final Joint Coordination Committee (hereinafter referred to as “JCC”) on the Project for Capacity Building and Strengthening of Thermal Power Generation Operation and Maintenance (hereinafter referred to as "the Project").

The final JCC on the Project was held on 17 February 2022, through video conference chaired by Mr. Ahmad Taimoor Nasir. As a result of discussions on the final JCC Meeting, the Japanese side and the Pakistan side have confirmed the main items described in Annex.

Signed this (DD/MM/YYYY) : / / 2022

Mr. YUZURIO Susumu Senior Director Energy and Mining Group Infrastructure Management Division Japan International Cooperation Agency	Ahmad Taimoor Nasir Joint Secretary Ministry of Energy (Power Division)
OKUDA Hidenobu Chief Advisor JICA Expert Team	Muhammad Imran Chief Executive Officer GENCO Holding Company, Ltd

ANNEX

1. Achievement of the Project

The JICA Expert Team and GENCO Holding Company, Ltd (hereinafter referred to as “GHCL”) explained the achievement of the Project using presentation report as attachment 2. Both sides agreed that the project purpose have almost achieved considering monitoring indicators such as improvement of training contents. However, the output 3, “training as well as OJT at GENCOs are improved.”, were negatively affected due to unexpected disruption caused by the Covid-19 pandemic since activities relevant to the output were supposed to be carried out mainly in the last half of the Project. For complementing these delays and deficit of the output 3 and developing GENCO’s training abilities, the JICA Expert Team delivered the O&M training equipment (Vibration analysis demonstrator and Non-destructive inspection (hereinafter referred to as “NDI”) demonstrator) and conducted the online training.

The implementation of the Human Resource Development Action Plan (hereinafter referred to as HRD Action Plan), which was developed by managers who have participated in management trainings in Japan, was all completed, however, some action plans are still in progress.

The HRD Action Plan constitutes an integral part of the Project, and its execution plays crucial roles in enhancing impact and sustainability of the Project. The Project members, both in Japanese side and Pakistan sides, made utmost efforts to continue their activities remotely after March 2020.

Both sides confirmed that it is necessary for the management of thermal power stations (hereinafter referred to as “TPS”) to create enabling environment, in terms of staffs, finance, and equipment and facilities, for proper implementation of the Action Plan as planned in a systematic manner in order to further strengthen the training capacity on O&M in TPSs.

For this purpose, the JICA Expert Team requested further support from the Pakistan side for the implementation and monitoring of Action Plans by JICA-trained engineers & technicians, even after finishing the Project.
The Pakistan side acknowledged the contents of the explanation and agreed to meet the request form the JICA Expert Team.

2. Review of Action Plan Implementation

The JICA Expert Team explained the result of review of Action Plan implementation as follows. Pakistan side confirmed the contents.

(1) Actual Conditions

- ✓ Before the pandemic of Covid-19, JICA-trained engineers & technicians almost implemented their Action Plan as previously arranged with support from management, and a series of their dissemination activities can help improve the O&M capacity at TPSs.
- ✓ According to the reports from JICA-trained participants, they conducted 835 trainings for a total of 6,414 O&M personnel at TPSs and TCs.

- ✓ The results of questionnaire from those who participated in the training conducted by JICA-trained participants shows that the training was highly evaluated and improved their O&M ability at TPSs.
- ✓ JICA-trained participants disseminated their knowledge and skills to their colleagues not only by utilizing training materials provided by JICA Expert Team, but also by creating and arranging the materials by themselves.
- ✓ JICA Expert Team recognize that the training ability in TPSs is steadily increasing by using the enhanced training material instead of conventional verbal technical transfer.
- ✓ One engineer implemented dissemination activity not only for staff of his own TPS, but also for staff of other TPSs (e.x. Jamshoro to Kotri).
- ✓ The trainings conducted by JICA-trained participants are not limited to the lecture, they are provided in a more practical and easy-to-understand way, such as practical training using wasted materials in TPS, and OJT style.
- ✓ In addition to technical skills, JICA-trained participants also provide training on safety and quality learned in the training in Japan.
- ✓ Especially for TBM (Tool Box Meeting), this safety measure was already incorporated into usual operation in some TPSs, and it contributes to raising safety awareness of O&M personnel and building safety culture in the workplace.
- ✓ The spread of the Covid-19 continues to affect the implementation of the Action Plan, but with the utmost efforts of the participants and the support from their management, they keep implementing their dissemination activities to the extent possible.
- ✓ Action Plan made by the participant of the HRD training in Japan, Mr. Mushtaq Ahmad, efficiently accelerated the establishment of the training center for GENCOs in Muzaffargarh TPS.
- ✓ Engineers and technicians who participated in the training in Japan, are also assigned to the trainers in this training center.
- ✓ On the other hand, some JICA-trained engineers & technicians could not perform Action Plan activities satisfactorily due to the spread of the Covid-19, their busy work and lack of understanding in their colleagues and/or management.

(2) Request from the Project members

- ✓ The JICA Expert Team requested the management of GHCL/GENCOs (Project Director) for the further understanding and continuous support for Action Plan developed by JICA-trained engineers & technicians.
  - ➢ Coordinating with Engineers/Technicians to implement their Action Plan as planned.
  - ➢ Supporting to formulate effective training course in Pakistan using O&M training equipment (Vibration analysis demonstrator and NDI demonstrator) provided by JICA;

The Project Team from the Pakistan side presented the progress of the HRD Action Plan including as follows:

- ➢ Enhancement of Training facilities in Regional training center in Guddu

- Establishment of Exclusive training center at TPS Muzaffargarh
- Development of syllabus for training courses

They explained the effects and usefulness of the Project and expressed their commitment for promoting the Action Plan implementation utilizing the practical training equipment (Vibration analysis demonstrator and NDI demonstrator) provided by JICA for further strengthen the capacity on O&M in TPSs.

3. Analysis of current situation of O&M through Issue Analysis

The JICA Expert Team explained the result of analysis of current situation for further improvement of O&M at TPSs as follows. Pakistan side confirmed the contents.

(1) The JICA Expert Team comprehensively analyzed the O&M issues of TPSs in Pakistan and identified the countermeasures (not limited to Action Plan).

(2) As for the O&M issues that JICA-trained engineers & technicians can deal with, almost all of the countermeasures are covered by the O&M training course in Japan and their Action Plan.

(3) On the other hand, JICA Expert Team recognize that, through reviewing the Project progress, the following points need to be improved.

- ✓ Since trainings in Japan and online training mainly focused on general contents of thermal power generation and maintenance subjects, there is still room for improvement in;
  - Basic skills & knowledge of Plant Operation
  - More practical skills focusing on specific power generation type, fuel type, etc.
- ✓ Organizational issues such as identifying training needs and designing trainings curricula, securing budget and equipment for practical training, etc. for effective and systematic human resources development. Implementation of HRD Action Plan is essential in this regard.

4. Technical Proposal from the Project Team (JICA-trained participants and JCC members)

Based on the result of review of Action Plan and analysis of current situation, the JICA Expert Team suggested following items for further improvement in O&M at TPSs in Pakistan. Pakistan side confirmed the contents.

(1) Technical Training in Japan
- ✓ Training course of plant operation.
- ✓ Training course of more practical skills (Root Cause Analysis, Maintenance Scheduling Method, etc.) focusing on specific power generation type, fuel type, etc.

(2) Enhancement of HRD training system
- ✓ Includes training planning, training subjects reviewing, training teachers, providing training equipment (if necessary), etc.

5. Conclusion

Based on the implementation of the Project for around 4 years, the Project members concluded that the Project is practical and effective to improve O&M

capacity. JICA Expert Team suggested that the Pakistan side implement the Action Plan for further improvement of O&M at TPSs with strong support from their management.

6. Electronic signature

Both sides acknowledged and agreed that the Minutes of Meetings may be executed by electronic signature, which is considered as an original signature for all purposes and has the same force and effect as an original signature. "Electronic signature" includes faxed versions of an original signature or electronically scanned and transmitted versions (e.g., PDF format) of an original signature.

Attachment 1 Attendance List
Attachment 2 Presentation Materials
Attachment 3 Project Monitoring Sheet Ver. 6 (draft)

Attendance List

Meeting of the Final Joint Coordination Committee (JCC) on
"The Project for Capacity Building and Strengthening of Thermal Power Generation Operation & Maintenance"

Date: 17th February, 2022

Time: 12:30 – 13:30 (PST)

Method: Zoom Web Conference

No.	Name	Position	Company
1	Ahmed Taimoor Nasir	Joint Secretary, Chairperson of JCC	Ministry of Energy (Power Division)
2	Muhammad Imran Mian	Chief Executive Officer / MD, Project Director	GENCO Holding Company, Ltd
3	Syed Tanveer Ahmed Jafri	Chief Executive Officer	JPCL , GENCO-I
4	Mushtaq Ahmad	Advisor (HR)	GENCO Holding Company, Ltd
5	Masood Ahmed	Finance Director	GENCO Holding Company, Ltd
6	Muhammad Jafar	Additional Director (Technical), Focal Point of the project	GENCO Holding Company, Ltd
7	Iftikhar Ahmad	Assistant Director (Technical)	GENCO Holding Company, Ltd
8	Muhammad Ahmed	Additional Deputy Director (Coordination)	GENCO Holding Company, Ltd
9	Konishi Hideaki	Sr. Advisor	JICA Headquarters
10	Shibata Kuri	Program officer	JICA Headquarters
11	Aramaki Risa	Representative	JICA Pakistan Office

12	Amir Bukhari	Chief Program Manager	JICA Pakistan Office
13	Sawa Koki	Project Formulation Advisor	JICA Pakistan Office
14	Okuda Hidenobu	JICA Expert Team	Kansai Electric
15	Fukuda Naga	JICA Expert Team	Kansai Electric
16	Kozakai Akira	JICA Expert Team	Kansai Electric
17	Doi Yoshihiro	JICA Expert Team	Kansai Electric
18	Ichioka Hidenobu	JICA Expert Team	Kansai Electric
19	Obe Yuki	JICA Expert Team	Kansai Electric

OVERVIEW of INTERIM REPORT

February 2022

Japan International Cooperation Agency (JICA)

The Kansai Electric Power Co., Inc.

Contents 2

1. Project Summary: Capacity Building for O&M at TPSs 3

This JICA project aims to implement capacity building for O&M at Thermal Power Stations (TPSs), in order to make continuous technical support for Pakistani side.

Project Purpose

Overall Goal	Technology and technical skills obtained by the project are utilized in actual O&M at GENCOs power stations.
Project Goal	Training capacity on O&M of GENCOs is strengthened.

Project Output

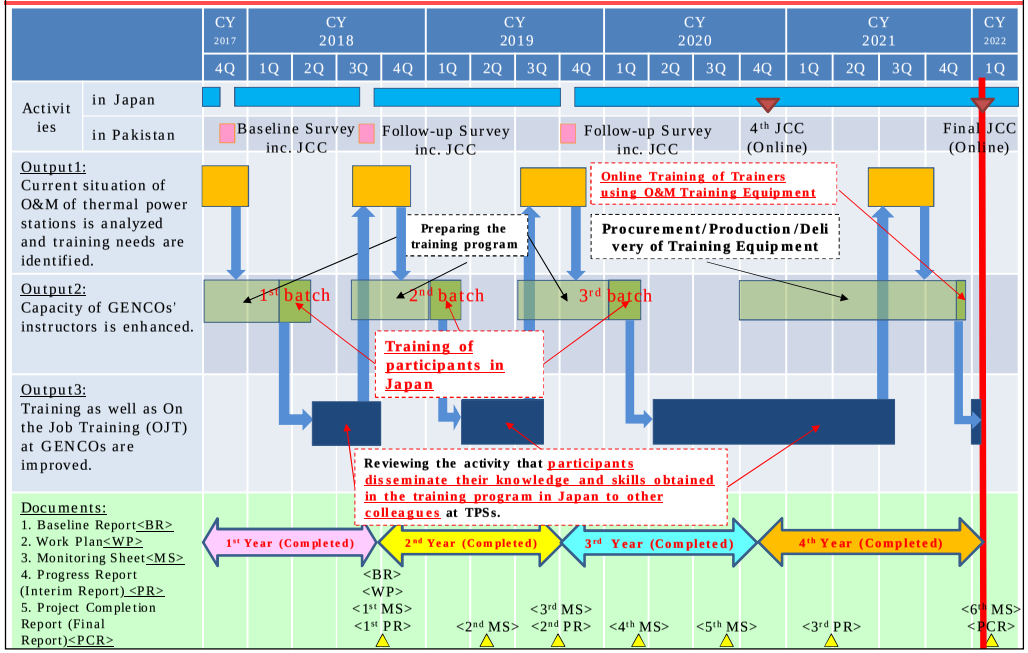
Output 1	Current situation of O&M of thermal power stations is analyzed and training needs are identified.
Output 2	Capacity of GENCOs' instructors is enhanced.
Output 3	Training as well as On the Job Training (OJT) at GENCOs are improved.

1. Project Summary: Capacity Building for O&M at TPSs 4

Targeted Type of Power Generation	Conventional Type (Gas, Coal and Oil) and Gas Turbine Combined Cycle (GTCC) including advanced environmental practices in Japan
Project Sites	GENCOs' thermal power station in Jamshoro, Guddu, Muzaffargarh, Lakhra, Nandipur etc.
Counterpart	Ministry of Energy (MOE), GENCO Holding Company, Ltd (GHCL), and GENCOs
Beneficiaries	O&M instructors of GENCOs and their trainees
Duration	October 2017 – March 2022 (4.5 years)

(Attachment 2-1)

1. Project Summary: Work Flowchart



1. Project Summary: Monitoring Indicators

Items	Monitoring Indicators	Achievement
Overall Goal: Technology and technical skills obtained by the project are utilized in actual O&M at GENCOs power stations.	ü Number of GENCOs power stations which utilize obtained technology and technical skills.	ü 6 TPSs (Jamshoro, Kotri, Guddu, Muzaffargarh, Nandipur and Lakhra) utilized knowledge and skill obtained in Japan as scheduled. ü 2 Training Centers (Muzaffargarh and Guddu) used training equipment and educational materials provided by JICA Expert Team to train O&M personnel.
Project Goal: Training capacity on O&M of GENCOs is strengthened.	ü 100% of GENCOs power stations where participants come from, implement trainings (OJTs) based on the Action Plan prepared by trained instructors.	ü Training is being implemented at the 100% of GENCOs TPS: Jamshoro, Kotri, Guddu, Muzaffargarh, Nandipur and Lakhra. ü As Off-JT, training is being conducted using the equipment provided by JICA Expert Team at the training centers of Muzaffargarh and Guddu.

1. Project Summary: Monitoring Indicators

Items	Monitoring Indicators	Achievement
Project Goal: Training capacity on O&M of GENCOs is strengthened.	ü Improvement of GENCOs training contents based on the Action Plan developed by trained instructors.	ü JICA-trained participants implemented their Action Plan almost as previously arranged with support from management, regardless of various hard duties in each workplace. ü JICA Expert Team provided training equipment (Vibration Analysis Demonstrator and Non Destructive Inspection (NDI) Demonstrator) to GENCOs training centers and trained instructors to train using the equipment ü A series of their dissemination activities can help to improve the O&M capacity at TPSs.

1. Project Summary: Monitoring Indicators

Items	Monitoring Indicators	Achievement
Output 1: Current situation of O&M of thermal power stations is analyzed and training needs are identified.	ü Training needs are compiled based on the current situation.	ü JICA Expert Team compiled training needs based on the current situation of O&M including request from GHCL/GENCOs: "comprehensive field of TPSs". ü Through field surveys of GENCOs training centers and discussions with GHCL/GENCOs management, JICA Expert Team summarized the needs for training equipment to improve training capabilities at GENCOs.
Output 2: Capacity of GENCOs' instructors is enhanced.	ü Training program is formulated based on the training needs.	ü Based on the survey result such as shown in Output1, JICA Expert Team prepared these O&M training program in Japan. 1st batch: Mechanical maintenance 2nd batch: Electrical maintenance 3rd batch: C&I maintenance ü JICA Expert Team prepared and provided O&M training using the provided training equipment. < Muzaffargarh Training Center > - Vibration Analysis Demonstrator - NDI Demonstrator < Guddu Training Center> - NDI Demonstrator

1. Project Summary: Monitoring Indicators

Items	Monitoring Indicators	Achievement
Output 2: Capacity of GENCOs' instructors is enhanced.	ü Total number of trained instructors.	ü 24 engineers & 24 technicians trained in Japan for dissemination to other colleagues at TPSs. ü A total of 8 instructors from Muzaffargarh Training Center and Guddu Training Center received online training to utilize the training equipment provided by JICA.
Output 3: Training as well as OJT at GENCOs are improved.	ü Achievement level of Action Plans developed by trained instructors.	ü JICA-trained participants from TPSs and TCs disseminated their knowledge and skills to their colleagues by utilizing training equipment and materials provided by JICA Expert Team. ü The O&M training in Japan helped them improve their attitude, way of thinking and approach to problem.
	ü The results of checklists.	ü According to the training reports and checklists from JICA-trained participants, they conducted 835 improved/new trainings for 6,414 O&M personnel at TPSs and TCs (in total).

1. Project Summary: Action Plan Implementation

Through past on-site/online survey and this online survey, about action plan implementation, we've understood that TPSs are well-operated. JICA Expert Team thinks that the continuous implementation of the Action Plans of each of these participants / TPSs will lead to the enhancement of O&M capabilities in GENCOs.

	TPSs (Instructor)	Jamshoro (E:4, T:4)	Kotri (E:0, T:2)	Guddu (E:11, T:9)	Muzaffargarh (E:4, T:6)	Nandipur (E:1, T:0)	Lakhra (E:1, T:3)	GHCL (E:2, T:0)	Total (E:23, T:24)
Engineers	No of Training (General / Technical)	26	-	261	45	6	43	4	385
	No of participants	332	-	2,745	204	30	197	13	3,521
Technicians	No of Training (General / Technical)	94	11	255	44	-	33	-	437
	No of participants	398	98	1,824	259	-	229	-	2,808
Total	No of Training (General / Technical)	120	11	516	89	6	76	4	822
	No of participants	730	98	4,569	463	30	426	13	6,329

1. Project Summary: Action Plan Implementation

Through this online survey, it was found that the action plans created by the instructors who participated in JICA online training from TCs are being well-operated. JICA Expert Team thinks that incorporating these participants' action plans into base of training plans at TC, and continuing to implement them as an organization will further improve the O&M capabilities of GENCOs.

	Training Centers (Instructor)	Muzaffargar (4)	Guddu (4)	Total (8)
Vibration Analysis Demonstrator	No of Training	5	-	5
	No of participants	25	-	25
NDI Demonstrator [PT/MT/UT]	No of Training	4	4	8
	No of participants	28	32	60
Total	No of Training	9	4	13
	No of participants	53	32	85

1. Project Summary: Project Evaluation (1/6)

Evaluation based on DAC (Development Assistance Committee) Evaluation Criteria

Evaluation

Evaluation Criteria	(1) Relevance	(2) Effectiveness	(3) Impact	(4) Efficiency	(5) Sustainability
Evaluation Results	High	High	High	Relatively High	High

Detailed Evaluation Results

(1) Relevance : High

Evaluation Aspects	Detailed Evaluation Results
Priority	ü In the GENCOs, it is an urgent task to efficiently operate and maintain thermal power generation, which is consistent with the goal of the Project.
Adequacy of Project Approach	ü As for the approach of the Project, it is appropriate that O&M personnel in leading positions are trained as instructors through O&M training in Japan including practical training, and the trained instructors implement dissemination activities at their power stations. ü In addition to the original project, JICA Expert Team provided training equipment (Vibration Analysis Demonstrator and NDI Demonstrator) to public training centers in Pakistan (Muzaffargarh Training Center and Gudddu Training Center) and trained instructors to train using the equipment. ü These are appropriate approaches to achieving the goals of this project.

1. Project Summary: Project Evaluation (2/6)

(1) Relevance : High

Evaluation Aspects	Detailed Evaluation Results
Consistency with the Japanese ODA policy	ü The Project is consistent with Japanese Official Development Assistance (ODA) policy for Pakistan.

(2) Effectiveness :

Evaluation Aspects	Detailed Evaluation Results
Achievement of Project Outputs	ü The Output 1 and 2 have been achieved. ü As for the Output 3, there are the unimplemented Action Plans by some participants due to Covid-19 pandemic so far, but the trainings conducted by the participants were highly evaluated, so it is considered that Output 3 has been mostly achieved. ü In addition to the initial project, JICA Expert Team provided training equipment to each training center based on the field survey in Pakistan, discussions with the management of GHCL/GENCOs, and follow-up surveys to the participants trained in Japan. ü In addition, JICA Expert Team conducted online training for instructors who conduct training using these equipment. ü From these, it can be concluded that this project including additional projects was achieved at a satisfactory level.
Achievement of Project Purpose	ü As per the questionnaire surveys for management and participants, the implementation of Action Plans by participants has led to the improvement of O&M performance at TPSs, so it is considered that the Project Purpose has been achieved.

1. Project Summary: Project Evaluation (3/6)

(2) Effectiveness :

Evaluation Aspects	Detailed Evaluation Results
Beneficiaries of Project	ü As per the beneficiaries of the Project, each participant has been able to disseminate the knowledge and skills learned during O&M Training in Japan to 6,329 colleagues in the Project.

(3) Impact : High

Evaluation Aspects	Detailed Evaluation Results
Prospect of achieving Overall Goal	ü Improvements of training capacity on O&M at TPSs have been confirmed. In addition, as per the questionnaire surveys for management and participants, improvements of O&M performance at TPSs have already been confirmed. Therefore, it is highly possible that Overall Goal will be achieved.
Ripple Effects	ü The participants not only have implemented training to disseminate the knowledge and skills learned during O&M Training in Japan, but have worked on the improvement activities through 4S (Sort, Set in order, Shine and Standardize) activities and TBM (Tool Box Meeting) learned in Japan. The improvement activities have a positive impact on the safety and quality at TPSs.

1. Project Summary: Project Evaluation (4/6)

(4) Efficiency : Relatively

Evaluation Aspects	Detailed Evaluation Results
Inputs	ü As for the inputs of the Japanese side, the dispatch of the Japanese experts was not conducted as planned due to the cancellation of the 4th survey (the 3rd follow-up survey) and final survey (the 4th follow-up survey and on-site training) added to the original project. However, those activities could be carried out by substituting email, web conference and online training, which was appropriate to produce the outputs as planned. ü As for the inputs of the Pakistan side, the scheduled 3rd management training was canceled and the 3rd training period for engineers was shortened due to insufficient coordination.
Improvement of Efficiency	ü Since the Project was conducted as the same program including other countries, synergistic effects could be achieved by laterally applying the activity results of each project. In addition, the efficiency of the Project was able to be improved.

1. Project Summary: Project Evaluation (5/6)

(5) Sustainability : High

Evaluation Aspects	Detailed Evaluation Results
Policy / Institutional aspect	ü It is not predicted any policy or institutional change that may affect the sustainability of the Project effects.
Organization aspect	ü As a change in the organization that affects the sustainability of the effects created by this project, a training center for GENCOs (Muzaffragarh Training Center) was newly established according to the HRD Action Plan created by the GHCL management. ü As the engineer training of GENCOs, by utilizing this training center instead of the training at WEA so far, it has become possible to acquire skills more specialized in thermal power generation technology. ü At the training centers of GENCOs, engineers and technicians trained in Japan are appointed as instructors, and it can be confirmed that the organization is trying to sustain and develop this project.
Technical aspect	ü In JICA training, engineers and technicians prepared the Action Plans for improvement of the O&M capacity of TPSs. Due to the dissemination of knowledge through the implementation of the Action Plans, basic technical and safety knowledge of the O&M staff at TPSs were enhanced, which lead to reduction in accidents at TPSs, and improvement of O&M quality of the staff at TPSs. ü Furthermore, in order to sustain and develop activities for the O&M capacity of thermal power plants, as described in the "Organizational aspect" of the previous section, the dedicated training center specializing in thermal power generation has been established and operated.

1. Project Summary: Project Evaluation (6/6)

(5) Sustainability : High

Evaluation Aspects	Detailed Evaluation Results
Financial aspect	ü At the GENCOs training centers, practical training was limited in some items due to lack of finances and equipment, but JICA Expert Team provided the necessary training equipment based on field surveys, discussions with management, and the results of questionnaires from participants trained in Japan. ü In addition, JICA Expert Team trained instructors to use those equipment to train for many O&M personnel in thermal power plants, so that they can continue their training activities autonomously even after the completion of this project.

Contents

2. O&M Training in Japan: Overall Framework

Job Report Presentation: Participatory (Active)
To grasp actual condition of O&M at TPSs.

Lecture & practical training at KANSAI's Training Center: Passive
To learn each essence on the training program and how to teach them to others efficiently.

+

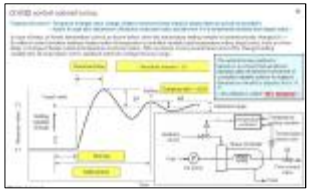
Site visit to Kansai's TPSs and Japanese manufacturer's factory: Passive
To understand high-level safety & quality management at their sites directly.

Workshop for Issue Analysis: Participatory (Active)
To analyze current issues, in logical manner, especially on the cause & effect basis.

Action Plan Presentation: Participatory (Active)
To make action plan for disseminating their knowledge & skills obtained in the training program in Japan to other colleagues.

2. O&M Training in Japan: Training Curriculum

JICA Expert Team conducted the O&M training in Japan 3 times during the duration of the Project, respectively focusing on Mechanical, Electrical and I&C Maintenance.

1st Batch in 2018	2nd Batch in 2019	3rd Batch in 2020
Mechanical Maintenance	Electrical Maintenance	I&C Maintenance
		
		

2. O&M Training in Japan: Course Examples (1)

Example: Experience-based Safety Training (Practical Training)

Training Item

Safety training using following;
- ü Ladder
- ü Safety belt
- ü Electric shock
- ü Be caught by rotation
- ü Helmet

Effects of Training:

- ü Can understand the importance of labor safety and equipment safety
- ü Can improve capability to properly use safety equipment ready for emergency situations

Training Materials

Training Snapshot

2. O&M Training in Japan: Course Examples (2)

Example: Tour of Himeji No.2 TPS (Site Visit)

About Himeji No.2 TPS

- ü Largest TPS of KANSAI (4,119 MW)
- ü Introduced latest GTCC technology, and achieved high thermal efficiency of 60%
- ü LNG terminal is adjacent to TPS, and integratedly operated

Effects of Training:

- ü Can grasp O&M current situation in Japanese electrical power company
- ü Can understand the 5S methodology ("Sort", "Set In order", "Shine", "Standardize" and "Sustain") and its effects on quality of work
- ü Can understand how to well-operate aged-facilities

Overview of Himeji No.2 TPS

Training Snapshot

2. O&M Training in Japan: Action Plan Presentation

Implementing their action plan in TPSs enables not only participants but also their colleagues to improve their O&M knowledge & skills.

About Action Plan

- ü Participants will be core instructors, and disseminate the knowledge and skills learned during O&M Training in Japan when they come back to Pakistan.
- ü Participants made and presented Action Plan which illustrates the detailed actions to improve quality of work, such as On-the-Job Training at their TPS.

Introduction of Participant's Action Plan

Engineer

1. Training for technical staff on TPSs
   - ü I&C Maintenance
     Monitoring Device、GTCC Control System、Turbine Supervisory Instrument
   - ü General Contents
     Tool Box Meeting (TBM)
2. Activity on actual work
   Tool Box Meeting (TBM) before actual work

Technician

1. Training for technical staff on TPSs
   Monitoring Device, Control Valve, Control Cable, etc.
2. Activity on actual work
   Apply practical knowledge/maintenance skill learned in Japan to actual work.

2. O&M Training in Japan: Other Activities

We provided the participants with comprehensive O&M training as well as opportunities to learn Japanese culture.

- ü Japanese Language Lesson
- ü Home-Visit Program for Engineers
- ü Kyoto Sightseeing for Engineers & Technicians

2. HRD Training in Japan: Overview

- ü We provided management with Human Resource Development (HRD) training in Japan to realize more effective capacity building for O&M at TPSs.
- ü HRD training consisted of Job Report Presentation, Visit on Kansai's Training Centers for engineers and technicians, Issue Analysis and Action Plan Presentation as follows:
  - Introduction of proper OJT in GENCOs
  - Enhancement of Training Facilities in Regional Training Centre
  - Establishment of exclusive Training Facility Centre for Thermal Engineers

Human Resource Development (HRD) Issue Analysis

Site Visit on Training Center (For Engineers)

2. HRD Training in Japan: Overview

Demonstration of Training Equipment (Plant Simulator)

Demonstration of Training Equipment (NDI kit)

Demonstration of Training Equipment (Vibration Rotor kit)

Action Plan Presentation

Contents

3. O&M Training Equipment: Amendment of R/D

- ü In order to secure sufficient time to develop GENCO's training abilities by using the equipment (Vibration analysis demonstrator, Non-destructive inspection demonstrator) to be provided under this Project, the Project was extended to March 2022.

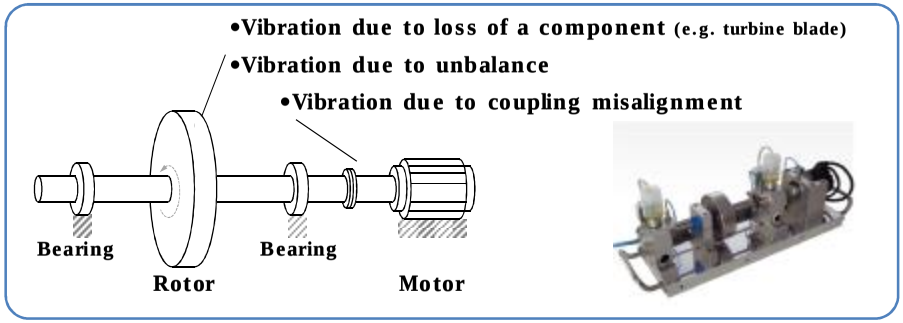
Pakistan side and JICA Expert Team amended Record of Discussion on the Project in September 2020.

	Vibration Analysis Demonstrator	NDI Demonstrator [PT/MT/UT]
Image		
Description	This is the device for demonstration of the variable vibration failures in rotating machinery. Its associated course and exercise allows for theoretical and practical training in vibration causes & effects, balancing and data collection.	NDI is a wide group of analysis techniques to evaluate the properties of a material, component or system without causing damage. Its associated course/exercise allows for theoretical and practical training in correct inspection and record.

3. O&M Training Equipment: Vibration Analysis Demonstrator

(1) Specification:

This demonstrator can simulate following phenomena and trainees can observe the typical vibration curve and analyze the root causes.



These phenomena are required relatively high level knowledge to understand.

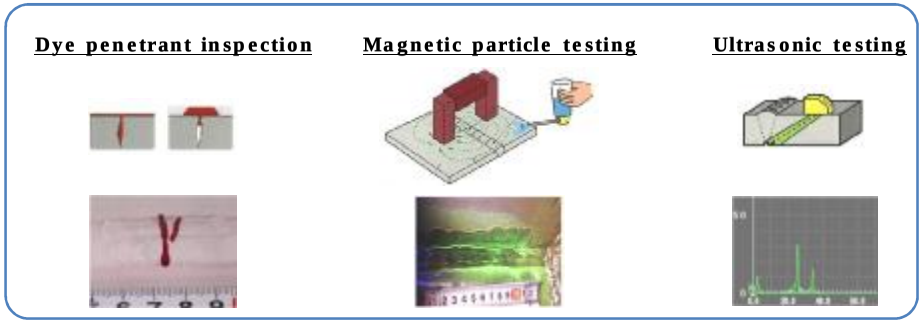
(2) Target:

Middle to expert level engineers (mechanical & electrical)

3. O&M Training Equipment: NDI Demonstrator

(1) Specification [PT/MT/UT]:

This demonstrator can provide principles, correct inspection procedure, how to ensure the quality and how to record correctly.



These phenomena are NOT required high level knowledge to understand.

(2) Target:

Novice to middle level engineers/technicians (mechanical & electrical)

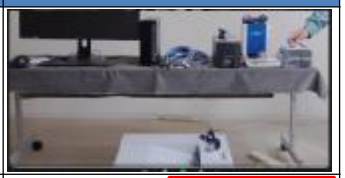
3. O&M Training Equipment: Online Training for Trainers

ü The training was conducted online due to the spread of the Covid-19, and focused on Vibration Analysis Demonstrator and NDI Demonstrator.

	Time PKT/[JST]	10am-12am [14pm-16pm]	13pm-15pm [17pm-19pm]	Muzaffargarh	Guddu
Day 0	10 Nov (Wed)	Web meeting connecting test with Muzaffargarh		✓	X
	TBS	Web meeting connecting test with Guddu		X	✓
Day1	29 Nov (Mon)	Unpacking and checking the quantity of vibration model rotor	Installing the model rotor (assembling, connecting cables, etc.)	✓	X
Day2	30 Nov (Tue)	How to use the model rotor(1) Operating and maintenance of the model rotor	How to use the model rotor(2) Demo of the phenomenon (unbalance/Fly-loss)	✓	X
Day3	1 Dec (Wed)	Lecture Ⅰ : Basic of vibration Practical training 1 : Critical speed and changes in phase of a high-spot position during speeding up	Practical training 2 : Checking response by unbalance form Practical training 3 : Checking vibration response by cancel weight Lecture Ⅱ : Vibration Diagnosis	✓	X
Day4	2 Dec (Thu)	Lecture Ⅲ : Cause of vibration Practical training 4 : Flying of a revolution body	Lecture Ⅳ : Taking countermeasures Practical training 5:Balancing by the three-point balancing method Practical training 6 : Balancing by the influence coefficient method	✓	X
	3-5 Dec	Holiday			
Day5	6 Dec (Mon)	Unpacking and checking the quantity of NDT kit Overall the Non-destructive Test	Lecture &workshop: Penetrant Testing	✓	✓
Day6	7 Dec (Tue)	Lecture &workshop: Ultrasonic Testing	Lecture &workshop: Magnetic particle Testing	✓	✓
Day7	8 Dec (Wed)	Making Action Plan of vibration & NDT	Demonstrating the training by lecturing each other	✓	✓

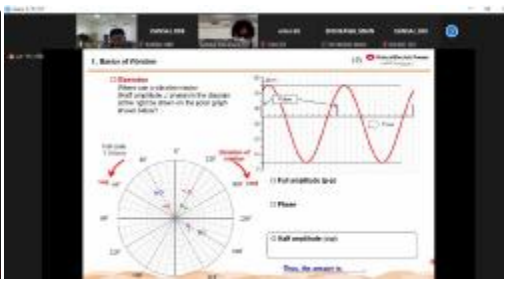
3. O&M Training Equipment: Points for Effective Training

ü JICA Expert Team enhanced the effectiveness of the online training by utilizing our expertise and experience.

Example	Description	
Easy-to-understand Training Manual including Video Contents	Made installation and operation manual of Vibration Analysis Demonstrator, using video contents as well as documents to promote participants' understanding.	
Support by Manufacturer	Manufacturer (Shinkawa Electric Co., Ltd.) also joined the online training and assisted the participants in operation of the training equipment.	
Training Demonstration by Participants	Participants demonstrated the Vibration Analysis and NDI training by themselves to formulate effective training course in Pakistan.	

3. O&M Training Equipment: Online Training for Trainers

Installation of Vibration Analysis Demonstrator



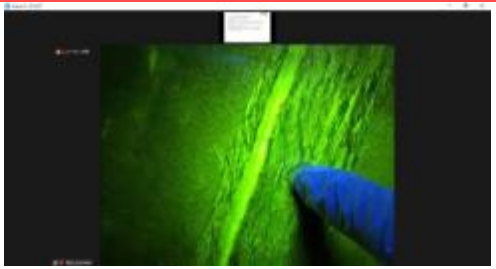
Online Lecture (Vibration Analysis)

Practical Training (Vibration Analysis Demonstrator)

Practical Training (Vibration Analysis Demonstrator)

3. O&M Training Equipment: Online Training for Trainers

Practical Training (PT: Penetrant Test)



Practical Training (MT: Magnetic Test)

Practical Training (UT: Ultrasonic Test)

Action Plan

Contents

4. Action Plan Implementation: Format

■Detailed Plan of OJT for Objective 1: To Improve Skills of Engineers through On the Job Training (OJT)

NO.	Training Subject	Purpose	Training Item		Effect	Important Points	Trainer	Where	How	Tools	Achievements		2018			2019										Remarks
													OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	
1	Service Life Diagnosis	(1) To understand the outline of Service Life Evaluation (2) To understand the various type of deterioration/events of Thermal Power plant (3) To understand the evaluation methods and their process (4) To understand important check points for evaluation	1-1	Purpose of Service Life Evaluation	(1) (2)	- Why Service Life Evaluation is important	JICA-trained participant	TPP	Lecture	- Textbook (provided by JICA) - O&M Manual (provided by manufacturers)	Plan	No. of times			1										
												No. of participants			5										
											Result	No. of times													
												No. of participants													
			1-2	Main Deterioration Events and their Mechanism of Deterioration	(2)	- What are the main damage factors - How each damage factor causes what kind of damage on where.	JICA-trained participant	TPP	Lecture	- Textbook (provided by JICA) - O&M Manual (provided by manufacturers)	Plan	No. of times			1										
												No. of participants			5										
											Result	No. of times													
												No. of participants													
			1-3	Service Life Diagnosis Methods	(2) (3)	- Where & how to check the damage, according to the kinds of damage	JICA-trained participant	TPP	Lecture	- Textbook (provided by JICA) - Manual (provided by manufacturers)	Plan	No. of times			1										
												No. of participants			5										
											Result	No. of times													
												No. of participants													
2	Vibration	(1) To understand the mechanism of vibration (2) To understand the important checking points.	2-1	Basics of Vibration	(1)	- How vibrations occur.	JICA-trained participant	TPP	Lecture	- Textbook (provided by JICA)	Plan	No. of times				1									
												No. of participants				5									
											Result	No. of times													
												No. of participants													
			2-2	Analysis of Vibration	(1) (2)	- How to read and follow up the vibration trend and take action.	JICA-trained participant	TPP	Practical training	- Textbook (provided by JICA)	Plan	No. of times				1									
												No. of participants				5									
											Result	No. of times													
												No. of participants													

4. Action Plan Implementation: Findings

(Actual Conditions : Participants of the 1st/2nd/3rd Engineer and Technician Training)

- Before the pandemic of Covid-19, JICA-trained engineers & technicians almost implemented their Action Plan as previously arranged with support from management, and a series of their dissemination activities can help to improve the O&M capacity at TPSs.
- According to the reports from JICA-trained participants, they conducted 822 trainings for a total of 6,329 O&M personnel at TPSs.
- The results of questionnaire from those who participated in the training conducted by JICA-trained participants shows that the training was highly evaluated and improved their O&M ability at TPSs.



4. Action Plan Implementation: Findings

(Actual Conditions : Participants of the 1st/2nd/3rd Engineer and Technician Training)

- JICA-trained participants disseminated their knowledge and skills to their colleagues not only by utilizing training materials provided by JICA Expert Team, but also by creating and arranging the materials by themselves.
- JICA Expert Team recognize that the training ability in TPSs is steadily increasing by using the training material of high-quality instead of conventional verbal technical transfer.
- One engineer implemented dissemination activity not only for staff of his own TPS, but also for staff of other TPSs (e.x. Jamshoro to Kotri).



4. Action Plan Implementation: Findings

(Actual Conditions : Participants of the 1st/2nd/3rd Engineer and Technician Training)

- The trainings conducted by JICA-trained participants are not limited to the lecture, they are provided in a more practical and easy-to-understand way, such as practical training using wasted materials in TPS, and OJT style.






4. Action Plan Implementation: Findings

(Actual Conditions : Participants of the 1st/2nd/3rd Engineer and Technician Training)

- In addition to technical skills, JICA-trained participants also provide training on safety and quality learned in the training in Japan.
- Especially for TBM (Tool Box Meeting), this safety measure was already incorporated into usual operation in some TPSs, and it contributes to raise safety awareness of O&M personnel and building safety culture in the workplace.


4. Action Plan Implementation: Findings

(Actual Conditions : Participants of the 1st/2nd/3rd Engineer and Technician Training)

- The spread of the Covid-19 continues to affect the implementation of the Action Plan, but with the utmost efforts of the participants and the support from their management, they keep implementing their dissemination activities to the extent possible.
- However, the impact of Covid-19 is still serious, so the continuous implementation of the Action Plan of JICA-trained participants still requires the continued understanding and cooperation of management.

4. Action Plan Implementation: Findings

(Actual Conditions : Participants of the 2nd Management Training)

- Action Plan made by the participant of the HRD training in Japan, Mr. Mustag, efficiently accelerated the establishment of the training center for GENCOs in Muzaffargarh TPS.
- Engineers and technicians who participated in the training in Japan, are also assigned to the trainers in this training center.

4. Action Plan Implementation: Findings

(Actual Conditions : Participants of the 4th Instructor Training)

- Instructors at the Muzaffargarh and Guddu training centers conducted the new training using equipment (Vibration Analysis Demonstrator / NDI Demonstrator) provided by JET.
- According to the reports from JICA-trained participants, they conducted 13 trainings for a total of 85 O&M personnel at Training Centers.

4. Action Plan Implementation: Findings

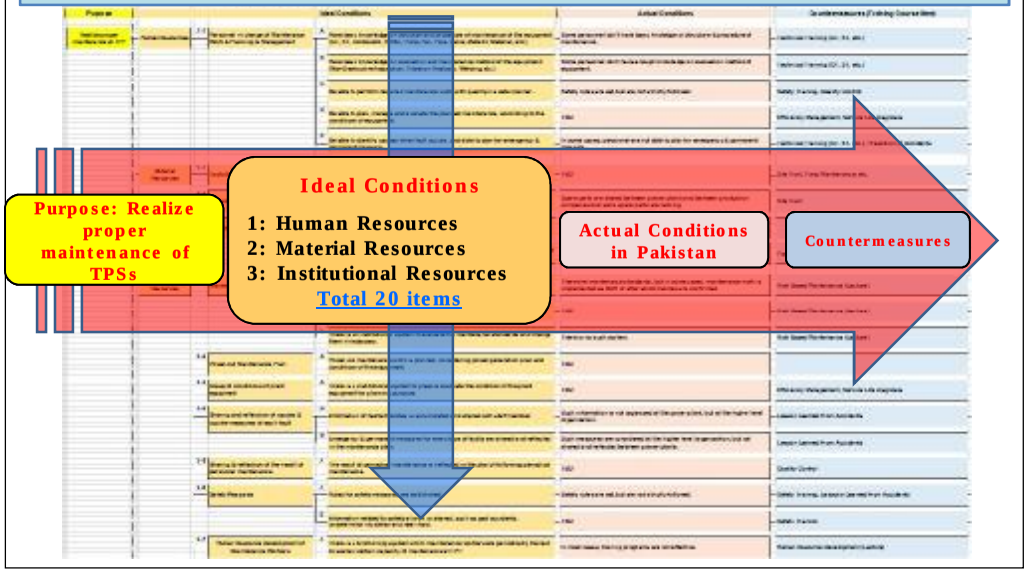
(Suggestion from JICA Expert Team)

- JICA Expert Team would like to request Pakistan side for the further understanding and continuous support for the Action Plan implemented by JICA-trained engineers & technicians.
  - Coordinating Engineers/Technicians work to implement their Action Plan as planned.
  - Supporting to formulate effective training course in Pakistan using O&M training equipment provided by JICA: Vibration analysis demonstrator and NDI demonstrator.

Contents

5. Issue Analysis of O&M in TPS

Participants and JICA Expert Team comprehensively analyzed O&M issues of TPSs in Pakistan and identified the countermeasures.



5. Issue Analysis of O&M in TPS: Human Resources

Category	Ideal Condition	Actual Condition	Countermeasure
Human Resources	Every personnel has basic knowledge on structure and maintenance procedure of the equipment.	(E) Engineers have basic technical knowledge, but to meet latest technology equipment. They need updated technology trainings. (T) About 40% of technicians have basic knowledge or structure and procedure of maintenance of the equipment.	Dissemination from Participants (E/T) about Mechanical, Electrical and C&I maintenance subjects.
	Every personnel has basic knowledge on evaluation and maintenance method of the equipment.	(E) Yes, we have basic knowledge of the equipment, callibration, tuning, testing etc. (T) About 40% of technicians have enough skill regarding evaluation and maintenance methods.	Dissemination from Participants (E/T) about NDI, Remaining Life Assessment, balancing etc.
	Every personnel can perform required maintenance work with quality in a safe manner.	(E) We used to take care of safety measures while carrying out maintenance work in order to avoid any mishap. But need improvement. (T) About 10% of technicians can perform maintenance work in a safe manner and about 30% of technicians can perform it in a quality manner.	Dissemination from Participants (E/T) about Safety/Quality Training etc.
	Be able to plan, manage and evaluate the planned maintenance, according to the conditions of equipment.	(E) Yes, we have the ability. (T) Technicians can perform work according to the planned maintenance schedule.	Dissemination from Participants (E/T) about Mechanical, Electrical and C&I maintenance subjects.
	It's possible to identify causes when fault occurs, and plan for emergency & permanent measure.	(E) Yes, we have ability to diagnose faults and plan for emergency & permanent measures. (T) About 80% of technicians can identify causes and perform emargency measures. Technicians request senior engineers to plan the permanent measures and senior engineers will arrange the permanent measures.	Dissemination from Participants (E/T) about Mechanical, Electrical and C&I maintenance subjects. More practical training using the training equipment (Vibration and NDI demonstrator)

5. Issue Analysis of O&M in TPS: Material Resources

Category	Ideal Condition	Actual Condition	Countermeasure
Material Resources	Tools and Jigs necessary for maintenance are neatly stored in designated areas, well managed and available on demand.	(E) Although tools and jigs are kept in safe place, but need to manage in proper order. (T) Tools and Jigs necessary for maintenance are neatly stored in designated areas, well managed and available on demand.	Dissemination from Participants (E/T) about 5S methodology, etc. If needed, management may be responsible to procure it.
	Consumables & Spare parts are stored, well managed and available on demand.	(E) Consumables and spare parts are kept and available in store but need to be properly stacked and recorded. (T) Consumables & Spare parts are stored, well managed and available on demand.	Dissemination from Participants (E/T) about 5S methodology, etc. If needed, management may be responsible to procure it.
	All manuals of each equipment are available on demand.	(E) All the manuals od related equipment are available as and when required. (T) All manuals of each equipment are available on demand.	Making exiting manuals set in order. (E/T). If needed, management may request the supplier/vender for additional manual.
	Work procedures for each maintenance of each equipment are written, well kept and available on demand.	(E) The trouble shooting are available in the manuals, but work procedure of their maintenance is not defined separately. (T) Work procedures for each maintenance of each equipment are written, well kept and available on demand.	Making exiting procedures set in order. (E/T). If needed, management may request the supplier/vender for additional manual.

5. Issue Analysis of O&M in TPS: Institutional Resources

Category	Ideal Condition	Actual Condition	Countermeasure
Institutional Resources (1)	Each equipment has prescribed maintenance standards such as frequency, details of maintenance work.	(E) Most of the equipment have the prescribed maintenance standards. (T) Each equipment has prescribed maintenance standards such as frequency, details of maintenance work.	Dissemination from Participants (E) about Risk Based Maintenance etc.
	Each equipment has standard check points.	(E) Yes. We have check points. (T) Each equipment has standard check points.	Dissemination from Participants (E) about Risk Based Maintenance etc.
	There is an institutional system to evaluate the maintenance standards and change them if necessary.	(E) We do not have any institutional system to evaluate the maintenance standards. But we follow the OEM's recommendations. (T) There is an institutional system to evaluate the maintenance standards and change them if necessary.	Dissemination from Participants (E) about Risk Based Maintenance etc.
	Power-cut maintenance work is planned, considering power generation plan and conditions of the equipment.	(E) Yes. We have power cut maintenance work plan in reasoning with power regulators. (T) Power-cut maintenance work is planned, considering power generation plan and conditions of the equipment.	Not included in O&M training in Japan, but management should take the initiative in coordination with transmission division.
	There is a institutional system to grasp & evaluate the condition of the plant equipment for planning purpose.	(E) We do have this system available at our new plant and work is underway for rest of plants. (T) There is a institutional system to grasp & evaluate the condition of the plant equipment for planning purpose.	Dissemination from Participants (E) about Thermal Efficiency Management, etc. More practical training using the training equipment (Vibration and NDI demonstrator)

5. Issue Analysis of O&M in TPS: Institutional Resources

Category	Ideal Condition	Actual Condition	Countermeasure
Institutional Resources (2)	Information of faults/troubles is accumulated and shared with staff member.	(E) Trouble reports are accumulated and there counter measures are discussed with staff. And recorded in progress registers also. (T) Information of faults/troubles is accumulated and shared with staff member.	Dissemination from Participants (E) about Lesson Learned from Accidents etc. Information sharing on technical failures/troubles by engineers & technicians.
	Emergency & permanent measures for every type of faults are shared and reflected in the maintenance plan.	(E) Yes, shared and reflected. (T) Emergency & permanent measures for every type of faults are shared and reflected in the maintenance plan.	Dissemination from Participants (E) about Lesson Learned from Accidents etc. Information sharing on technical failures/troubles by engineers & technicians.
	The result of periodical maintenance is reflected in the plan of following periodical maintenance.	(E) The result of periodical maintenance is reflected as per instruction of OEM. (T) The result of periodical maintenance is reflected in the plan of following periodical maintenance.	Dissemination from Participants (E/T) about Quality Control etc.
	Rules for safety measures are established.	(E) Shared verbally. (T) Rules for safety measures are established.	Dissemination from Participants (E/T) about Safety Training, but management should take the initiative in the organization.
	Information related to safety at work is shared, such as past accidents, unsafe/minor incidents and near miss.	(E) We have training facilities to train workers in TPS. (T) Information related to safety at work is shared, such as past accidents, unsafe/minor incidents and near miss.	Dissemination from Participants (E/T) about Safety Training Information sharing on labor accidents by engineers & technicians.
	There is a functioning system which maintenance workers are periodically trained to sustain certain capacity of maintenance.	(E) In most cases, training programs are not effective. (T) There is a functioning system which maintenance workers are periodically trained to sustain certain capacity of maintenance at TPS.	Dissemination from Participants (E/T) about Human Resource Development. More practical training using the training equipment (Vibration and NDI demonstrator)

5. Issue Analysis of O&M in TPS: Findings

(Findings from JICA Expert Team)

- **As for the O&M issues that JICA-trained engineers & technicians can deal with, almost all of the countermeasures are covered with O&M training course in Japan and their Action Plan.**
- **On the other hand, JICA Expert Team recognizes through the Project that the following points to be improved.**
  - **Since trainings in Japan and online training mainly focused on general contents of thermal power generation and maintenance subjects, there is still room for improvement in;**
    - **Basic skills & knowledge of Plant Operation**
    - **More practical skills focusing on specific power generation type, fuel type, etc.**
  - **Although O&M skills are being improved though JICA-trained engineers' & technicians' dissemination activities and O&M training equipment provided by JICA under this Project, there is still room for improvement in organizational HRD system.**

Contents

(Suggestion from JICA Expert Team)

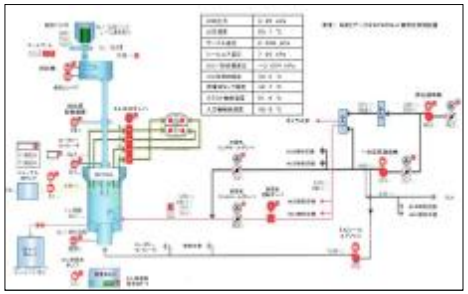
ü JICA Expert Team would like to suggest following items for further improvement in O&M at TPSs in Pakistan.

1. Technical Training in Japan
   i. Training Course of Plant Operation
   ii. Training Course of more practical skills (Root Cause Analysis, Maintenance Scheduling Method, etc.) focusing on specific power generation type, fuel type, etc.

2. Enhancement of HRD training system
   - Includes training planning, training subjects reviewing, training teachers, providing training equipment (if necessary), etc.

(1) Training Course of Plant Operation

(Operation training image) Plant Simulator



(Operation training image) Training Material (P&ID)

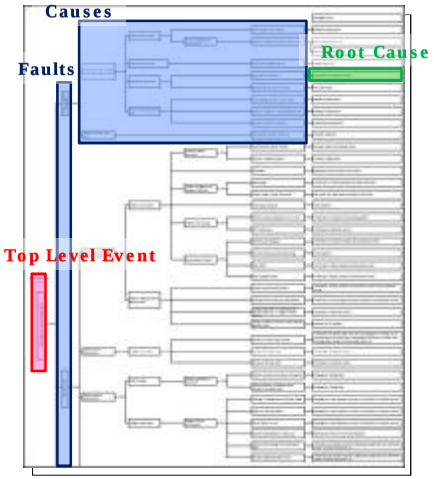
ü Same as Maintenance, Operation is another important part in O&M of TPSs.
ü Training Course of Plant Operation can enhance basic skills & knowledge of plant operators as achieved in the training course of mechanical, electrical and I&C maintenance in this Project.

(2) Training Course of more practical skills (Root Cause Analysis)

About Fault Tree Analysis (FTA)
- ü Deductive Analytic Method
- ü Visually indicating a failure path
- ü Can identify the root causes of Trouble

Benefits of Fault Tree Analysis
- ü When trouble happens, engineers and technicians can easily check the possible causes at glance
- ü Engineers and technicians can quickly identify the root causes of the trouble
- ü Can prevent the recurrence of the trouble
- ü Lead to reduce down-time of TPS

Fault Tree Analysis Structure



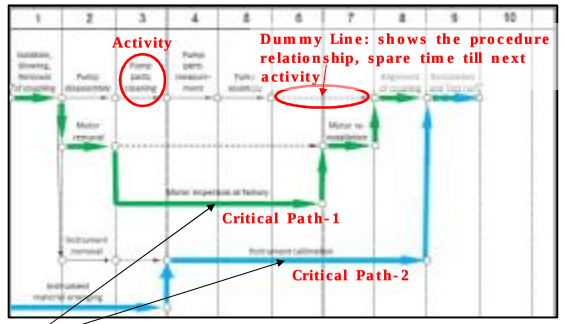
ü Fault Tree Analysis can enhance analytic skills and knowledge of engineers and technicians, that leads to reduce down-time of TPS.

(3) Training Course of more practical skills (CPM for Maintenance Scheduling)

About Critical Path Method (CPM)
- ü A project management method to schedule a set of activities
- ü Use network diagrams to represent the necessary activities

Benefits of Critical Path Method
- ü Easily visualize project activities and their relations
- ü Easy to revise the schedule
- ü Effective to manage schedule even in large-scale, complicated plan such as major overhaul

Critical Path Method Example



The "Critical Path" means…
the sequence of activities that have little or no room for delay in a project

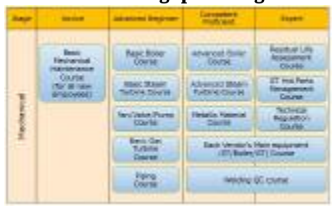
ü Critical Path Method (CPM) can help engineers and technicians to easily optimize maintenance schedule planning, management and revising, that leads to improve productivity and reduce maintenance cost.

7. KANSAI's Technical Proposal: Enhancement of HRD training system

(1) Enhancement of HRD training system

Establishment of Comprehensive Training System

Training planning



Training teachers

Training subjects review

Introducing Practical Training Equipment

ü **Enhancement of HRD training system** (e.g. training planning, training subjects reviewing, introducing practical training equipment) can strengthen the **organizational O&M capability in Pakistan** not depending on the skills and knowledge of individual engineers and technicians.

Contents

7. Conclusion

Summary of the JICA project

ü We've already implemented the capacity building project for O&M at TPSs for around 4 years as follows:
- Ø Conducting **O&M training in Japan** based on the training needs and the current situation.
- Ø **Providing O&M training equipment and Conduct online training** to develop GENCO's training abilities.
- Ø Reviewing **dissemination from JICA-trained participants to other colleagues** about knowledge and skills obtained in JICA training.

ü Through analyzing the O&M issues at TPSs, we conclude **the project is practical and effective to improve O&M capacity.**

For further improvement of O&M at TPSs

ü **Engineers and Technicians** should continue to disseminate their Action Plan Activities with strong **support and promotion from Management**.

ü When you need further support, you may have an **option to utilize external resources** at the request from GHCL to JICA.

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Thermal Power Division
The Kansai Electric Power Co.,Inc.

Action Plan

Capacity Building & Structuring of Thermal Power Generation Operation & Maintenance, Pakistan

17th February, 2022

Training Need Analysis (TNA)

Training Need Analysis (TNA)

- Training is much needed when there is a gap between the desired performance and the current performance.
- Training plays importance role in HR Development.
- The following are also contributory sectors in effecting performance:
  - Lack of skills or knowledge, or experience
  - Not having the equipment or resources
  - Not being encouraged, enough
  - Unconducive work environment.
- To overcome these problems an attempt has been made to change the methodology and approach by conducting inhouse seminars & workshop for enhancing capabilities.
- The trained staff by JICA are also engaged in these activities.

Utilization Of JICA Trained Staff

(Attachment 2-2)

Utilization Of JICA Trained Staff

- A comprehensive schedule of Lectures / Presentations was framed at GHCL Training Centre to utilize the expertise of JICA trained Engineers / Technicians in the field of Mechanical, Electrical and Instrumentations.
- These activities were badly affected due to COVID-19, however, training centre was successful to conduct these trainings under strict compliance of SOPs as well as conducting online training sessions.
- JICA trained staff plays the role of master trainer in the field of Mechanical, Electrical and Instrumentations and conducted the training sessions in the respective GENCOs and other GENCOs.
- These master trainers conducted 822 training sessions across the GENCOs with more then 6000 employees participation.

Field of Utilization Of JICA Trained Staff

The Training were conducted at GHCL Training Center, Muzaffargarh from February 2020 to January 2022.

Name	Discipline	Topics
Mr. Allah Nawaz, Electrician	Electrical	Turbine Supervisory Instrument, Maintenance of Transformers, Maintenance of T/F Cooling System
Engr. Faisal Naeem, Junior Engineer	I&C	Turbine Supervisory Instrument, Maintenance of Measuring and Monitoring Devices, Fundamental of DP Cell
Mr. Shahid Masood, Foreman	I&C	Pressure Gauge Calibration, Copper Pipe Flaring & Seal Topping, Calibration of Pressure Gauge
Mr. Muhammad Ijaz, Fitter	I&C	Cable & Terminal Treatment, Thermocouple Classification & Type, Working Pressure Switches
Mr. Muhammad Asadullah, ASA	I&C	Structure Type Working of Pressure Gauge, Thermo Structure Operation and Types, Temperature Measuring Instrument
Mr. Muhammad Arif, Fitter	Mechanical	Valve Maintenance Skills, Structure of Bearings,
Engr. Zahid Ali Bugti, Senior Engineer	Electrical	Cable / Terminal Processing / Conduct, Five Preventative Measures of Electrical Equipments
Mr. Pervaiz Iqbal, Fitter	Mechanical	NDT Inspection, Rotary Equipment Alignment

Allah Nawaz, Electrician

JICA Trained Staff Conducting On Job Training Sessions

Faisal Naeem, Junior Engineer

JICA Trained Staff Conducting On Job Training Sessions

Shahid Masood, Foreman

JICA Trained Staff Conducting On Job Training Sessions

Muhammad Arif, Fitter

JICA Trained Staff Conducting On Job Training Sessions

Zahid Ali Bugti, Sr. Engineer

JICA Trained Staff Conducting On Job Training Sessions

Pervaiz Iqbal, Fitter

JICA Trained Staff Conducting On Job Training Sessions

TRAINING EQUIPTMENTs RECEIVED FROM JICA

GHCL Training Center, Muzaffargarh

Regional Training Center, Guddu

Training Equipment's received from JICA

- To strengthening the ongoing training activities and equip the GHCL training center Muzaffargarh and Regional Training Center Guddu the undermentioned equipment's has been received from JICA, JAPAN and installed for practical demonstration to trainees;

Muzaffargarh Training Center

- Vibrator Analysis Demonstrator/ Non Destructive Inspection (NDI) Demonstrator

Guddu Training Center

- NDI Demonstrator

Equipment's utility- Action Plan

- 15 number of Employees were trained as per the action plan in Dec 2021 ,

Following equipment's were received

- Received At Muzaffargarh
  - NDT (Non Destructive Testing).
  - Vibration Analysis.
- Received At COGCL – Guddu
  - NDT (Non Destructive Testing)

- 10 Number participants were trained from CPGCL and NPGCL were trained during online training session via Zoom with JAICA Officials on 29.11.2021 till 08.12.2021

Future Training Needs

GHCL Training Center, Muzaffargarh

Regional Training Center, Guddu

Future Training Needs- Action Plan

- Training is ongoing process to equip employees with modern trends & practices.
- GHCL under the guidance of Power Division will further strengthen the Training Centers to impart cutting edge knowledge and utility.
- GHCL is thankful of JICA, JAPAN and the Power Division, Government of Pakistan for providing the support in Training of Thermal Generation Engineers and Technicians in JAPAN and in GHCL/ GENCOs training centers .
- The training activities will not only be continued but efforts will be made to enhance further its standards and make the training more useful and productive.

Thank You

(Attachment 3)

・TO Chief Representative of JICA Pakistan Office

Project Monitoring Sheet

Project Title: The Project for Capacity Building and Strengthening of Thermal Power Generation Operation and Maintenance in The Islamic Republic of Pakistan

Version of the Sheet: Ver.6 （Term: December 2020 – February 2022）

Name: Muhammad Imran Mian
Title: Project Director
Name: Okuda Hidenobu
Title: Chief Advisor/Thermal Power Generation O&M
Submission Date: 17th February, 2022

I. Summary

1 Progress

1-1 Progress of Inputs

➢ *The Japanese side provided the following items from December 2020 to February 2022.*

- Training equipment for Muzaffargarh and Guddu training center
  Muzaffargarh training center
  - Vibration Analysis Demonstrator / Non Destructive Inspection (NDI) Demonstrator

  Guddu training center
  - NDI Demonstrator
- Online training for instructors from Muzaffargarh and Guddu training center
  - 8 instructors, from 29th November 2021 to 8th December 2021
- Although the Japanese side was planning to dispatch the Japanese experts for the final survey (the 4th follow-up survey) during this reporting period, the dispatch of the Japanese experts was not conducted as planned due to the Covid-19 pandemic.

➢ *The Pakistan side provided the following items from December 2020 to February 2022.*

- Assignment of counterpart personnel
- Dispatch of participants for the online training
- Implementation and reporting of action plan activities

1-2 Progress of Activities (up-date with in the this reporting period)

The progress of activity set for each output is as follows.

- *Output 1: Current situation of O&M of thermal power stations is analyzed and training needs are identified.*
  - [1.1] To analyze the current situation of O&M at thermal power stations
    - ✓ Already completed.
  - [1.2] To review the training system of thermal power generation, and analyze the current situation and issues of O&M personnel
    - ✓ Already completed.
  - [1.3] To specify the training needs
    - ✓ As agreed at the 4th JCC online meeting on 19th November 2020, JICA Expert Team (JET) decided to provide the additional training (4th batch training) using the training equipment (Vibration Analysis Demonstrator / NDI Demonstrator) provided by JET.

- *Output 2: Capacity of ~~WEA and~~ GENCOs' Instructors is enhanced*
  - [2.1] To set the target O&M skills that instructors & potential instructors should obtain
    - ✓ JET set the target skills to be acquired in the additional mechanical maintenance training using the training equipment provided by JET.
  - [2.2] To formulate the program of training in Japan
    - ✓ JET formulated the additional mechanical maintenance training program using the training equipment provided by JET.
  - [2.3] To set selection criteria for the training in Japan
    - ✓ JET created selection criteria based on the additional mechanical maintenance training and shared it with counterparts.
  - [2.4] To conduct trainings in Japan
    - ✓ Due to the spread of covid-19 infection, additional training has been changed to online training instead of on-site training.
    - ✓ 8 instructors belonging to each GHCL training center were trained in the additional online training.
  - [2.5] To modify the contents of training in Japan at ~~WEA and~~ GENCOs' thermal power stations (OJTs) in Pakistan
    - ✓ Already completed.

- *Output 3: Trainings as well as On-the-Job Training (OJT) at ~~WEA and~~ GENCOs are improved*
  - [3.1] To develop action plans of trainings (OJTs) for O&M of thermal power

stations

- ✓ In the 4th batch online training, instructors made the action plans for improvement of O&M capacity of TPSs.

- [3.2] To disseminate obtained knowledge and technical skills to O&M personnel based on the action plans and verify the skilled up level by checklist developed at the above [2.4]
  - ✓ According to regular training reports from the participants trained in Japan (24 engineers & 24 technicians), they conducted a total of 822 trainings and they trained a total of 6,329 trainees of GENCOs during this project.
  - ✓ According to training reports from the participants (8 instructors) from each GHCL training center who trained in the online training, they conducted a total of 13 trainings using training equipment provided by JET and they trained a total of 85 trainees of GENCOs.
  - ✓ The results of reports from those who participated in the training conducted by JICA-trained participants shows that the training was highly evaluated and improved their O&M ability at TPSs. (as shown in Chart 1-1)

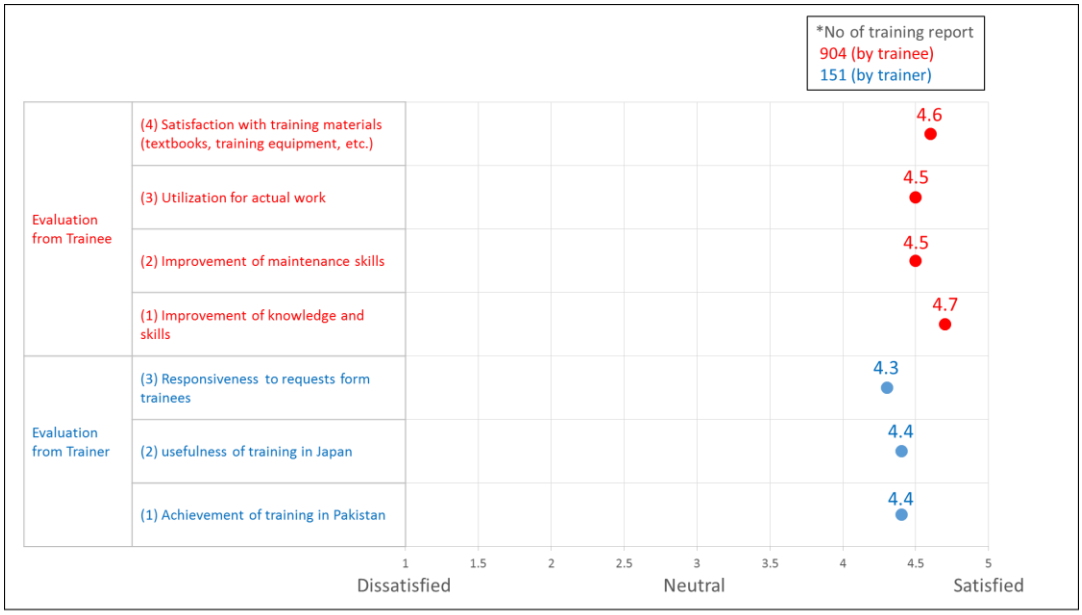


Chart 1-1: Evaluation of Training provided by JICA trained participants (based on report surveys)

- [3.3] To review the results of action plans to improve the training at ~~WEA and~~ GENCOs' thermal power stations (OJTs) in Pakistan
  - ✓ JET conducted a remote survey to confirm the implementation status of the action plans of 1st/2nd/3rd batch participants trained in Japan.
    It seems that 46% of the participants trained in Japan were able to implement

the Action Plan as planned. The remaining 56% seemed to be able to implement only partial Action Plans due to Covid-19 pandemic as shown in Chart 1-2.

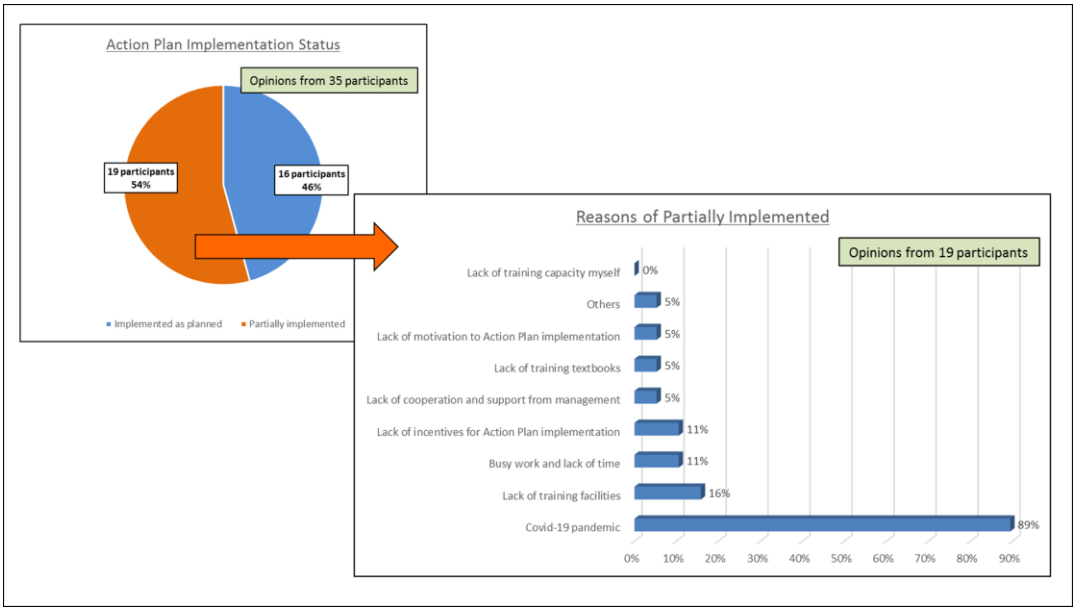


Chart 1-2: Action Plan Implementation Status (based on report surveys)

✓ JET conducted a remote survey to confirm the implementation status of the action plans of 4th batch participants who received online training.
JET confirmed that the instructors at the Muzaffargarh and Guddu training centers are implementing their own action plans as planned.

✓ JET has obtained the following good results through reports from JICA-trained participants.
(Engineer and Technician)

- JICA-trained participants disseminated their knowledge and skills to their colleagues not only by utilizing training materials provided by JICA Expert Team, but also by creating and arranging the materials by themselves. JET recognize that the training ability in TPSs is steadily increasing by using the training material of high-quality instead of conventional verbal technical transfer.
- Some JICA-trained participants implemented dissemination activity not only for staff of his own TPS, but also for staff of other TPSs (e.x. Jamshoro to Kotri).
- The trainings conducted by JICA-trained participants is not limited to the lecture, they are provided in a more practical and easy-to-understand way, such as practical training using wasted materials in TPS, and OJT

style.

- In addition to technical skills, JICA-trained participants also provide training on safety and quality learned in the training in Japan. Especially for TBM (Tool Box Meeting), this safety measure was already incorporated into usual operation in some TPSs, and it contributes to raise safety awareness of O&M personnel and building safety culture in the workplace.

(Management)

- Action Plan made by the participant of the HRD training in Japan, efficiently accelerated the establishment of the training center for GENCOs in Muzaffargarh TPS. Engineers and technicians who participated in the training in Japan, are also assigned to the trainers in this training center.

(Instructor)

- The instructors at each training center conducted unprecedented practical training using the training equipment provided by JET according to the action plan created by themselves.

1-3 Achievement of Output (with in the project period)

➢ *Output 1: Current situation of O&M of thermal power stations is analyzed and training needs are identified.*

- Output 1 was achieved as follows.
  - ✓ JET analyzed the current situation of O&M and training needs of Pakistan's TPS through the 3 times on-site survey and 1 time online survey.
  - ✓ JET summarized the current status of O & M at TPSs in Pakistan in the baseline report and 3 interim reports of this project. In those reports, JET considers that it is necessary to improve the knowledge and technology required for basic maintenance at TPS, ensure safety and improve quality of work.
  - ✓ JET and GHCL have confirmed at the JCC that there is no gap in their perception of that needs. Below is a summary of the main training needs.
    - Basic training needs (reflected in 1st to 3rd training in Japan)
      HRD / Safety management / Quality control / Efficiency management / Optimal maintenance / TBM / Overview of thermal power plant (including site visit) / Manufacturer factory tour related to thermal power generation / etc.
    - Training needs for mechanical maintenance (reflected in 1st training in

Japan)

Metal materials / Vibration analysis and suppression technology / Non-destructive inspection / Residual life diagnosis / Boiler water quality management / GTCC power generation technology / etc.

- Training needs for electrical maintenance (reflected in 2nd training in Japan)
  Generator / Motor / Cable / Breaker / Transformer / Insulation standard / Vibration analysis and suppression technology / non-destructive inspection / etc.
- Training needs for I & C maintenance (reflected in 3rd training in Japan)
  Measuring and monitoring device / Turbine supervisory instrument / Control valve and accessories / Basic control theory (PID control) and optimal tuning / GTCC control system and maintenance / Periodic maintenance of measuring and monitoring device / etc.
- Additional training needs for mechanical maintenance (reflected in 4th online training)
  Vibration Analysis / Non Destructive Inspection

➢ *Output 2: Capacity of ~~WEA and~~ GENCOs' Instructors is enhanced.*

- Output 2 was achieved as follows.
  - ✓ Based on the analysis of training needs shown in Output 1, JET prepared and provided the 3 training programs (Mechanical maintenance / Electrical maitenance / I&C maitenance) in Japan as the measures to fill the gap between the actual conditions and the ideal conditions for the O&M of TPSs.
  - ✓ Total of 24 engineers,24 technicians and 6 managements were trained as expected instructors in the 1st, 2nd, and 3rd trainings in Japan. The participants who participated in respective trainings answered that they had almost achieved the training objective (“Training Capacity of the participants for O&M of TPSs will be strengthened.”), and that the knowledge and experience they acquired can be directly applied or adaptable to their work as shown in Table 1-1 and 1-2.

Table 1-1: Achievement level of the training objective in the training in Japan

	← Fully Achieved			Not Achieved →
	4	3	2	1
Engineer Training (23 participants)	15 (65%)	8 (35%)	-	-
Technician Training (24 participants)	14 (58%)	10 (42%)	-	-
Management Training (6 participants)	3 (50%)	3 (50%)	-	-

Table 1-2: Usefulness level of the training results from the training in Japan

	Be directly applied to work	Be adaptable to work	Not be directly applied and adapted to work	Not useful
Engineer Training (23 participants)	17 (74%)	1 (5%)	5 (21%)	-
Technician Training (24 participants)	16 (67%)	8 (33%)	-	-
Management Training (6 participants)	3 (50%)	3 (50%)	-	-

In the evaluations of the 1st and 2nd participants, some results with low satisfaction were found, but the results of the 3rd participants were generally satisfactory.

This may have been improved because the 3rd training menu was adjusted with the results of the JET's on-site surveys and training needs from GHCL/GENCOs, and more practical training was provided compared to the previous year.

- ✓ Most of the participants answered by questionnaire that they were able to improve their own thermal power plant maintenance and management capacity through the training in Japan provided in line with the training needs of Output1. During the training in Japan, they created the action plans as shown in Output3, and after returning to Pakistan, they are training themselves at each TPS as instructors based on these improved knowledge and skills.

- ✓ Based on the analysis of additional training needs shown in Output1, JET prepared and provided the additional online training program (Mechanical maintenance) along with the equipment (Vibration Analysis Demonstrator / NDI Demonstrator) used for the training.
- ✓ Total of 8 instructors from each GHCL training center were trained as the additional online training.

  The objective of the online training ("Training Capacity of the participants for O&M of TPSs will be strengthened.") was achieved, and the training equipment provided by JET was made available to the training centers.

➢ *Output 3: Trainings as well as On-the-Job Training (OJT) at ~~WEA and~~ GENCOs are improved.*

- Output 3 was achieved as follows.
  - ✓ In the 1st, 2nd, and 3rd trainings in Japan, engineers and technicians made the action plans for improvement of the O&M capacity of TPSs.
  - ✓ Through the implementation of the 1st, 2nd and 3rd participant's action plans, their dissemination activities helped to enhance the basic technical knowledge of the

O&M staff of TPSs and safety culture is now being improved.

✓ According to the regular training reports from the 1st, 2nd and 3rd participants trained in Japan (24 engineers and 24 technicians), they conducted a total of 822 trainings and they trained a total of 6,329 trainees of GENCOs as of December 2021 based on action plans.

Table 1-3 shows the implementation status of the action plan that was prepared in the 1st, 2nd and 3rd trainings in Japan as of December 2021.

Table 1-3: Status of implementation of the action plan by participants in the 1st to 3rd training in Japan (as of December 2021)

		Number of training implementation times	Number of trainees
1st participants trained in Japan	7 Engineers	233	2,692
	8 Technicians	268	1,907
	Total	501	4,599
2nd participants trained in Japan	8 Engineers	102	495
	8 Technicians	128	620
	Total	230	1,115
3rd participants trained in Japan	8 Engineers	50	334
	8 Technicians	41	281
	Total	91	615
Total		822	6,329

JET confirmed that the action plan was being implemented as planed with active support from management.

✓ In this project, not only the number of participants but also the quality of training is important. Therefore, in order to ensure the quality of the training to be implemented after returning to Pakistan, the purpose and important points of the training were included in the Action Plan as an OJT checklist with reference to the training syllabus prepared by JET.

In addition, JET asked all participants trained by JICA to give a presentation on implementation status of own action plan. Due to the influence of COVID-19, the follow-up survey was not a field survey but a remote survey, but JET was able to obtain detailed information on the activities of trainees by referring to these presentation materials.

✓ In previous surveys of participants trained in Japan, many have expressed the opinion that practical training is necessary for effective training. Therefore, JET asked each counterpart to cooperate with the request for the use of training equipment.

- ✓ In addition to this project, JET selected necessary training equipment for training to improve O&M capacity of thermal power plants through field surveys and discussions with GHCL/GENCOs, provided the training equipment to the Muzaffargarh and Guddu training centers, and trained instructors from each training center to conduct online training using the equipment.
- ✓ According to training reports from the participants (8 instructors) from each GHCL training center who trained in the online training, they conducted a total of 13 trainings using training equipment provided by JET and they trained a total of 85 trainees of GENCOs.

  Table 1-4 shows the implementation status of the action plan that was prepared in the 4th training conducted online as of December 2021.

Table 1-4: Status of implementation of the action plan by participants in the 4th training (as of December 2021)

Training Center	Training equipment provided by JET	Number of training implementation times	Number of trainees
Muzaffargarh Training Center	Vibration Analysis Demonstrator	5	25
	NDI Demonstrator	4	28
	Total	9	53
Guddu Training Center	NDI Demonstrator	4	32
Total		13	85

1-4 Achievement of the Project Purpose

- ➢ *Project Purpose: Training capacity on O&M of GENCOs is strengthened.*

  Project Purpose has been achieved as follows. However, in order to further strengthen the training capacity on O&M of TPSs, the HRD action plan needs to be continued and developed by the management.
  - ✓ JICA-trained engineers & technicians almost implemented their Action Plan as previously arranged with support from management, and a series of their dissemination activities can help to improve the O&M capacity at TPSs. According to the reports from JICA-trained participants, they conducted 822 trainings for a total of 6,329 O&M personnel at TPSs. The results of questionnaire from those who participated in the training conducted by JICA-trained participants shows that the training was highly evaluated and improved their O&M ability at TPSs.
  - ✓ Until now, transfer of technical knowledge within TPS in Pakistan have mainly

oral lecture style based on the work experience and notes of trainers. JICA-trained participants disseminated their knowledge and skills to their colleagues not only by utilizing training materials provided by JICA Expert Team, but also by creating and arranging the materials by themselves. JICA Expert Team recognize that the training ability in TPSs is steadily increasing by using the training material of high-quality instead of conventional verbal technical transfer. Furthermore, some JICA-trained engineers & technicians implemented dissemination activity not only for staff of their own TPS, but also for staff of other TPSs.

- ✓ Until now, transfer of technical skill in TPS has been mainly during actual work. However, through this project, technical knowledge education has begun to be implemented effectively using textbooks and the like in a state separated from actual work.
- ✓ Until now, practical training excepted OJT had been conducted only at training centers, but some participants trained in Japan have conducted practical training within TPS using surplus equipment and waste equipment. It can be seen that the training capacity at TPS has improved.
- ✓ In addition to technical skills, JICA-trained participants also provide training on safety and quality learned in the training in Japan. Especially for TBM (Tool Box Meeting), this safety measure was already incorporated into usual operation in some TPSs, and it contributes to raise safety awareness of O&M personnel and building safety culture in the workplace.
- ✓ Action Plan made by the participant of the 2nd HRD training in Japan, efficiently accelerated the establishment of the training center for GENCOs in Muzaffargarh TPS. JICA-trained engineers & technicians are also assigned to the trainers in this training center.
- ✓ As an additional project, JET provided training equipment (Vibration Analysis Demonstrator and NDI Demonstrator) to the Muzaffargarh and Guddu training centers. These equipment was selected based on field surveys and discussions with GHCL/GENCOs in order to strengthen the training capacity of GHCL/GENCOs.
- ✓ JET has also trained a total of 8 instructors from each training center through online training as the 4th training program of the project in order to provide autonomous training using these training equipment. JET has already received reports from the instructors at each training center on the use of the equipment provided, and according to the reports, each training center has conducted total of 13 training sessions with 8 trainees.

- *Project Evaluation by DAC Evaluation Criteria*

  The Project is evaluated in accordance with the five criteria set by DAC (Development Assistance Committee) Evaluation Criteria, namely (1) relevance, (2) effectiveness, (3) impact, (4) efficiency and (5) sustainability.

(1) Relevance

Relevance is considered "high" for the following reasons.

Priority	✓ In the GENCOs, it is an urgent task to efficiently operate and maintain thermal power generation, which is consistent with the goal of the Project.
Adequacy of Project Approach	✓ As for the approach of the Project, it is appropriate that O&M personnel in leading positions are trained as instructors through O&M training in Japan including practical training, and the trained instructors implement dissemination activities at their power stations. ✓ In addition to the original project, JICA Expert Team provided training equipment (Vibration Analysis Demonstrator and NDI Demonstrator) to public training centers in Pakistan (Muzaffargarh Training Center and Guddu Training Center) and trained instructors to train using the equipment. ✓ These are appropriate approaches to achieving the goals of this project.
Consistency with the Japanese ODA policy	✓ The Project is consistent with Japanese Official Development Assistance (ODA) policy for Pakistan.

(2) Effectiveness

Effectiveness is considered "high" for the following reasons.

Achievement of Project Outputs	✓ The Output 1 and 2 have been achieved. ✓ As for the Output 3, there are the unimplemented Action Plans by some participants due to Covid-19 pandemic so far, but the trainings conducted by the participants were highly evaluated, so it is considered that Output 3 has been mostly achieved. ✓ In addition to the initial project, JICA Expert Team provided training equipment to each training center based on the field survey in Pakistan, discussions with the management of GHCL/GENCOs, and follow-up surveys to the participants trained in Japan. ✓ In addition, JICA Expert Team conducted online training for instructors who conduct training using these equipment. ✓ From these, it can be concluded that this project including

	additional projects was achieved at a satisfactory level.
Achievement of Project Purpose	✓ As per the questionnaire surveys for management and participants, the implementation of Action Plans by participants has led to the improvement of O&M performance at TPSs, so it is considered that the Project Purpose has been achieved.
Beneficiaries of Project	✓ As per the beneficiaries of the Project, each participant has been able to disseminate the knowledge and skills learned during O&M Training in Japan to 6,414 colleagues in the Project.

(3) Impact

Impact is considered "high" for the following reasons.

Prospect of achieving overall goal	✓ Improvements of training capacity on O&M at TPSs have been confirmed. In addition, as per the questionnaire surveys for management and participants, improvements of O&M performance at TPSs have already been confirmed. Therefore, it is highly possible that Overall Goal will be achieved.
Ripple effects	✓ The participants not only have implemented training to disseminate the knowledge and skills learned during O&M Training in Japan, but have worked on the improvement activities through 4S (Sort, Set in order, Shine and Standardize) activities and TBM (Tool Box Meeting) learned in Japan. The improvement activities have a positive impact on the safety and quality at TPSs.

(4) Efficiency

Efficiency is considered "relatively high" for the following reasons.

Inputs	✓ As for the inputs of the Japanese side, the dispatch of the Japanese experts was not conducted as planned due to the cancellation of the 4th survey (the 3rd follow-up survey) and final survey (the 4th follow-up survey and on-site training) added to the original project. However, those activities could be carried out by substituting email, web conference and online training, which was appropriate to produce the outputs as planned. ✓ As for the inputs of the Pakistan side, the scheduled 3rd management training was canceled and the 3rd training period for engineers was shortened due to insufficient coordination.

Improvement of efficiency	✓ Since the Project was conducted as the same program including other countries, synergistic effects could be achieved by laterally applying the activity results of each project. In addition, the efficiency of the Project was able to be improved.

(5) Sustainability

Sustainability is considered “high” for the following reasons.

Policy / Institutional aspect	✓ It is not predicted any policy or institutional change that may affect the sustainability of the Project effects.
Organization aspect	✓ As a change in the organization that affects the sustainability of the effects created by this project, a training center for GENCOs (Muzaffragarh Training Center) was newly established according to the HRD Action Plan created by the GHCL management. ✓ As the engineer training of GENCOs, by utilizing this training center instead of the training at WEA so far, it has become possible to acquire skills more specialized in thermal power generation technology. ✓ At the training centers of GENCOs, engineers and technicians trained in Japan are appointed as instructors, and it can be confirmed that the organization is trying to sustain and develop this project.
Technical aspect	✓ In JICA training, engineers and technicians prepared the Action Plans for improvement of the O&M capacity of TPSs. Due to the dissemination of knowledge through the implementation of the Action Plans, basic technical and safety knowledge of the O&M staff at TPSs were enhanced, which lead to reduction in accidents at TPSs, and improvement of O&M quality of the staff at TPSs. ✓ Furthermore, in order to sustain and develop activities for the O&M capacity of thermal power plants, as described in the “Organizational aspect" of the previous section, the dedicated training center specializing in thermal power generation has been established and operated.
Financial aspect	✓ At the GENCOs training centers, practical training was limited in some items due to lack of finances and equipment, but JICA Expert Team provided the necessary training equipment based on field surveys, discussions with management, and the results of questionnaires from participants trained in Japan. ✓ In addition, JICA Expert Team trained instructors to use those equipment to train for many O&M personnel in

	thermal power plants, so that they can continue their training activities autonomously even after the completion of this project.

1-5 Changes of Risks and Actions for Mitigation

N/A

1-6 Progress of Actions undertaken by JICA

N/A

1-7 Progress of Actions undertaken by Gov. of Pakistan

N/A

1-8 Other remarkable/considerable issues related/affect to the project (such as other JICA's projects, activities of counterparts, other donors, private sectors, NGOs etc.)

- Action Plan made by the participant of the 2nd HRD training in Japan, efficiently accelerated the establishment of the training center for GENCOs in Muzaffargarh TPS. JICA-trained engineers & technicians are also assigned to the trainers in Muzaffargarh TPS training center and Guddu training center.
- Due to government realignment, WEA deviated from thermal power generation on their mandate. With the realistic circumstance, GENCO become an only counterpart under the project.

2 Delay of Work Schedule and/or Problems (if any)

2-1 Detail

- Although JET planned to conduct the 4th survey (the 3rd follow-up survey) and final survey (the 4th follow-up survey) in Pakistan, JET won't be able to conduct the survey in Pakistan due to the Covid-19 pandemic.

2-2 Cause

- Covid-19 pandemic.

2-3 Action to be taken

- Regarding the activities to be carried out in the 4th survey (the 3rd follow-up survey) and final survey (the 4th follow-up survey), JET substituted the activities with exchanging e-mails with each participants and conducting the questionnaire surveys for participants.

- The both sides obtained the mutual understanding on achievement of the Project and future issues by holding the 4th Joint Coordination Committee (JCC) and final JCC, online instead of face-to-face.

2-4 Roles of Responsible Persons/Organization (JICA, Gov. of Pakistan, etc.)

- N/A

3 Modification of the Project Implementation Plan

3-1 PO

Based on the Minutes of the Meeting agreed on 2nd October 2020, WAPDA Engineering Academy (WEA) is removed from Project Purpose, Outputs 2, Activities 2-5 &3-3, Objectively Verifiable Indicators, Means of Verification and Important Assumptions in Project Design Matrix (PDM) and Plan of Operation.

3-2 Other modifications on detailed implementation plan

(Remarks: The amendment of R/D and PDM (title of the project, duration, project site(s), target group(s), implementation structure, overall goal, project purpose, outputs, activities, and input) should be authorized by JICA HDQs. If the project team deems it necessary to modify any part of R/D and PDM, the team may propose the draft.)

N/A

4 Preparation of Gov. of Pakistan toward after completion of the Project

N/A

II. Project Monitoring Sheet I & II *as Attached*

Project Design Matrix (PDM)

Project Title: The Project for Capacity Building and Strengthening of Thermal Power Generation Operation and Maintenance in The Islamic Republic of Pakistan

Implementing Agency: ~~WAPDA Engineering Academy (WEA) and~~ GENCO Holding Company Ltd.

Target Group: ~~WEA instructors and~~ O&M staff of GENCOs

Version No. 6

Period of Project: October, 2017 - March, 2022

Dated: 17th February, 2022

Project Site: ~~WEA and~~ GENCOs' thermal power stations

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	Achievement	Remarks
Overall Goal Technology and technical skills obtained by the project are utilized in actual O&M at GENCOs power stations.	- Number of GENCOs power stations which utilize obtained technology and technical skills.	- Questionnaire to ~~WEA and~~ GENCOs including regular training reports at ~~WEA &~~ GENCOs provided by trained instructors.		-6 TPSs (Jamshoro, Kotri, Guddu, Muzaffargarh, Nandipur and Lakhra) utilized knowledge and skill obtained in Japan as scheduled. - 2 Training Centers (Muzaffargarh and Guddu) used training equipment and educational materials provided by JICA Expert Team to train O&M personnel. - Through the implementation of the Action Plans, their dissemination activities enhanced the basic technical & safety knowledge of the O&M staff of TPSs, reduced accidents at TPSs, and improved the O&M quality of the O&M staff of TPSs. In addition to technical skills, JICA-trained participants also provide training on safety and quality learned in the training in Japan. Especially for TBM (Tool Box Meeting), this safety measure was already incorporated into usual operation in some TPSs, and it contributes to raise safety awareness of O&M personnel and building safety culture in the workplace.	
Project Purpose Training capacity on O&M of ~~WEA and~~ GENCOs is strengthened.	- 100% of GENCOs power stations where participants come from, implement trainings (OJTs) based on the Action Plan prepared by trained instructors. ~~- Improvement of WEA training contents based on the Action Plan developed by trained instructors.~~	- Project Monitoring Sheet, including regular training reports at ~~WEA and~~ GENCOs provided by trained instructors.	- Trained instructors wiil not resign and/or transfer outside of ~~WEA and~~ GENCOs.	- 24 engineers and 24 technicians were trained in Japan to share what they learned to other colleagues at TPSs. JICA-trained participants disseminated their knowledge and skills to their colleagues not only by utilizing training materials provided by JICA Expert Team, but also by creating and arranging the materials by themselves. JET recognize that the training ability in TPSs is steadily increasing by using the training material of high-quality instead of conventional verbal technical transfer. The trainings conducted by JICA-trained participants is not limited to the lecture, they are provided in a more practical and easy-to-understand way, such as practical training using wasted materials in TPS, and OJT style. Some engineer and technician implemented dissemination activity not only for staff of there own TPS, but also for staff of other TPSs. - 6 managers were trained in Japan to improve O&M capacity of TPS and ability of Training Centers. Action Plan made by 2nd dispatched management, could accelerate efficiently establishment of the training center for GENCOs in Muzaffargarh TPS. - 8 instructors at each GHCL training center were trained in the additional online training. They conducted a total of trainings using training equipment provided by JET.	- 1 engineer and 1 technician have retired.

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	Achievement	Remarks
Outputs 1. Current situation of O&M of thermal power stations is analyzed and training needs are identified.	- Training needs are compiled based on the current situation.	- Project Monitoring Sheet		- JET analyzed the current situation of O&M and training needs of TPSs/TCs through the 3 times of field survey, interviews with participants (engineers, technicians and managers) in Japan and communication with each counter part.	
2. Capacity of ~~WEA and~~ GENCOs' instructors is enhanced.	- Training program is formulated based on the training needs. - Total number of trained instructors. - Total number of training in Japan.	- Project Monitoring Sheet	- Trained instructors continue to work for ~~WEA and~~ GENCOs during the project period.	- Based on the analysis of current situation of O&M and training needs shown in Output1, JET prepared training program which was held 3 times in Japan and the additional online training program. - 24 engineers and 24 technicians were trained as expected instructors in the 1st, 2nd, and 3rd trainings in Japan. - 6 managers were trained in Japan to improve O&M capacity of TPS and ability of Training Centers. -8 instructors from each GHCL training center were trained to conduct training using training equipment provided by JET.	- 1 engineer and 1 technician have retired. - The 3rd training in Japan for management was canceled due to inadequate approval procedures in Pakistan.
3. Training as well as OJT at ~~WEA and~~ GENCOs are improved.	- Achievement level of Action Plans developed by trained instructors. - The results of checklists.	- Project Monitoring Sheet, including regular training reports at ~~WEA and~~ GENCOs provided by trained instructors. - Progress report of each Action Plan. - Checklist.		- According to regular training reports from the participants trained in Japan (24 engineers & 24 technicians), they conducted a total of 822 trainings and they trained a total of 6,329 trainees of GENCOs. - According to training reports from the participants (8 instructors) from each GHCL training center who trained in the online training, they conducted a total of 13 trainings using training equipment provided by JET and they trained a total of 85 trainees of GENCOs. - The results of reports from those who participated in the training conducted by JICA-trained participants shows that the training was highly evaluated and improved their O&M ability at TPSs.	- 1 engineer and 1 technician have retired.

Activities	Inputs		Important Assumption
	The Japanese Side	**The Pakistan Side**	
1-1 To analyze the current situation of O&M at thermal power stations. 1-2 To review the training system of thermal power generation, and analyze the current situation and issues of O&M personnel. 1-3 To specify the training needs.	a. Dispatch of Experts - Chief Advisor / Thermal Power Generation Operation & Maintenance - Thermal Power Generation Operation - Thermal Power Generation Maintenance (Mechanical) - Thermal Power Generation Maintenance (Electrical) - Thermal Power Generation Maintenance (C&I) b. Training in Japan c. Training equipment	a. Assignment of Counterpart personnel - Project Chairperson - Project Director - Project Manager - Project Coordinator - Counterpart members b. Office space and necessary facilities for Japanese experts c. Other operational cost	
2-1 To set the target O&M skills that instructors & potential instructors should obtain. 2-2 To formulate the program of training in Japan. 2-3 To set selection criteria for the training in Japan. 2-4 To conduct trainings in Japan. 2-5 To modify the contents of training in Japan at ~~WEA and~~ GENCOs' thremal power stations (OJTs) in Pakistan.			**Pre-Conditions**
3-1 To develop action plans of trainings (OJTs) for O&M of thermal power stations. 3-2 To disseminate obtained knowledge and technical skills to O&M personnel based on the action plans and verify the skilled up level by checklist developed at the above 2-4. 3-3 To review the results of action plans to improve the training at ~~WEA and~~ GENCOs' thermal power stations (OJTs) in Pakistan.			**<Issues and countermeasures>**

Project Monitoring Sheet II (Revision of Plan of Operation)

Version No. 6

Dated: 17th February, 2022

Project Title: The Project for Capacity Building and Strengthening of Thermal Power Generation Operation and Maintenance in The Islamic Republic of Pakistan

Inputs	Plan/Actual	2017		2018				2019				2020				2021				2022		Remarks	Monitoring: Issue	Monitoring: Solution
		III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II			
Expert	Month	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 4 5 6 7 8 9 10 11 12				1 2 3 4 5 6				
Chief Advisor/ Thermal Power Generation O&M	Plan																							
	Actual																							
Thermal Power Generation Operation	Plan																							
	Actual																							
Thermal Power Generation Maintenance (Mechanical)	Plan																							
	Actual																							
Thermal Power Generation Maintenance (Electrical)	Plan																							
	Actual																							
Thermal Power Generation Maintenance (C&I)	Plan																							
	Actual																							
Equipment																						JICA Expert Team (JET) provided the necessary training equipment (Vibration Analysis Demonstrator Kit and Non Destructive Inspection Demonstrator)based on field surveys, discussions with management, and the results of questionnaires from participants trained in Japan.		
Necessary Equipment if any	Plan																							
	Actual																							
Training in Japan																						The 4th training was conducted online for instructors belonging to two GHCL training centers.		
Training on O&M of thermal power stations	Plan																							
	Actual																							
In-country/Third country Training																								
	Plan																							
	Actual																							

Activities / Sub-Activities	Plan/Actual	2017		2018				2019				2020				2021				2022		Responsible Organization: Japan	Responsible Organization: ~~WEA and GENCOs~~	Achievements	Issue & Countermeasures
		III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II				
Output 1: Current situation of O&M of thermal power stations is analyzed and training needs are identified.																									
1.1 To analyze the current situation of O&M at thermal power stations.	Plan																							1.1 / 1.2 JET analyzed the current status of O&M situation and training system at TPSs through 3 times of field surveys, interviews with participants trained in Japan and communication with each counter part.	
	Actual																								
1.2 To review the training system of thermal power generation, and analyze the current situation and issues of O&M personnel.	Plan																								
	Actual																								
1.3 To specify the training needs.	Plan																							1.3 Based on these analysis results, JET summarized the training needs to improve the O&M of TPSs in Pakistan.	
	Actual																								

Activities / Sub-Activities	Plan / Actual	2017		2018				2019				2020				2021				2022		Responsible Organization		Achievements	Issue & Countermeasures
		III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	Japan	~~WEA and~~ GENCOs		
Output 2: Capacity of ~~WEA and~~ GENCOs' Instructors is enhanced.																									
2.1 To set the target O&M skills that instructors and potential instructors should obtain.	Plan																							2.1 / 2.2 / 2.3 Based on the analysis of training needs shown in Output1, JET prepared training program which was held 3 times in Japan and additional online training program. For engineer and technician, the 1st training specialized in the mechanical maintenance field, the 2nd training specialized in the electrical maintenance field and the 3rd training specialized in the I&C maintenance field. For managment, the 1st and 2nd training specialized in the HRD. For instructors at each GHCL training center, the online training specialized in the online training using training equipment provided by JET.	
	Actual																								
2.2 To formulate the program of Training in Japan for instructors.	Plan																								
	Actual																								
2.3 To set selection criteria for the Training in Japan.	Plan																								
	Actual																								
2.4 To conduct Trainings in Japan.	Plan																							2.4 In the 3 times training in Japan and 1 time online trainig, 24 engineers, 24 technicians, 6 managers and 8 instructors were trained.	The 3rd training in Japan for management was canceled due to inadequate approval procedures in Pakistan.
	Actual																								
2.5 To modify the contents of Training in Japan as necessary based on feedbacks of trainings at ~~WEA and~~ GENCOs' thermal power stations (OJTs) in Pakistan.	Plan																							2.5 JET prepared training curriculum for each training through the field survey, training needs and feedbacks from Pakistan.	
	Actual																								
Output 3: Trainings as well as On-the-Job Training (OJT) at ~~WEA and~~ GENCOs are improved.																									
3.1 To develop Action Plans of trainings (OJTs) for O&M of thermal power stations.	Plan																							3.1 In the 1st/2nd/3rd training in Japan and additional online trainig, engineers, technicians, managers and instructors created the action plan for improvement of O&M capacity of TPS.	The 3rd training in Japan for management was canceled due to inadequate approval procedures in Pakistan.
	Actual																								
3.2 To disseminate obtained knowledge and technical skills to O&M personnel based on the Action Plans and verify the skilled up level by checklist developed at the above 2-4.	Plan																							3.2 / 3.3 According to regular training reports from the the participants trained in Japan (24 engineers & 24 technicians), they conducted a total of 822 trainings and they trained a total of 6,329 trainees of GENCOs. Action Plan made by 2nd dispatched management, could accelerate efficiently establishment of the training center for GENCOs in Muzaffargarh TPS. According to training reports from the participants (8 instructors) from each GHCL training center who trained in the online training, they conducted a total of 13 trainings using training equipment provided by JET and they trained a total of 85 trainees of GENCOs.	
	Actual																								
3.3 To review the results of Action Plans to improve the trainings at ~~WEA and~~ GENCOs' thermal power stations (OJTs) in Pakistan.	Plan																								
	Actual																								

Duration / Phasing																									Remarks	Issue	Solution
	Plan																										
	Actual																										

Monitoring Plan		2017		2018				2019				2020				2021				2022		Remarks	Issue	Solution
	Actual	Ⅲ	Ⅳ	Ⅰ	Ⅱ	Ⅲ	Ⅳ	Ⅰ	Ⅱ	Ⅲ	Ⅳ	Ⅰ	Ⅱ	Ⅲ	Ⅳ	Ⅰ	Ⅱ	Ⅲ	Ⅳ	Ⅰ	Ⅱ			
Monitoring																								
JCC (Joint Coordination Committee)	Plan																						Cancellation of the 3rd on-site monitoring mission (incl. the 4th JCC) and the final on-site monitoring mission (incl. the final JCC) due to the spread of the COVID-19.	The 4th and final JCC were held online instead of face-to-face.
	Actual																							
Submission of Monitoring Sheet	Plan																						The monitoring sheet was not submitted as scheduled because the 3rd on-site monitoring mission and the final on-site monitoring mission were canceled due to the spread of the COVID-19.	The 5th monitoring sheet was submitted after the 4th JCC conducted online. The 6th and 7th monitoring sheets at the time of planning were submitted after the final JCC conducted online as the 6th monitoring sheet due to the cancellation of the final on-site monitoring mission.
	Actual																							
Monitoring Mission from Japan	Plan																						Cancellation of the 3rd on-site monitoring mission and the final on-site monitoring mission due to the spread of the COVID-19.	The 3rd and final on-site monitoring missions were conducted online.
	Actual																							
Reports/Documents																								
Work Plan	Plan																							
	Actual																							
Baseline Survey Report	Plan																							
	Actual																							
Progress Report	Plan																							
	Actual																							
Project Completion Report	Plan																							
	Actual																					Due to the extension of the project period, Project Completion Report was submitted in February 2022.		
Public Relations																								
	Plan																							
	Actual																							
	Plan																							
	Actual																							

Annex 4

Results of the Training

(1) 1st Training in Japan

The 1st training in Japan

(1) Engineer training: March 21 to April 27, 2018

Schedule	Time	Training item	Venue
March 21 (Wednesday)	-	Arrival in Japan	-
March 22 (Thursday)	9:30～16:00	Briefing	JICA Chugoku Center
		Program orientation	
March 23 (Friday)	9:30～11:30	General orientation (Japanese economy)	JICA Chugoku Center
	13:00～14:00	Opening ceremony	
	14:10～17:00	Job report Presentation	
March 24 (Saturday)	-	Day off	-
March 25 (Sunday)	-	Moving (from JICA Chugoku to International Hotel Ube)	-
March 26 (Monday)	9:00～12:00	Course orientation and action plan preparation (PCM)	PET
	13:00～16:00	Preparation of Action Plan (PCM method)	
March 27 (Tuesday)	9:00～16:00	TQM activities in Japan	PET
March 28 (Wednesday)	9:00～12:00	TQM activities in Japan	PET
	13:00～16:00	Human resource development for thermal power plants	
March 29 (Thursday)	9:00～12:00	Human resource development for thermal power plants	PET
	13:00～16:00	USC overview	
	17:00～19:30	Accompanied to hospital (Mr. BABAR Asadullah and Mr. MUHAMMAD Aslam Motlani)	-
March 30 (Friday)	9:00～14:00	Waiting	-
	14:00～16:00	Fundamental technology for vibration	PET
March 31 (Saturday)	-	Day off	-
April 1 (Sunday)	-	Day off	-
April 2 (Monday)	9:00～16:00	Fundamental technology for vibration	PET
April 3 (Tuesday)	9:00～16:00	Fundamental technology for vibration	PET
April 4 (Wednesday)	9:00～16:00	Nondestructive testing technique • Lecturing (UT, PT, MT, RT) • Practice (PT, MT, UT)	PET
April 5 (Thursday)	9:00～12:00	Nondestructive testing technique • Lecturing (UT, PT, MT, RT) • Practice (PT, MT, UT)	PET
	13:00～16:00	Diagnostic technique for remaining life assessment	
April 6 (Friday)	9:00～16:00	Diagnostic technique for remaining life assessment	PET
April 7 (Saturday)	-	Day off	-
April 8 (Sunday)	-	Day off	-
April 9 (Monday)	9:00～16:00	Diagnostic technique for remaining life assessment	PET

April 10 (Tuesday)	9:00～10:30	Safety (accident case studies session, etc.)	PET
	10:30～12:00	Action plan guidance (for how to draw up a plan)	
	13:00～16:00	Approach to environmental protection	
April 11 (Wednesday)	9:00～12:00	Approach to environmental protection	PET
	13:00～16:00	Boiler water quality control	
April 12 (Thursday)	13:00～16:00	Gas Turbine Combined Cycle (GTCC) power generation technology	The Chugoku Electric Power Yanai Thermal Power Station
April 13 (Friday)	9:30～16:00	Gas Turbine Combined Cycle (GTCC) power generation technology	The Chugoku Electric Power Yanai Thermal Power Station
April 14 (Saturday)	-	Day off	-
April 15 (Sunday)	-	Day off	-
April 16 (Monday)	9:30～16:00	Gas Turbine Combined Cycle (GTCC) power generation technology	The Chugoku Electric Power Yanai Thermal Power Station
April 17 (Tuesday)	9:30～11:30	Gas Turbine Combined Cycle (GTCC) power generation technology	The Chugoku Electric Power Yanai Thermal Power Station
	13:20～15:30	Field trip to Hiroshima Peace Memorial Museum	Hiroshima Peace Memorial Park
April 18 (Wednesday)	10:00～16:00	Site Visit to Mitsubishi-Hitachi Power Systems	MHPS Kure Works
April 19 (Thursday)	10:00～16:00	Preparation of Action	JICA Chugoku Center
April 20 (Friday)	9:00～16:00	Preparation of Action	JICA Chugoku Center
April 21 (Saturday)	-	Day off	-
April 22 (Sunday)	-	Moving (from JICA Chugoku to Hitachi)	-
April 23 (Monday)	10:00～16:00	Site Visit to Mitsubishi-Hitachi Power Systems	MHPS Hitachi Works
April 24 (Tuesday)	-	Moving (from Hitachi to JICA Yokohama)	-
April 25 (Wednesday)	10:00～13:00	Presentation of Action Plan	JICA Yokohama Center
April 26 (Thursday)	10:00～11:00	Evaluation meeting	JICA Yokohama Center
	11:00～12:00	Closing ceremony	
	13:00～14:30	Review meeting	
April 27 (Friday)	-	Leaving Japan	-

(2) Technician training: March 4 to 24, 2018

Schedule	Time	Training item	Venue
March 4 (Sunday)	-	Arrival in Japan	-
March 5 (Monday)	9:30～10:15	Briefing	JICA Kansai Center
	10:15～11:00	Program orientation	
	11:00～12:00	Course orientation	
	14:00～17:00	Job report Presentation	
March 6 (Tuesday)	9:00～12:00	Overview of Kansai Electric Power, and fuel	JICA Kansai Center
	13:00～16:00	Thermal power plant (GTCC / coal)	
	16:30～17:30	Japanese language session	
March 7 (Wednesday)	10:00～16:00	Instruction for preparing Action Plan (PCM method)	JICA Kansai Center
	16:30～17:30	Japanese language session	
March 8 (Thursday)	10:00～12:00	Orientation	Kanden Plant Technocenter
	13:00～16:30	Experiential safety training	
March 9 (Friday)	9:00～12:00	Welding Procedure Management	Kanden Plant Technocenter
	13:00～16:30	Prevention of accidents and disasters	
March 10 (Saturday)	-	Day off	-
March 11 (Sunday)	-	Day off	-
March 12 (Monday)	9:00～12:00	Handling metal materials	Kanden Plant Technocenter
	13:00～16:30	Experiential quality training	
March 13 (Tuesday)	9:00～16:30	Valve overhaul	Kanden Plant Technocenter
March 14 (Wednesday)	9:00～12:00	Maintenance for high-temperature and high-pressure piping	Kanden Plant Technocenter
	13:00～16:30	Maintenance of instruments	
March 15 (Thursday)	9:00～16:30	Motor overhaul	Kanden Plant Technocenter
March 16 (Friday)	10:00～12:00	Site Visit to Himeji No.2 Thermal Power Station	Himeji No.2 Thermal Power Station
	14:00～17:00	Site Visit to Ishikawajima-Harima Heavy Industries	IHI Aioi Works
March 17 (Saturday)	-	Day off	-
March 18 (Sunday)	-	Experiencing Japanese culture	Himeji
March 19 (Monday)	9:00～12:00	Preparation of Action Plan	Himeji Castle Grandvrio Hotel
	13:30～17:30	Site Visit to Mitsubishi-Hitachi Power Systems	MHPS Takasago Works
March 20 (Tuesday)	9:00～12:00	Types and characteristics of nondestructive testing	Kanden Plant Technocenter
	13:00～16:30	Nondestructive testing	
March 21 (Wednesday	-	(Moving to next accommodation)	-
March 22 (Thursday)	9:00～17:30	Preparation of Action Plan	JICA Kansai Center
March 23 (Friday)	9:30～12:30	Presentation of Action Plan	JICA Kansai Center
	13:30～14:30	Evaluation meeting	
	14:30～15:15	Closing ceremony	
	15:15～16:00	Skull session	
	16:00～17:00	Review meeting	

March 24 (Saturday)	-	Leaving Japan	-

(3) Management training: March 14 to 24, 2018

Schedule	Time	Training item	Venue
March 14 (Wednesday)	-	Arrival in Japan	-
March 15 (Thursday)	10:00～10:30	Briefing	JICA Kansai Center
	11:00～11:30	Program orientation	
	13:00～14:00	Course orientation and overview of Kansai Electric Power	
	14:00～17:00	Problem analysis using PCM (including discussion)	
March 16 (Friday)	10:00～12:00	Site Visit to Himeji No.2 Thermal Power Station	Himeji No.2 Thermal Power Station
	14:00～17:00	Site Visit to Ishikawajima-Harima Heavy Industries	IHI Aioi Works
March 17 (Saturday)	-	Day off	-
March 18 (Sunday)	-	Day off	-
March 19 (Monday)	9:00～12:00	Objective analysis using PCM	JICA Kansai Center
	13:30～17:30	Site Visit to Mitsubishi-Hitachi Power Systems	MHPS Takasago Works
March 20 (Tuesday)	10:00～12:00	Site Visit to Kanden Plant Technocenter	Kanden Plant Technocenter
	13:00～16:30	Nondestructive testing	
March 21 (Wednesday)	-	Day off	-
March 22 (Thursday)	10:00～12:00	Human resource development	Kansai Electric Power Training Center
	13:00～15:30	Site Visit to Kansai Electric Power Training Center Introduction to O&M solutions	
March 23 (Friday)	9:30～12:30	Presentation of Action Plan	JICA Kansai Center
	13:30～14:30	Evaluation meeting	
	14:30～15:15	Closing ceremony	
	15:15～16:00	Skull session	
	16:00～17:00	Review meeting	
March 24 (Saturday)	-	Leaving Japan	-

(2) 2nd Training in Japan

The 2nd training in Japan

(1) Engineer training: January 6 to February 9, 2019

Schedule	Time	Training item	Venue
January 6 (Sunday)	-	Arrival in Japan	-
January 7 (Monday)	10:00～11:00	Briefing	JICA Kansai Center
	11:00～12:00	Program orientation	
	13:00～14:00	Course orientation	
	14:00～17:00	Job report Presentation	
January 8 (Tuesday)	9:00～12:00	Issue analysis	JICA Kansai Center
	13:00～16:00	Issue analysis	
	18:00～19:30	Japanese language session	
January 9 (Wednesday)	9:00～12:00	Issue analysis	JICA Kansai Center
	14:00～15:00	Site visit to RMC of Kansai Electric Power	Kansai Electric Power Headquarters
	15:00～16:00	Site visit to the Central Load Dispatching Center of Kansai Electric Power	
	18:00～19:30	Japanese language session	JICA Kansai Center
January 10 (Thursday)	9:00～12:00	Overview of Kansai Electric Power, and fuel	JICA Kansai Center
	13:00～16:00	Thermal power plant (GTCC / coal)	
January 11 (Friday)	10:00～12:00	Orientation	Kanden Plant Technocenter
	13:00～14:00	The outline of insulation	
	14:00～16:00	Fire prevention measures of electrical equipment	
January 12 (Saturday)	-	Day off	-
January 13 (Sunday)	-	Day off	-
January 14 (Monday)	10:20～20:00	Home visit	-
January 15 (Tuesday)	9:00～12:00	Preventive maintenance of generators	Kanden Plant Technocenter
	13:00～16:00	Maintenance of electrical cables	
January 16 (Wednesday)	9:00～12:00	Protection systems of main electrical equipment	Kanden Plant Technocenter
	13:00～15:30	System protective relays	
	15:30～17:00	Site Visit to the educational institution	KWANSEI GAKUIN University Kobe Sanda Campus
January 17 (Thursday)	9:00～12:00	Protection systems of generators, transformers and 6.6kV motors	Kanden Plant Technocenter
	13:00～16:00	Preventive maintenance of transformers	
January 18 (Friday)	13:00～16:00	Site Visit to Maizuru Thermal Power Station	Maizuru Thermal Power Station
January 19 (Saturday)	-	Day off	-
January 20 (Sunday)	-	Day off	-
January 21 (Monday)	9:30～12:00	Site visit to Mitsubishi Electric Corporation	Mitsubishi Electric Corporation Kobe Works
	14:00～16:00	Site visit to Mitsubishi Electric Corporation	Mitsubishi Electric Corporation Itami Works
January 22	9:00～12:00	Orientation	

(Tuesday)	13:00～14:30	Quality control	Kansai Electric Power Training Center
	14:30～16:00	Thermal efficiency control	
January 23 (Wednesday)	9:00～16:00	Nondestructive inspection	Kansai Electric Power Training Center
January 24 (Thursday)	9:00～16:00	Nondestructive inspection	Kansai Electric Power Training Center
January 25 (Friday)	9:00～12:00	Site Visit to Himeji No.2 Thermal Power Station	Himeji No.2 Thermal Power Station
	14:00～17:00	Site Visit to Nihondenken Industrial	Nihondenken Industrial
January 26 (Saturday)	-	Day off	-
January 27 (Sunday)	-	Day off	-
January 28 (Monday)	9:00～12:00	Site Visit to Himeji No.2 Thermal Power Station	Himeji No.2 Thermal Power Station
	13:30～17:00	Site Visit to Mitsubishi-Hitachi Power Systems	MHPS Takasago Works
January 29 (Tuesday)	9:00～10:30	Human resource development	Kansai Electric Power Training Center
	10:30～12:00	Lessons through major accidents	
	13:00～16:00	Preventive maintenance of circuit breakers	
January 30 (Wednesday)	9:00～16:00	Basic training of vibration	Kansai Electric Power Training Center
January 31 (Thursday)	9:00～16:00	Basic training of vibration	Kansai Electric Power Training Center
February 1 (Friday)	9:00～16:00	Basic training of vibration	Kansai Electric Power Training Center
February 2 (Saturday)	-	Experiencing Japanese culture	Kyoto
February 3 (Sunday)	-	Day off	-
February 4 (Monday)	9:00～12:00	Optimal maintenance planning	Kansai Electric Power Training Center
	13:00～16:00	Preventive maintenance of excitation system	
February 5 (Tuesday)	9:00～12:00	Experiential safety training	Kansai Electric Power Training Center
	13:00～16:00	Preventive maintenance of highvoltage motors	
February 6 (Wednesday)	9:00～16:00	Preparation of Action Plan	JICA Kansai Center
February 7 (Thursday)	9:00～12:00	Preparation of Action Plan	JICA Kansai Center
	13:00～16:00	Presentation of Action Plan	
February 8 (Friday)	9:00～10:00	Evaluation meeting	JICA Kansai Center
	11:00～12:00	Closing ceremony	
	16:00～17:00	Review meeting	
February 9 (Saturday)	-	Leaving Japan	-

(2) Technician training: January 6 to 26, 2019

Schedule	Time	Training item	Venue
January 6 (Sunday)	-	Arrival in Japan	-
January 7 (Monday)	10:00～11:00	Briefing	JICA Kansai Center
	11:00～12:00	Program orientation	
	13:00～14:00	Course orientation	
	14:00～17:00	Job report Presentation	
January 8 (Tuesday)	9:00～12:00	Issue analysis	JICA Kansai Center
	13:00～16:00	Issue analysis	
	18:00～19:30	Japanese language session	
January 9 (Wednesday)	9:00～12:00	Issue analysis	JICA Kansai Center
	14:00～15:00	Site visit to RMC of Kansai Electric Power	Kansai Electric Power Headquarters
	15:00～16:00	Site visit to the Central Load Dispatching Center of Kansai Electric Power	
	18:00～19:30	Japanese language session	JICA Kansai Center
January 10 (Thursday)	9:00～12:00	Overview of Kansai Electric Power, and fuel	JICA Kansai Center
	13:00～16:00	Thermal power plant (GTCC / coal)	
January 11 (Friday)	10:00～12:00	Orientation	Kanden Plant Technocenter
	13:00～16:00	Preventive maintenance of transformers	
January 12 (Saturday)	-	Day off	-
January 13 (Sunday)	-	Day off	-
January 14 (Monday)	-	Experiencing Japanese culture	Kyoto
January 15 (Tuesday)	9:00～12:00	Protection systems of main electrical equipment	Kanden Plant Technocenter
	13:00～14:00	The outline of insulation	
	14:00～16:00	Fire prevention measures of electrical equipment	
January 16 (Wednesday)	9:00～12:00	Preventive maintenance of generators	Kanden Plant Technocenter
	13:00～15:30	System protective relays	
	15:30～17:00	Site Visit to the educational institution	KWANSEI GAKUIN University Kobe Sanda Campus
January 17 (Thursday)	9:00～12:00	Preventive maintenance of highvoltage motors	Kanden Plant Technocenter
	13:00～16:00	Protection systems of generators, transformers and 6.6kV motors	
January 18 (Friday)	13:00～16:00	Site Visit to Maizuru Thermal Power Station	Maizuru Thermal Power Station
January 19 (Saturday)	-	Day off	-
January 20 (Sunday)	-	Day off	-
January 21 (Monday)	9:30～12:00	Maintenance of electrical cables	Kanden Plant Technocenter
	14:00～16:00	Experiential quality training	
January 22 (Tuesday)	9:00～12:00	Prevention of accidents and disasters	Kanden Plant Technocenter
	13:00～14:30	Occupational safety	
	14:30～16:00	Experiential safety training	

January 23 (Wednesday)	9:00～16:00	Motor overhaul	Kanden Plant Technocenter
January 24 (Thursday)	9:00～16:00	Preparation of Action Plan	JICA Kansai Center
January 25 (Friday)	10:00～11:00	Evaluation meeting	JICA Kansai Center
	14:00～15:30	Presentation of Action Plan	
	15:30～16:15	Closing ceremony	
	16:15～17:15	Review meeting	
January 26 (Saturday)	-	Leaving Japan	-

(3) Management training: January 6 to 26, 2019

Schedule	Time	Training item	Venue
February 3 (Sunday)	-	Arrival in Japan	-
February 4 (Monday)	10:30～11:00	Briefing	JICA Kansai Center
	13:00～13:30	Program orientation	Kansai Electric Power Headquarters
	13:30～14:00	Course orientation	
	14:20～16:00	Job report Presentation	
	16:00～17:00	Site visit to RMC of Kansai Electric Power	
February 5 (Tuesday)	9:00～12:15	Site Visit to Kansai Electric Power Training Center	Kansai Electric Power Training Center
	13:15～17:00	Stakeholder Analysis / Issue Analysis	
February 6 (Wednesday)	10:00～11:30	Site Visit to Sakaiko Thermal Power Station	Sakaiko Thermal Power Station
	13:00～14:15	Site Visit to Sakai LNG receiving terminal	Sakai LNG
	15:00～16:00	Site Visit to Nanko Thermal Power Station	Nanko Thermal Power Station
February 7 (Thursday)	9:00～12:00	Preparation of Action Plan	JICA Kansai Center
	13:00～15:00	Presentation of Action Plan	
	13:00～15:00	Human resource development	
February 8 (Friday)	10:00～10:30	Evaluation meeting	JICA Kansai Center
	11:00～12:00	Closing ceremony	
	14:30～15:40	Review meeting	
February 9 (Saturday)	-	Leaving Japan	-

(3) 3rd Training in Japan

The 3rd training in Japan

(1) Engineer training: January 23 to February 15, 2020

Schedule	Time	Training item	Venue
January 23 (Thursday)	-	Arrival in Japan	-
January 24 (Friday)	10:00～11:00	Briefing	JICA Kansai Center
	11:00～12:00	Program orientation	
	13:00～14:00	Course orientation	
	14:00～17:00	Job report presentation	
January 25 (Saturday)	-	Day off	-
January 26 (Sunday)	09:00～17:00	Issue analysis	JICA Kansai Center
January 27 (Monday)	09:00～10:00	Orientation	Kansai Electric Power Training Center
	10:00～11:00	Tool Box Meetitng (TBM)	
	11:00～14:00	Overview of Turbine Supervisory Instrument	
	14:00～17:00	Maintenance of Turbine Supervisory Instrument (Practice)	
January 28 (Tuesday)	10:00～17:00	Maintenance of Turbine Supervisory Instrument (Practice)	Kansai Electric Power Training Center
January 29 (Wednesday)	10:00～17:00	Maintenance of Turbine Supervisory Instrument (Practice)	Kansai Electric Power Training Center
January 30 (Thursday)	09:30～12:00	Overview of Gas Turbine Combined Cycle Power Generation Control System and Maintenance	Himeji No.2 Thermal Power Station
	13:00～14:00	Simulation of Gas Turbine Combined Cycle Power Generation Control System	
	14:00~16:00	Site Visit to Himeji No.2 Thermal Power Station	
January 31 (Friday)	09:00～10:30	Quality control	Kansai Electric Power Training Center
	10:30～12:00	Lessons Learned from Accidents	
	13:30～16:00	Experience-based Safety Training	
	16:00～17:00	Weekly review of training	
February 1 (Saturday)	-	Experiencing Japanese culture	Kyoto
February 2 (Sunday)	-	Day off	-
February 3 (Monday)	09:00～10:00	Orientation	Kanden Plant Technocenter
	10:00～12:00	Overview of Measuring and Monitoring Device	
	13:00～13:30	Tool Box Meeting (TBM)	
	13:30～17:00	Maintenance of Measuring and Monitoring Device (Practice)	
February 4 (Tuesday)	09:00～12:00	Overview of Control Valve and Accessories	Kanden Plant Technocenter
	13:00～17:00	Maintenance of Control Valve and Accessories (Practice)	
February 5 (Wednesday)	09:00～17:00	Maintenance of Control Valve and Accessories (Practice)	Kanden Plant Technocenter
February 6 (Thursday)	09:00～12:00	Basic Control Theory (PID Control) and Optimal Tuning	Kanden Plant Technocenter
	13:00～17:00	Optimal Tuning of Process Controller (Practice) ・ Step response method ・ Ultimate ensitivity method	

February 7 (Friday)	09:00～16:00	Optimal Tuning of Process Controller (Practice) ・ Step response method ・ Ultimate ensitivity method	Kanden Plant Technocenter
	16:00～17:00	Weekly review of training	
February 8 (Saturday)	-	Day off	-
February 9 (Sunday)	-	Day off	-
February 10 (Monday)	10:30～15:00	Site Visit to Shimadzu Corporation Sanjo Works Site Visio to Shimadzu System Solutions, Sanjo Works	Shimadzu Corporation, Shimadsu System Solutions
February 11 (Tuesday)	-	Day off	-
February 12 (Wednesday)	09:00～10:00	The Quality of Electric Power Infrastructure (QEPI)	JICA Kansai Center
	10:00～11:00	Human Resource Development	
	11:00～12:00	Optimal Maintenance Planning (RBM)	
	13:00～17:00	Making of Action Plan	
February 13 (Thursday)	09:00～16:00	Making of Action Plan	JICA Kansai Center
	16:00～17:00	Presentation of Action Plan	
February 14 (Friday)	09:00～11:00	Evaluation meeting	JICA Kansai Center
	11:00～12:00	Closing ceremony	
	12:00～13:00	Review meeting	
February 15 (Saturday)	-	Leaving Japan	-

(2) Technician training: January 13 to February 1, 2020

Schedule	Time	Training item	Venue
January 13 (Monday)	-	Arrival in Japan	-
January 14 (Tuesday)	10:00～11:00	Briefing	JICA Kansai Center
	11:00～12:00	Program orientation	
	13:00～14:00	Course orientation	
	14:00～17:00	Job report presentation	
	18:00～19:30	Japanese language session	
January 15 (Wednesday)	9:00～17:00	Issue analysis	JICA Kansai Center
	18:00～19:30	Japanese language session	
January 16 (Thursday)	9:00～12:00	Issue analysis	JICA Kansai Center
	14:00～17:00	Site visit to the Central Load Dispatching Center of Kansai Electric Power and RMC, and introduction of K-VaCS	Kansai Electric Power Headquarters
	18:00～19:30	Japanese language session	JICA Kansai Center
January 17 (Friday)	09:30～12:00	Site Visit to Himeji No.2 Thermal Power Station	Himeji No.2 Thermal Power Station
	14:30～17:00	Site visit to Mitsubishi Electric Corporation	Mitsubishi Electric Corporation Kobe Works
January 18 (Saturday)	-	Day off	-
January 19 (Sunday)	-	Home visit	-
January 20 (Monday)	10:00～12:00	Orientation	Kanden Plant Technocenter
	13:00～14:00	Tool Box Meetitng (TBM)	

	14:00～17:00	Overview of Turbine Supervisory Instrument	
January 21 (Tuesday)	0900～10:00	Tool Box Meeting (TBM)	Kanden Plant Technocenter
	10:00～11:00	Copper Pipe Flaring and Seal Taping	
	11:00～12:00	Control Cable and Terminal Treatment	
	13:00～17:00	Maintenance of Measuring and Monitoring Device (Practice)	
January 22 (Wednesday)	09:00～12:00	Overview of Control Valve and Accessories	Kanden Plant Technocenter
	13:00～17:00	Maintenance of Control Valve and Accessories (Practice)	
January 23 (Thursday)	09:00～17:00	Maintenance of Control Valve and Accessories (Practice)	Kanden Plant Technocenter
January 24 (Friday)	09:00～16:00	Maintenance of Control Valve and Accessories (Practice)	Kanden Plant Technocenter
	16:00～17:00	Weekly review of training	
January 25 (Saturday)	-	Experiencing Japanese culture	Nara
January 26 (Sunday)	-	Day off	-
January 27 (Monday)	09:00～11:00	Basic Control Theory (PID Control) and Optimal Tuning	Kanden Plant Technocenter
	11:00～17:00	Optimal Tuning of Process Controller (Practice) ・ Step response method ・ Ultimate ensitivity method	
January 28 (Tuesday)	09:00～12:00	Optimal Tuning of Process Controller (Practice) ・ Step response method ・ Ultimate ensitivity method	Kanden Plant Technocenter
	13:00～17:00	Experiential Quality Training	
January 29 (Wednesday)	09:00～12:00	Prevention of Accidents and Disasters	Kanden Plant Technocenter
	13:00～14:00	Labor safety	
	14:00～16:00	Experiential Safety Training	
	16:00～17:00	Weekly review of training	
January 30 (Thursday)	09:00～17:00	Making of Action Plan	JICA Kansai Center
January 31 (Friday)	09:00～12:00	Making of Action Plan	JICA Kansai Center
	14:00～15:00	Presentation of Action Plan	
	15:00～16:00	Evaluation meeting	
	16:00～16:30	Closing ceremony	
	16:30～17:00	Review meeting	
February 1 (Saturday)	-	Leaving Japan	-

(4) 4th Online Training

The 4th online training

Instructor training: November 10, 2021 / November 29 to December 8, 2021

Schedule	Time (JST)	Training item	Venue
November 10 (Wednesday)	14:00~16:00	Kick-off meeting Web meeting connecting test with Muzaffargarh	Kansai Electric Power Headquarter Shinkawa Electric Osaka Branch Office Shinkawa Electric Chiba Sales Office Muzaffargarh TC
November 29 (Monday)	14:00~14:10	Opening ceremony	Kansai Electric Power Headquarter Shinkawa Electric Chiba Sales Office Muzaffargarh TC
	14:10~15:00	Course orientation	
	15:00~16:00	Unpacking and checking the quantity of vibration model rotor	
	16:00~18:00	Installing the model rotor (assembling, connecting cables, etc.)	
	18:00~20:00	Confirmation of startup (1)	
November 30 (Tuesday)	14:00~15:00	Confirmation of startup (2)	Kansai Electric Power Headquarter Shinkawa Electric Chiba Sales Office Muzaffargarh TC
	15:00~16:20	How to use the model rotor Demo of the phenomenon (bearing scratch / bearing replacement)	
	17:00~18:00	How to use the model rotor Demo of the phenomenon (rotor scattering)	
	18:00~20:00	How to use the model rotor Demo of the phenomenon (unbalance)	
December 1 (Wednesday)	14:00~16:15	How to use the model rotor Demo of the phenomenon (trouble-shooting)	Kansai Electric Power Training Center Shinkawa Electric Chiba Sales Office Muzaffargarh TC
	17:00~18:15	Lecture: Basic of vibration (1)	
	18:15~20:30	Practical training: Checking response by unbalance form	
December 2 (Thursday)	14:00~16:15	Lecture: Basic of vibration (2)	Kansai Electric Power Training Center Shinkawa Electric Chiba Sales Office Muzaffargarh TC
	17:00~19:15	Practical training: Balancing by the three-point balancing method	
	19:15~20:15	Summary of this week's training	
December 3 (Friday)	-	Day off	-
December 4 (Saturday)	-	Day off	-
December 5 (Sunday)	-	Day off	-
December 6 (Monday)	14:00~16:00	Unpacking and checking the quantity of NDI kit	Kansai Electric Power Training Center Muzaffargarh TC
	17:00~19:00	Lecture: Overall the NDI / PT	
	19:00~20:15	Plactical training: PT	
December 7 (Tuesday)	14:00~15:00	Lecture: MT	Kansai Electric Power Training Center Muzaffargarh TC
	15:00~16:00	Practical training: MT	
	17:00~18:00	Lecture: UT	
	18:00~20:15	Practical training: UT	
December 7 (Wednesday)	14:00~16:30	Making of Action Plan	Kansai Electric Power Training Center Muzaffargarh TC
	17:00~20:00	Training Demonstration (Vivration / NDI)	
	20:00~20:30	Critique / Training completion session	

Annex 5

Action Plan prepared by Participants

(1) Action Plan (prepared in the 1st training in Japan for Pakistan)

IN THE NAME OF ALLAH, THE MOST BENEFICENT, THE MOST MERCIFUL

JICA Japan International Cooperation Agency

THE KANSAI ELECTRIC POWER CO.,INC.

Energia THE CHUGOKU ELECTRIC POWER CO., INC.

PCT

COUNTERPART TRAINING ON IMPLEMENTATION OF EFFECTIVE MAINTENANCE & HSE (HEALTH, SAFETY & ENVIRONMENT) PROCEDURES IN GENCOS

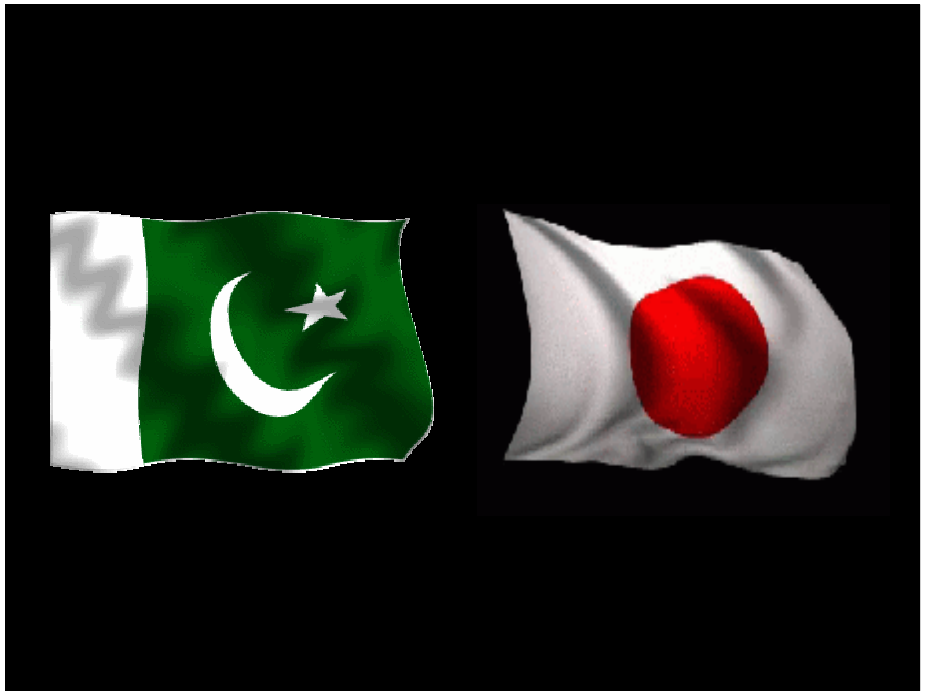
Prepared by:
1. NAZEER AHMED
2. RAJPER MUHIB ALI
3. BABAR ASADULLAH
4. ABBASI GUL MUNIR
5. KHAN ASIF HASSAN
6. KHAWAJA SHABAZ ILLAHI
7. MUHAMMAD MUDASSIR

GHC

N.P.G.C

POWER IS STRENGTH PGT

JAMSHORO POWER COMPANY LIMITED J.P.C.L



For Yuko Ebisu San

Arigatou gozaimasu.

ありがとうございます

[thank you very much]

Knowledge Acquired During Training:

"Counterpart Capacity and Strengthening of Thermal Power Generation Operation and Maintenance" (Pakistan Engineers)

Total Quality Management (TQM) in Japan Cont.

- TQM policies and regulations in Japan were conferred in detail.
- Seven Quality Control Tools and their application in maintenance of thermal power plants discussed and practiced in during the training session.
- Trainees applied these tools to probe in mechanical nature fault in thermal power plants, like;

Total Quality Management (TQM) in Japan

1. Cause-and-effect diagram (also known as the "fishbone" or Ishikawa diagram)
2. Check sheet
3. Control chart
4. Histogram
5. Pareto chart
6. Scatter diagram
7. Stratification (alternately, flow chart or run chart)

The session successfully concluded by the trainer and participants augmented their professional know-how, remarkably.

Human Resource Development in Power Plant

- The HRM core functions, policies and regulations were taught.
- Importance of HRM functions exhibited & discoursed; hence it was a massive conclusion of this session that, right people for the right job is guaranteed factor for an organization to achieve goals.
- Success of the organization is dependent on the successive application of HRM functions, like; Testing, Selection, Training, performance appraisal, reward & punishment.

Basics of Vibration

- Mechanical vibration monitoring, analysis & balancing discussed in this session.
- It was a subject of great interest for the trainees as vibrations troubles are often frequently faced and meet by the Mechanical Engineers of the GENCOs.
- High & Heavy spot terms discussed with vibrant conversation of trainer san with participants.
- Vibration analysis and analog balancing of thermal & single shaft rotors carried out by the participants.

Remaining Life Assesment

- Remaining life assessment of major power plant components discussed in detail;
- The terms; Fatigue, Creep, Erosion & Corrosion conversed in detail.
- Void Ratio Method used to determine the remaining life of welded pipe segment.

Non-Destructive Testing

- Penetrate & Magnetic Particle Testings (P.T & M.T) of S.S welded sheet, stationary blade of 1st stage Gas Turbine Blade & Gate Valve Seat, Magnetic Particle Test (M.T) HP Turbine's Inner Casing Upper Half.
- Radiography Testing of welded Boiler Tubes pieces.

Gas Turbine Combine Cycle Power Generation Technology

- GTCC power technology discoursed with massive interest in enthusiasm.
- Control System of the Yanai Power Plant discussed.
- Yanai Power Plant site visited twice.

Problems Faced By Gencos

Plant Maintenance

Description of Problems	Causes
1. Traditional Maintenance procedures.	The maintenance management frame work has not been strengthened with innovative technics & procedures.
2. Lack of time & cost beneficial maintenance activities.	Unavailability of advanced (tools & plants UTM, Laser Alignment, Vibration Analyzer & Balancer etc.) & their usage.
3. Modern Maintenance Management software for planning, organizing, conducting & controlling maintenance activities are not in practiced.	Advanced maintenance oriented data based management system (DBMS) is not functional yet.
4. On the Job Training (OJT) methods are not framed at Gencos.	The programmed training methods have not been replaced or strengthen the most with the innate progressive form of the training i.e. OJT.

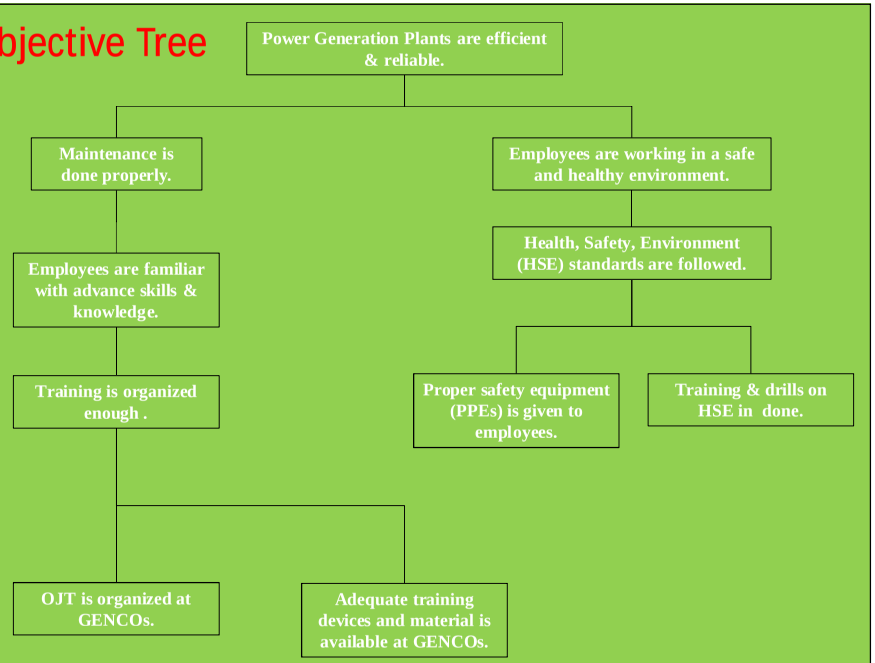
Problems Faced By Gencos

Health, Safety & Environment

Description of Problems	Causes
1. HSE standards are not followed.	a. HSE departments have not been developed in Gencos. b. Unavailability of the PPEs.
2. HSE Trainings are not framed for Gencos Employees.	An integrated safety training program has not been introduced though the limited safety training courses are carried out time to time.
3. Safety drills are not carried out in order to meet the emergencies.	Due to unavailability of a systematic & independent HSE directorate, the culture of regular safety drills has not been established, yet.

Remedial Measures For Problems

Objective Tree



Implementation of health, safety & environment procedures in Gencos

1. Importance of adopting Personal Protection Equipment (PPEs) including safety helmet, safety goggles, safety shoes, dangries, hand gloves, ear muffs, safety belt, chemical protecting safety kit & first aid medical kit.

2. Implementation of drills for health & safety to meet emergencies.

Implementation of Effective Maintenance In Gencos

Training methodology: On Job Training (OJT)

1. Effective procedures for inspecting & repairing or replacement of rotary & stationary equipment.

2. Online vibration monitoring / assessment (Monitoring during machine operation)

This equipment is not available at Genco-II Guddu & GTCC Kotri.

3. Ultrasonic Thickness Measuring devices & methods.

(This equipment is not available in any Genco)

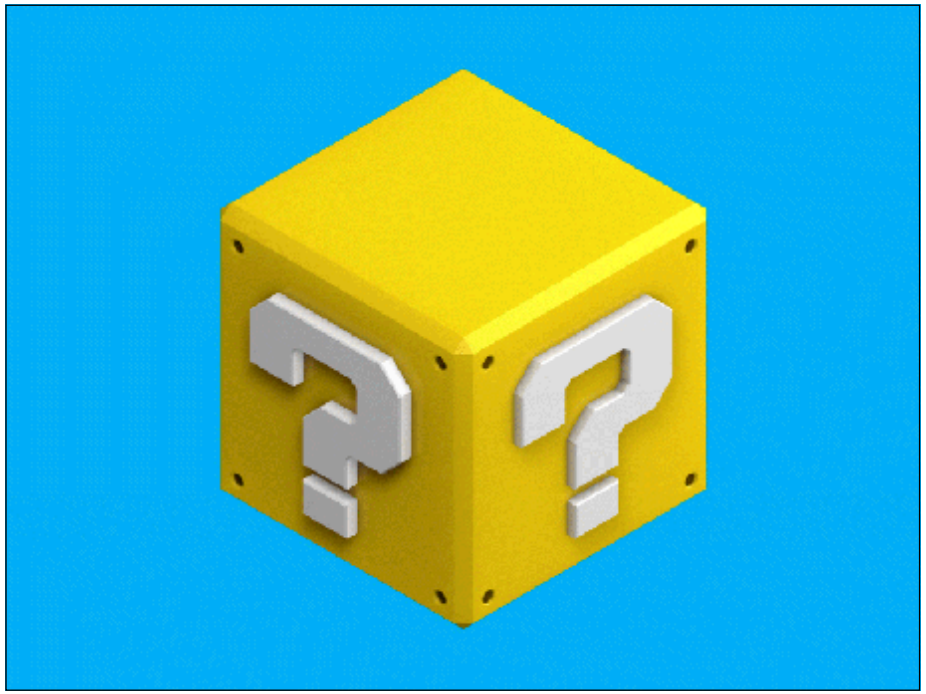
4. Laser Alignment of Rotary Equipment.

(This equipment is not available in Genco-I & Genco-II)

Limitations of Proposed Training

Potential Achievement	Capacity Development of GENCOs Employees
Person & Section in charge	Chief Executive Officer of concerned GENCOs
Nature of the Training Course	On-the-Job Training (OJT)
Venue of the Training	Respective GENCOs
Financial Resources	Concerned GENCOs
Training, Material & Equipment	UTM, Laser Alignment Device, Online Vibration Analyzer & Balancer & PPEs are essentially required for accomplishment of training.
Proposed Trainees	Engineers & Technicians of GENCOs
Proposed Trainers	JICA trainees/ other power plant engineers & Technicians

TECHNICAL VISIT OF MHPS (KURE/HITACHI)




A BIG
THANK
YOU!

Detailed Plan of the Training

Name of the Power Plant: Gencos TPS

Title of the Training	
Person/Section in charge	
Engineer	
Things that have to be considered in implementing the Training	
- Venue: Mechanical section - Facilities, equipment etc.: White board, Measuring tool, Lifting tool - Lecturers: Foreman - Financial source: Authority (C.E.O / Resident engineer) - Risks (possible obstacles): Work load due to unexpected maintenance work	
Target Group of the Training: Less skilled technicians	
Syllabus	Timeframe
1) We can improve the quality of maintenance work by referring the manufacturer's books.	6 weeks(4 persons each week, 1 day each week, 1 hour per OJT)
2) To guide the staff member for proper use measuring tools on site / work place.	6 weeks
3) Group discussion for sharing the knowledge about fault and results after maintenance.	6 weeks
4) How to load and unload the equipment properly, proper usage of lifting equipment.	6 weeks
5) Importance of meeting	6 weeks
6) To explain details of OEM manual / manufacturer's books. e.g. CCGT, Pumps, Valves, Bearing, Compressor, ST, etc.	6 weeks
7) How to use measuring tools. e.g. Vernier caliper, Micrometer, Dial indicator, Depth gauge, Mechanical level, Filler gauge, Thread gauge, Measuring tap.	6 weeks
8) How to use the lifting equipment. e.g. Hydraulic jack, Chain block, D-shackle, Slings, I-bolts.	6 weeks
9) How to check the equipment during running. e.g. Feed pump, Condensate pump, Vacuum pump, Lub-oil pump, Hydraulic oil pump. Physically check, Visual check, Any sound check, Any temperature check, Lub-oil level check.	6 weeks
10) N.D.T procedure after welding work. Visual, MT, PT, UT	6 weeks
11) How to use safety equipment e.g. Goggles, Helmets, Safety shoes, Coverall, Safety belt, Safety harness, Face shield.	6 weeks
12) How to use hand tool e.g. Grinder, Drill machine, Ratchet spanner, Combination spanner, Hammer, Chisel.	6 weeks

Summary of O&M Training results

[Engineer]

Dispatch to Japan: 1st Batch Engineer

Name:

Company:

TTP:

Workplace:

Position:

Training course		Year	2018												2019												2020												Total
No	Name	Month	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	
0	(Sample) Effective maintenane Procedure and importance	Number of times					1	1	1																														3
		Number of trainees					10	15	15																														40
1	Improve the quality of maintenance work by referring the manufacturer's books.	Number of times																																					0
		Number of trainees																																					0
2	To guide the staff member for proper use measuring tools on site / work place.	Number of times																																					0
		Number of trainees																																					0
3	Group discussion for sharing the knowledge about fault and results after maintenance.	Number of times																																					0
		Number of trainees																																					0
4	Training on how to load and unload the equipment properly, proper usage of lifting equipment.	Number of times																																					0
		Number of trainees																																					0
5	To explain details of OEM manual / manufacturer's books. e.g. CCGT, Pumps, Valves, Bearing, Compressor, ST, etc.	Number of times																																					0
		Number of trainees																																					0
6	Training on how to use measuring tools. e.g. Vernier caliper, Micrometer, Dial indicator, Depth gauge, Mechanical level, Filler gauge, Thread gauge, Measuring tap.	Number of times																																					0
		Number of trainees																																					0
7	Training on how to use the lifting equipment. e.g. Hydraulic jack, Chain block, D-shackle, Slings, I-bolts.	Number of times																																					0
		Number of trainees																																					0
8	Training on how to check the equipment during running. e.g. Feed pump, Condensate pump, Vacuum pump, Lub-oil pump, Hydraulic oil pump. Physically check, Visual check, Any sound check, Any temperature check, Lub-oil level check.	Number of times																																					0
		Number of trainees																																					0
9	Training on N.D.T procedure after welding work. Visual, MT, PT, UT	Number of times																																					0
		Number of trainees																																					0
10	Training on how to use safety equipment e.g. Goggles, Helmets, Safety shoes, Coverall, Safety belt, Safety harness, Face shield.	Number of times																																					0
		Number of trainees																																					0
11	Training on how to use hand tool e.g. Grinder, Drill machine, Ratchet spanner, Combination spanner, Hammer, Chisel.	Number of times																																					0
		Number of trainees																																					0
12		Number of times																																					0
		Number of trainees																																					0
13		Number of times																																					0
		Number of trainees																																					0
14		Number of times																																					0
		Number of trainees																																					0
15		Number of times																																					0
		Number of trainees																																					0

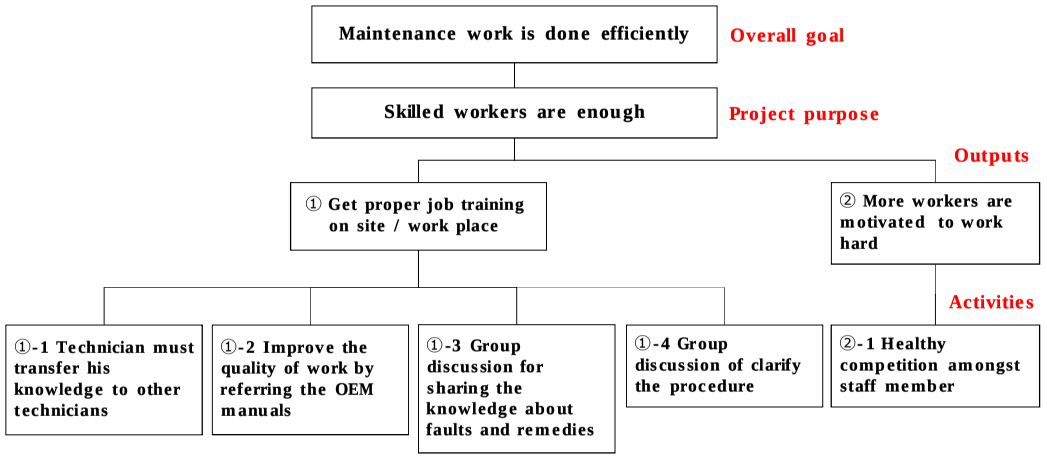
Capacity Building & Strengthening of Thermal Power Generation

Operation & Maintenance , Pakistan 2017

(Technician)

Action Plan

< Pakistan >



Detailed Plan of the Training

Name of the Power Plant: TPS Guddu, TPS Muzaffargarh, TPS Jamshoro

Title of the Training	
Improve the quality of technicians through on job training	
Person/Section in charge	
GENCOs CEO	
Things that have to be considered in implementing the Training	
- Venue: Mechanical section - Facilities, equipment etc.: White board, Measuring tool, Lifting tool - Lecturers: Foreman - Financial source: Authority (CEO / Resident engineer) - Risks (possible obstacles): Work load due to unexpected maintenance work	
Target Group of the Training: Less skilled technicians	
Syllabus	Timeframe
1) How to load and unload the equipment properly, proper usage of lifting equipment. e.g. Hydraulic jack, Chain block, D-shackle, Slings, Eye-bolts, Come-a-long.	6 weeks(4 persons each week, 1 day each week, 1 hour per OJT)
2) How to use measuring tools. e.g. Vernier caliper, Micrometer, Dial indicator, Depth gauge, Mechanical level, Feeler gauge, Thread gauge, Measuring tap.	6 weeks
3) How to check the equipment during running. e.g. Feed pump, Condensate pump, Vacuum pump, Lub-oil pump, Hydraulic oil pump. Physically check, Visual check, Any sound check, Any temperature check, Lub-oil level check.	6 weeks
4) N.D.T procedure after welding work. Visual, MT, PT, UT	6 weeks
5) How to use safety equipment e.g. Goggles, Helmets, Safety shoes, Coverall, Safety belt, Safety harness, Face shield.	6 weeks

Summary of O&M Training results

[Technician]

Dispatch to Japan: 1st Batch Technician

Name:

Company:

TTP:

Workplace:

Position:

Training course		Year	2018												2019												2020												Total
No	Name	Month	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	
0	(Sample) Effective maintenane Procedure and importance	Number of times					1	1	1																														3
		Number of trainees					10	15	15																														40
1	Training on how to load and unload the equipment properly, proper usage of lifting equipment. e.g. Hydraulic jack, Chain block, D-shackle, Slings, Eye-bolts, Come-a-long.	Number of times																																					0
		Number of trainees																																					0
2	Training on how to use measuring tools. e.g. Vernier caliper, Micrometer, Dial indicator, Depth gauge, Mechanical level, Feeler gauge, Thread gauge, Measuring tap.	Number of times																																					0
		Number of trainees																																					0
3	Training on how to check the equipment during running. e.g. Feed pump, Condensate pump, Vacuum pump, Lub-oil pump, Hydraulic oil pump. Physically check, Visual check, Any sound check, Any temperature check, Lub-oil	Number of times																																					0
		Number of trainees																																					0
4	Training on how to N.D.T procedure after welding work. e.g. Visual, MT, PT, UT	Number of times																																					0
		Number of trainees																																					0
5	Training on how to use safety equipment e.g. Goggles, Helmets, Safety shoes, Coverall, Safety belt, Safety harness, Face shield.	Number of times																																					0
		Number of trainees																																					0
6		Number of times																																					0
		Number of trainees																																					0
7		Number of times																																					0
		Number of trainees																																					0
8		Number of times																																					0
		Number of trainees																																					0
9		Number of times																																					0
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10		Number of times																																					0
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13		Number of times																																					0
		Number of trainees																																					0
14		Number of times																																					0
		Number of trainees																																					0
15		Number of times																																					0
		Number of trainees																																					0

(2) Action Plan (prepared in the 2nd training in Japan for Pakistan)

Action Plan

Capacity Building & Strengthening of Thermal Power Generation Operation & Maintenance (Engineers) Pakistan

[Jan 06 – Feb 09, 2019]

Index

1. Framework of the Course

Confirmation of the project framework

- ü Bilateral co-operation between the government of Pakistan & the government of Japan.
- ü Target Type of Power Generation: Gas Turbine Combined Cycle (GTCC)
- ü Target Sites: Thermal Power Plants (TPPs) of GENCOs.

Overall goal: Technology and technical skills obtained by the project are utilized in actual O&M at GENCOs power stations.

Project Goal: Training Capacity on Maintenance of WEA and GENCOs is strengthened.

Beneficiaries: Engineers & Technicians of production companies trained by JICA and their trainees.

2. Issue Analysis (1/3)

Purpose

We recognize the current situation against the ideal one. This Issue Analysis can help us make the Action Plan regarding what is to be improved and what is to be disseminated by us.

Method of Analysis

We analyzed the ideal conditions for proper maintenance at power plants, with three categories: Human Resources, Material Resources, Institutional Resources.

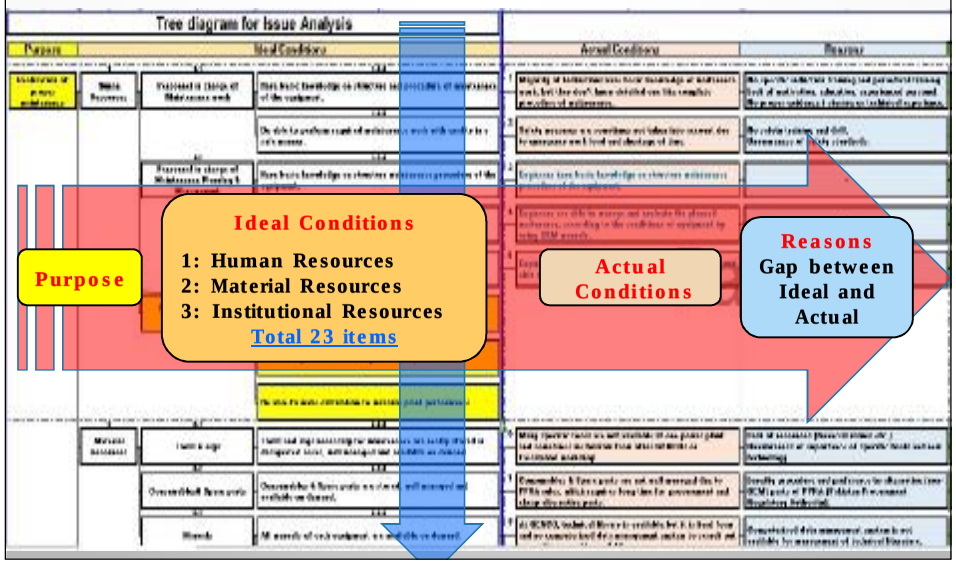
Further, we identifyed and summarized the reasons of the gaps between ideal and actual conditions.

Course theme

Realization of proper Operation & Maintenance

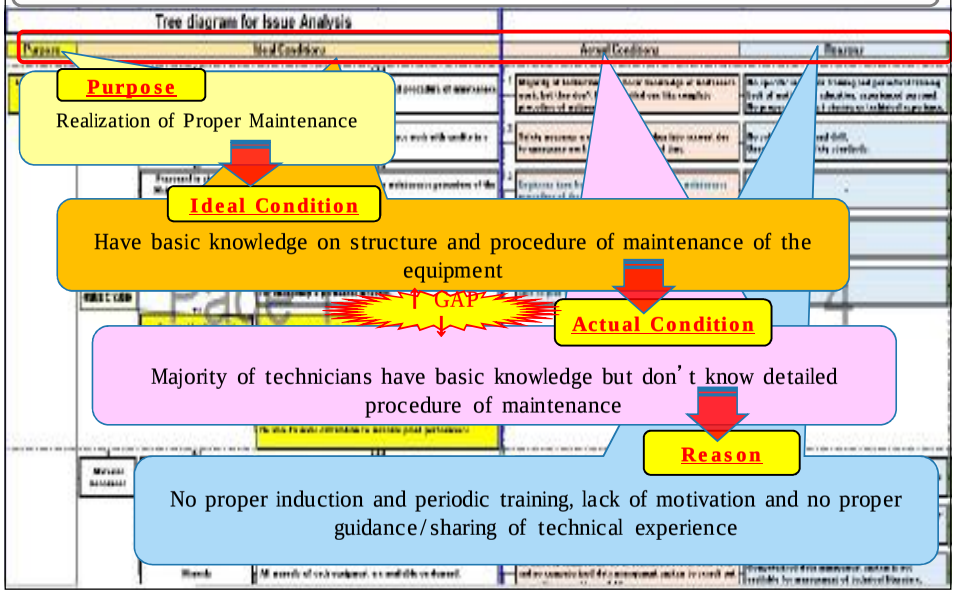
2. Issue Analysis (2/3)

We analyzed the Ideal Conditions, Actual Conditions and Reason of gap between ideal and actual conditions.



2. Issue Analysis (3/3)

An example of Issue Analysis.



3. Making the Action Plan- Methodology (1/4)

Action Plan

To bridge the gap between ideal and actual conditions, in the Issue Analysis, the skills learned through this training and the points noticed in site visits can be applied in GENCOs.

Reason for selecting the Training Item

1. To get knowledge of equipment, their troubles and failure modes.
2. Recognizing possible problems ahead of time and devising proper procedures to correct them in a scheduled way is needed to ensure the efficient and economic operations.
3. Accidents' analysis can lead to devise safety procedures.

Selected the Training Subject

1. Maintenance of Electrical Equipment (Gen., Transformer)
2. Maintenance Planning.
3. Techniques and Skills.
4. Safety and Accidents' Prevention.

3. Making the Action Plan- Electrical Equipment (2/4)

Ideal Condition

Have basic knowledge on structure and procedure of maintenance of the equipment

Actual Condition

Majority of technicians have basic knowledge but don't know detailed procedures of maintenance

Reason

No proper induction and periodic training, lack of motivation and no proper guidance/sharing of technical experience

Training Item

- Preventive Maintenance of Generators.
- Preventive Maintenance of Transformers.
- Basics of Vibration.
- Non-Destructive Inspection.

3. Making the Action Plan- Maintenance Planning (3/4)

Ideal Condition

Be able to conduct maintenance planning, draft maintenance procedures and root cause analysis of faults and plan for emergency and permanent measures.

Actual Condition

Although, the engineers are able enough to carryout maintenance planning but the system is completely manual, and therefore is largely ineffective.

Reason

The manual maintenance planning is by no means sufficient to ensure the desirable targets of availability and reliability.

Training Item

- Optimum Maintenance Planning (RBM Method).
- Efficiency Management.

3. Making the Action Plan - Safety (4/4)

Ideal Condition

Ø Be able to perform required maintenance work with quality in a safe manner.

Actual Condition

Ø Safety measures are sometime not taken into account due to emergency work load and shortage of time.

Reason

- No safety training and drill.
- Unawareness of safety standards.

Training Item

- Lessons learned from accidents.
- Experience based safety training.

4. Suggestions and Initiatives

Ø Implementation of CMMS at Power Plants.

Ø Provision of Power Plant Simulators.

Ø Acquisition of Training Apparatus.

Ø Establishment of HSE Departments at each Power Plant.

5. Impressions Regarding JICA Training

Ø Training was arranged under the aegis of JICA by KEPCO, Japan.

Ø Experienced KEPCO Engineers/Managers conducted the training.

Ø Lab work & visits of Power Plants and Manufacturing Facilities were integral part of the Training.

Ø The provided Training Materials are lucid and comprehensive.

Ø The interpretational services and presentation skills were very good.

Ø Stay at JICA Center was excellent.

Ø The introduction to Japanese culture and visit of historical site was really a good, fascination and awesome.

Ø Overall stay and experience in Japan was very rewarding and marvelous.

Thank you for your attention.

Action Plan

■Basic information

Country	**Pakistan**
Target TPP	**GHCL affiliated power generation companies**
Name of the Trainers (JICA-trained participants)	
Overall goal	**Human Resource Capacity Development for effective O&M at TPP**
Project Purpose	**Engineers and Technicians at TPPs improve their skills and knowledge on effective O&M**
Training Subjects	**1. Basic & Advance study of Electrical Equipments** **2. Implementation of Safety for Woker & Workplace**

■Detailed Plan

Survey ▼ (2019) Survey ▼ (2020)

NO.	Training Subject	Purpose		Training Item	Important Points	Trainer	Where	How	Tools	Achievements		2019 JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	2020 JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Remarks
1	Maintenance of Electrical Equipment	To be able to perform the preventive maitenance effectively and safely	1-1	Preventive Maintenance of Generators	Introduction, inspection, analysis of the result and preventive maintenance	JICA-Trained Participant	TPP	Lecture	Materials from JICA	Plan	No. of times				1							1															
											No. of participants				5							5															
										Result	No. of times																									
											No. of participants																									
			1-2	Preventive Maintenance of Transformers	Introduction, inspection, analysis of the result and preventive maintenance	JICA-Trained Participant	TPP	Lecture	Materials from JICA	Plan	No. of times				1							1															
											No. of participants				5							5															
										Result	No. of times																									
											No. of participants																									
2	Maintenance Planning	To achieve the efficient and reliable operation of TPP	2-1	Quality Control of TPP (including RBM)	Definition of Quality Control and Risk Based Maintenance	JICA-Trained Participant	TPP	Lecture	Materials from JICA	Plan	No. of times							1							1											
											No. of participants							5							5											
										Result	No. of times																									
											No. of participants																									
			2-2	Efficiency Management	Point-point efficiency calculation of all major equipment (GT, ST, HRSG etc.) of TPP	JICA-Trained Participant	TPP	Lecture	Materials from JICA	Plan	No. of times							1							1											
											No. of participants							5							5											
										Result	No. of times																									
											No. of participants																									
3	Techniques and Skills	To improve the analytical skills of personnel	3-1	Basics of Vibration	Causes and countermeasures of vibration issues for motors and generators	JICA-Trained Participant	TPP	Lecture	Materials from JICA	Plan	No. of times								1						1											
											No. of participants								5						5											
										Result	No. of times																									
											No. of participants																									
			3-2	Non Destructive Inspection	Finding the flaws of electrical equipment of TPP	JICA-Trained Participant	TPP	Lecture	Materials from JICA	Plan	No. of times								1						1											
											No. of participants								5						5											
										Result	No. of times																									
											No. of participants																									
4	Safety & Accidents Prevention	To give the awareness of importance of human and equipment safety and to protect all the members of TPP	4-1	Experienced based safety training	Importance and proper use of PPE (personnel protective equipment)	JICA-Trained Participant	TPP	Lecture OJT (Practical)	Available PPE at TPPs Materials from JICA	Plan	No. of times								1						1											
											No. of participants								5						5											
										Result	No. of times																									
											No. of participants																									
			4-2	Lessons from past accidents records	Importance of recording past accidents, root cause anlysis and sharing to avoid the same accidents in the future	JICA-Trained Participant	TPP	Lecture	TPP specific past accidents records Materials from JICA	Plan	No. of times								1						1											
											No. of participants								5						5											
										Result	No. of times																									
											No. of participants																									
5	Suggestions / initiatives	To ensure maintenance planning and scheduling, material management, trouble report and maitenance history	5-1	State-of-the-art CMMS	Procurement of CMMS	-	TPP	-	-	Result																											
		Hands on operation training	5-2	Power plant specific simulator	Procurement of simulator	-	TPP	-	-	Result																											
		To improve the analytical skills of personnel	5-3	Vibration and NDI training quipment	Procurement of training equipment	-	TPP	-	-	Result																											
		To ensure implementation of international HSE standards	5-4	Establishment of HSE section	To enroll and train HSE personnel	-	TPP	-	-	Result																											

Action Plan

Capacity Building & Strengthening of Thermal Power Generation Operation & Maintenance (Technician) Pakistan

[Jan.6 – Jan.26 2019]

独立行政法人 国際協力機構

Index

1. Framework of the Course

Confirmation of the project framework

- ü Bilateral co-operation between the government of Pakistan & the government of Japan.
- ü Target Type of Power Generation: Gas Turbine Combined Cycle (GTCC)
- ü Target Sites: Thermal Power Plants (TPPs) of GENCO and its affiliated production companies.

Overall goal: Technology and technical skills obtained by the project are utilized in actual O&M at GENCOs power stations.

Project Goal: Training Capacity on Maintenance of WEA and GENCOs is strengthened.

Beneficiaries: Engineers & Technicians of production companies trained by JICA and their trainees.

2. Issue Analysis (1/3)

Purpose

We recognize the current issue referring the ideal situation. This issue analysis can help us make the Action Plan over what should be enhanced and what should be disseminated by us.

Method of Analysis

We analyzed the ideal conditions for proper maintenance at power plants, with three categories: Human Resources, Material Resources, Institutional Resources.

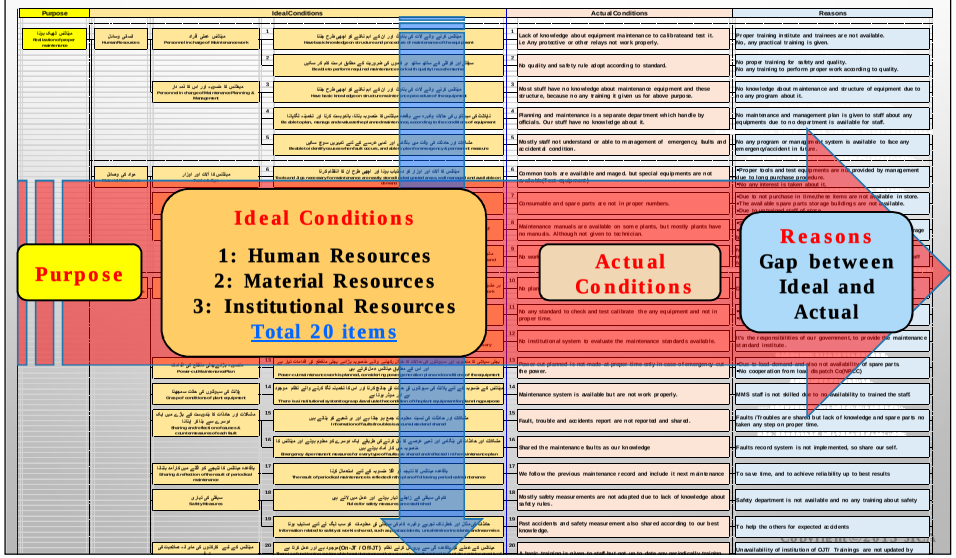
We observed and summarized the reasons of the gap between ideal and actual condition.

Course theme

Realization of proper maintenance

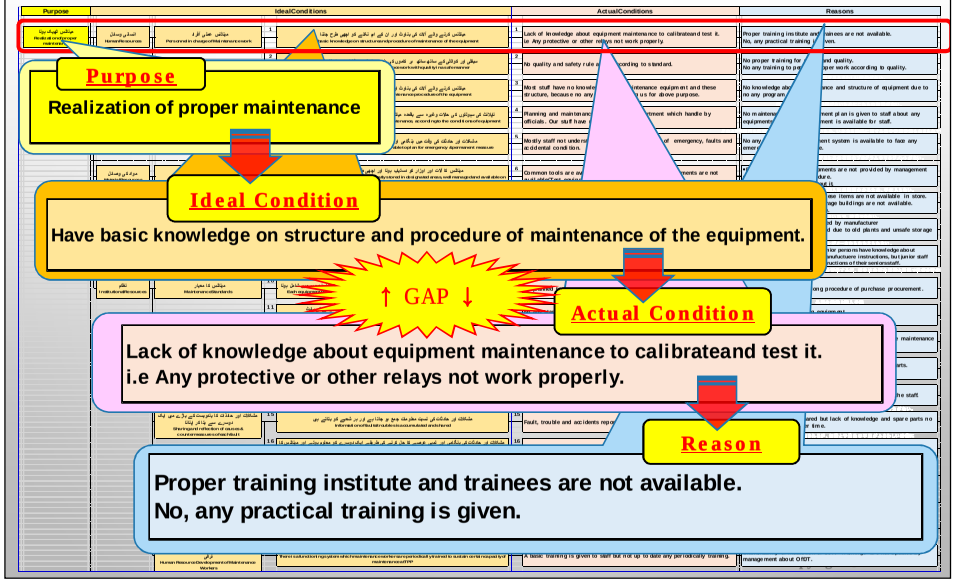
2. Issue Analysis (2/3)

We analyzed the Ideal Conditions, Actual Conditions and Reason of gap between ideal and actual condition.



2. Issue Analysis (3/3)

An example of Issue Analysis.



3. Making the Action Plan (1/3)

Action Plan

For the subject (the gap between ideal condition and actual condition)in the issue Analysis, the skill learned through this training or the point noticed through visiting site applied for operating our own power plants

Reason for selecting the Training Item

1. **We have studied about electric equipment including from basic knowledge to trouble and failure.**
2. **We have realized that accidents analysis leads proper procedure in a safe manner.**

Selected the Training Item

1. **Overview of the Gas Turbine Combined Cycle/Preventive Maintenance of Generators, High voltage Motors, Transformers Protection Systems of Main Electrical Equipment**
2. **Quality Training, Safety Training Prevention of Accidents and Disasters/Labor safety**

3. Making the Action Plan (2/3)

Ideal Condition

Ø **Have basic knowledge on structure and procedure of maintenance of the equipment**

Actual Condition

Ø **Lack of knowledge about equipment maintenance to calibrate and test it. i.e Any protective or other relays not work properly**

Reason

- **Proper training institute and trainees are not available.**
- **No, any practical training is given.**

Training Item

- **Overview of the Gas Turbine Combined Cycle**
- **Preventive Maintenance of Generators**
- **Preventive Maintenance of High voltage Motors**
- **Preventive Maintenance of Transformers**
- **Protection Systems of Main Electrical Equipment**
- **The outline of Insulation**

3. Making the Action Plan (3/3)

Ideal Condition

Ø Be able to perform required maintenance work with quality in a safe manner

Actual Condition

Ø No quality and safety rule adopt according to standard.

Reason

- No proper training for safety and quality.
- No any training to perform proper work according to quality.

Training Item

- Experiential Quality Training
- Experiential Safety Training
- Prevention of Accidents and Disasters
- Labor safety

Thank you for your attention.

Action Plan

■Basic information

Country	**Pakistan**
Target TPP	**JPCL, Jamshoro** **LPGCL, Lakhra** **CPGCL, Guddu** **NPGCL, Muzzaffar Garh**
Name of the Trainers (JICA-trained participants)	
Overall goal	**Human Resources for effective O&M is developed at TPP**
Project Purpose	**Technicians at TPPs improve their skills and knowledge on effective O&M**
Training Subjects	**1. Basic & Advance study of Electrical Equipments** **2. Implementation of Safety for Woker & Workplace**

■Detailed Plan

Survey ▼ (2019) Survey ▼ (2020)

NO.	Training Subject	Purpose		Training Item	Important Points	Trainer	Where	How	Tools	Achievements		2019 JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	2020 JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Remarks
1	Basic & Advance study of Electrical Equipments	Strengthen & Buildlup the Technical Staff of TPP	1-1	Overview of the Gas turbine Combined Cycle	・The latest structure o GTCC	JICA-Trained Participant	TPP	Lecture	・Textbook (provided by JICA)	Plan	No. of times			1								1														
											No. of participants			5								5														
										Result	No. of times																								
											No. of participants																								
			1-2	Preventive maintenance of Generators	・Expected failures (weak points) ・Health check (inspection measures and points)	JICA-Trained Participant	TPP	Lecture & OJT	・Textbook (provided by JICA) ・Electrical testing equipments	Plan	No. of times			1								1													
											No. of participants			5								5														
										Result	No. of times																								
											No. of participants																								
			1-3	Preventive Maintenance of High Voltage Motors	・Expected failures (weak points) ・Health check (inspection measures and points)	JICA-Trained Participant	TPP	Lecture & OJT	・Textbook (provided by JICA) ・Electrical testing equipments	Plan	No. of times					1							1													
											No. of participants					5						5														
										Result	No. of times																								
											No. of participants																								
			1-4	Preventive Maintenance of Transformers	・Expected failures (weak points) ・Health check (inspection measures and points)	JICA-Trained Participant	TPP	Lecture & OJT	・Textbook (provided by JICA) ・Electrical testing equipments	Plan	No. of times							1							1												
											No. of participants							5						5												
										Result	No. of times																								
											No. of participants																								
			1-5	Protection systems of Main Electrical Equipment	・The logic of protection relay ・The check points for health condition ・How to evaluate the test results ・How to recover from failures	JICA-Trained Participant	TPP	Lecture	・Textbook (provided by JICA)	Plan	No. of times								1							1											
											No. of participants								5						5											
										Result	No. of times																								
											No. of participants																								
			1-6	The Outline of Insulation	・Expected failures (weak points) ・Health check (inspection measures and points)	JICA-Trained Participant	TPP	Lecture	・Textbook (provided by JICA)	Plan	No. of times							1							1											
											No. of participants							5						5											
										Result	No. of times																								
											No. of participants																								
2	Implementation of Safety for Woker & Workplace	Safety of Human and Resources	2-1	Exproential Quality Training	・Experience of slight dangerous situations ・Motivation for ensuring the safety ・Put helmet on always ・Check the surrounding safety	JICA-Trained Participant	TPP	Lecture	・Textbook (provided by JICA)	Plan	No. of times			1								1														
											No. of participants			5								5														
										Result	No. of times																								
											No. of participants																								
			2-2	Prevention of Accidents and disasters	・Experience of slight dangerous situations ・Motivation for ensuring the safety ・Put helmet on always ・Check the surrounding safety	JICA-Trained Participant	TPP	Lecture	・Textbook (provided by JICA)	Plan	No. of times			1								1													
											No. of participants			5								5														
										Result	No. of times																								
											No. of participants																								
			2-3	Labour Saftey	・Experience of slight dangerous situations ・Motivation for ensuring the safety ・Put helmet on always ・Check the surrounding safety	JICA-Trained Participant	TPP	Lecture	・Textbook (provided by JICA)	Plan	No. of times		1										1													
											No. of participants		5										5													
										Result	No. of times																								
											No. of participants																								
			2-4	Exproential Safety Training	・Experience of slight dangerous situations ・Motivation for ensuring the safety ・Put helmet on always ・Check the surrounding safety	JICA-Trained Participant	TPP	Lecture	・Textbook (provided by JICA)	Plan	No. of times		1										1													
											No. of participants		5										5													
										Result	No. of times																								
											No. of participants																								

ACTION PLAN

FOR

CAPACITY BUILDING & STRUCTURING OF THERMAL POWER GENERATION OPERATION & MAINTENANCE PAKISTAN

Feb 03 To Feb 09, 2019

CONTENTS

- The present Training facility conditions
- Training Needs in Thermal Generation
- Utilization of the Technical Skills and Expertise acquired by Engineers & Technicians in JICA
- Introduction of proper On Job Training (OJT) in GENCOs
- Enhancement of Training Facilities in Regional Training Centre, Guddu
- Establishment of exclusive Training Facility Centre for Thermal Engineers at GENCO-II, Guddu

The present Training facility conditions

- After unbundling of Water And Power Development Authority (WAPDA), the management of Power sector i.e. Thermal generation , Distribution system and National Power Transmission System was separated from WAPDA and is being managed by independent BODs but the Training Facility Centres for the above sectors remained with WAPDA.
- Due to separate management domains, the Thermal Generation Trainings Syllabi was not updated on need basis.

Training Needs in Thermal Generation

- The existing trainings are made only for Career advancement and not specific for Capacity Building and Skill enhancement.
- Since trainings are not exclusively meant for bridging the gap, therefore, an employee get opportunity of training after a long period.
- Trainings are beneficial to all employees and if delivered under a proper methodology and framework, can be much beneficial.

Utilizing the Technical Skills and Expertise acquired by Engineers & Technicians in JICA

- JICA under Capacity Building Program imparted training to Technicians and Engineers of Thermal Generation who acquire knowledge and skills in a best training facility centre at Japan.
- The two batches of technicians & engineers received training, can be best utilized as Trainers.
- The cutting edge knowledge acquired in Thermal Generation by GHCL/GENCOs employees to be utilized as knowledge reservoir.

Introduction of proper On Job Training (OJT) in GENCOs

- Proper framework for On Job Training (OJT) is to be developed in GENCOs by GHCL in each Thermal Generation department where services of the Technicians & Engineers who got training at JICA can be best utilized.
- The resource persons selected for OJT will be properly declared and certain incentives will be given viz;
  - Recognition Certificates will be awarded
  - To be declared champions and will be shown on meritorious display boards.
  - Financial incentives will be given in exceptional cases
  - Mentoring will be adopted as part of HR policy.

Enhancement of Training Facilities in Regional Training Centre Guddu

- Facilities in the Regional Training Centre (RTC), Guddu (GENCO-II) will be upgraded to bring at par with the present day needs.
- IN GENCOs job description for each category of employees will be prepared to set KPIs.
- Gap analysis will be made to ascertain the causes of deficiencies.
- Trained Engineers and Technicians from JICA will be blended with other trainers in RTC Guddu.
- Training aids as well as trainees residential facilities will be upgraded.

Establishment of exclusive Training Facility Centre for Thermal Engineers at GENCO-II, Guddu

- To have an exclusive training facility for Thermal Engineers, GHCL has decided to establish an independent Training Institute for all level courses at Genco-II, Guddu where infrastructure is available.
- Faculty will be taken from the field formations including the Engineers of Mechanical & Electrical disciplines who got training at JICA.
- Besides mandatory trainings required for career advancement, capacity building courses will be framed to enhance the knowledge & sharpen the existing skills.
- Short term courses will be introduced viz;
  - Induction/beginners courses
  - Refresher courses
  - Sector Specific courses
  - Advance Engineering Management courses

RECOMMENDATIONS:-

- For Capacity Building of Thermal Engineers & Technicians, continuation of JICA cooperation is foremost important.
- In development of Training Syllabi the expertise of JICA experts will be availed.
- The modern day Training aids and equipment are required for which cooperation of JICA is solicited.
- Coordination between JICA and GHCL is to be further enhanced and partnership developed to make the Action Plan possible.

Thank you

Arigatou Gozaimasu

Capacity Building & Strengthening of Thermal Power Generation Operation and Maintenance for Managers
Pakistan (Feb.03-Feb-09)

- In Cooperation by JICA

Index

- Frame work of the Course
- Issue Analysis
- Making the Action Plan

1.Frame work of the Course
Confirmation of the Project frame work

- Bilateral Cooperation between the government of Pakistan & the government of Japan
- Target Type of Power Generation Gas Turbine Combined Cycle(GTCC)
- Target Sites: Thermal Power Plants(TPPs) of GENCO and its affiliated Production Companies.

Overall goal: Technology and Management skills obtained by the project would be utilized in actual WEA Performance.

Project Goal: Training Capacity on Maintenance of TPP at WEA and GENCOs is strengthened.

Beneficiaries: Managers of WEA & GENCOs trained by JICA and their trainees.

2.Issue Analysis

- **Purpose**

Recognize the current issue referring the ideal situation. This Issue Analysis can help us make the Action Plan over what should be enhanced and what should be disseminated by us.

§ Method of Analysis

Analyzed the ideal condition for Proper Human Resources Development and Capacity Building at WEA With Following

- Human Resources
- Material Resources
- Institutional Resources

2.Issue Analysis Cont..

We Observed and Summarized the reason of the gap between ideal and actual conditions.

§ Method of Analysis

Realization of proper HRD

2.Issue Analysis Cont..

- Analyzed
  - Ideal Conditions
  - Actual Conditions
  - Reasons of gap between ideal and actual conditions

3. Action Plan

- GM/Principal WEA will be approached regarding updating of training material
- GM/Principal may be realized for need of rehabilitation of lab/Training Equipment's
- Efforts would be made to make training plan as per GENCO need basis
- Evaluation Criteria of Trainees would be reviewed

3. Action Plan

- Incentives for trainers at WEA must be enhanced
- TOT should be introduced (local/foreign)

(3) Action Plan (prepared in the 3rd training in Japan for Pakistan)

Action Plan

Capacity Building & Strengthening
of Thermal Power Generation
Operation & Maintenance (Engineer)
Pakistan
[Jan.23 – Feb.15 2020]

Index

1. Framework of the Course

Confirmation of the project framework

- ü Bilateral co-operation between the government of Pakistan & the government of Japan.
- ü Target Type of Power Generation: Conventional Type (Gas, Coal and Oil) and Gas Turbine Combined Cycle (GTCC)
- ü Target Sites: Thermal Power Plants (TPPs) of GENCOs.

Overall goal: Technology and technical skills obtained by the project are utilized in actual O&M at GENCOs power stations.

Project Goal: Training Capacity on Maintenance of WEA and GENCOs is strengthened.

Beneficiaries: Engineers & Technicians of production companies trained by JICA and their trainees.

2. Issue Analysis (1/3)

Purpose

Our aim is to deliver the knowledge and methods we have learned and gained during our training in Japan in order to minimize the gap between actual and ideal situation at our TPP.

Course theme

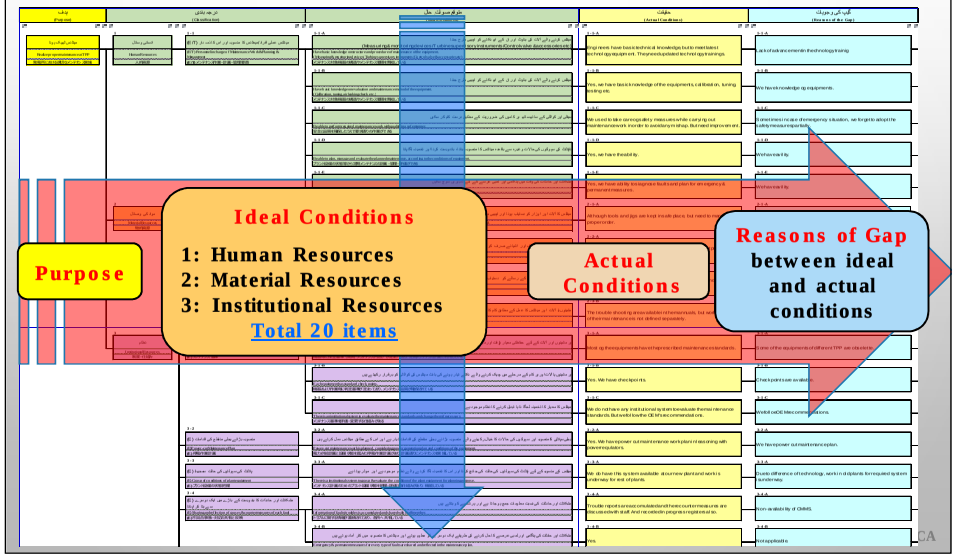
Realization of proper maintenance

Method of Analysis

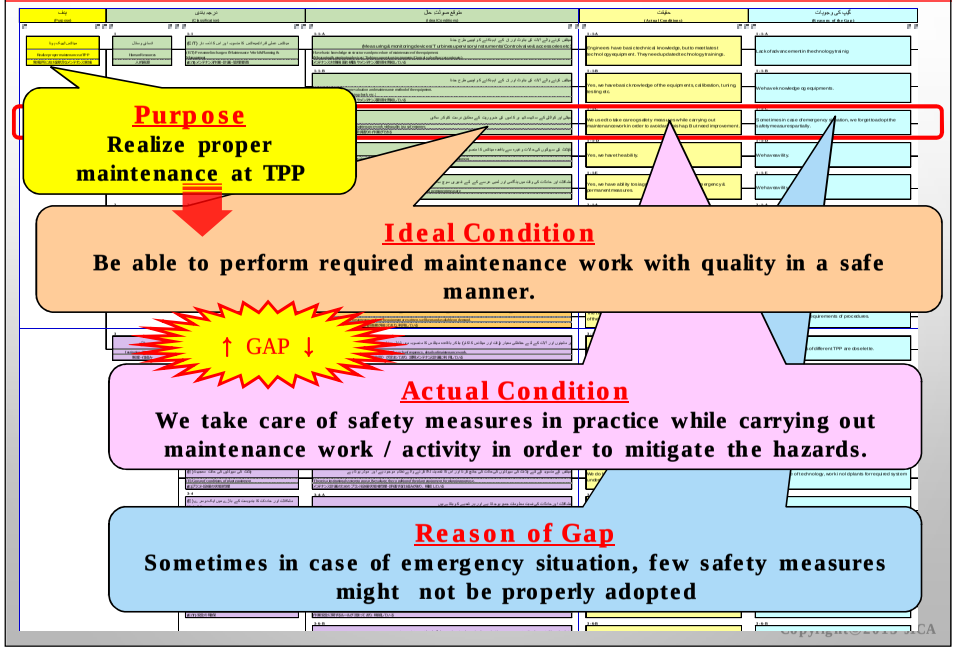
For the sake of issue analysis, carried out the meetings and had discussions to find out the deficiencies in certain skills considering the ideal situation.
In meetings deficiency level was quantified and same would be addressed by utilizing Human Resources, Material Resources and Institutional Resources.

2. Issue Analysis (2/3)

We analyzed the Ideal Conditions, Actual Conditions and Reason of gap between ideal and actual condition.



2. Issue Analysis (3/3)



3. Making the Action Plan (/)

Purpose of making the Action Plan

The purpose of making the action plan is to implement the best practices which we have learned in Japan to enhance the quality of work and performance of our TPPs.

Detail of the Action Plan

1. **Training for technical staff on TPPs**
   (I&C Maintenance)
   1-1. Overview of Measuring and Monitoring Device (Pressure, Temperature, Level, Flow Rate)
   1-2. Maintenance of Measuring and Monitoring Device (Pressure, Temperature)
   1-3. Overview of Gas Turbine Combined Cycle Power Generation Control System and maintenance.
   1-4. Overview of Turbine Supervisory Instrument (Lecture Only)
   (General)
   2-1. Experience Based Safety Training
   2-2. Toolbox Meeting (TBM)
2. **Activity on actual work**
   Tool box meeting (TBM) before actual work

3-1. Training for technical staff on TPPs (1/2)

Training Item

Overview of Measuring and Monitoring Device (Pressure, Temperature, Level, Flow Rate)

Ideal Condition

Have basic knowledge on evaluation and maintenance method of the equipment (Calibration, Tuning, Air Leaking check etc)

Actual Condition

Yes, We have basic knowledge of the equipment's, calibration, tuning and testing etc

Reason of Gap

There is no significant gap but sometime due to lack of advance calibration equipment, minor gap might be there.

3-1. Training for technical staff on TPPs (2/2)

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Training Item

Experience Based Safety Training

Ideal Condition

Be able to perform required maintenance work with quality in a safe manner

Actual Condition

We take care of safety measures in practice while carrying out maintenance work / activity in order to mitigate the hazards.

Reason of Gap

Sometimes in case of emergency situation, few safety measures might not be properly adopted

3-2. Activity on actual work

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Activity Item

Tool box meeting (TBM) before actual work

Ideal Condition

TBM provide an opportunity to communicate among engineers, technicians and workers about how the safety at the work place can be ensured.

Actual Condition

We conduct the general meeting regarding preparation and safety measures before commencement of the job

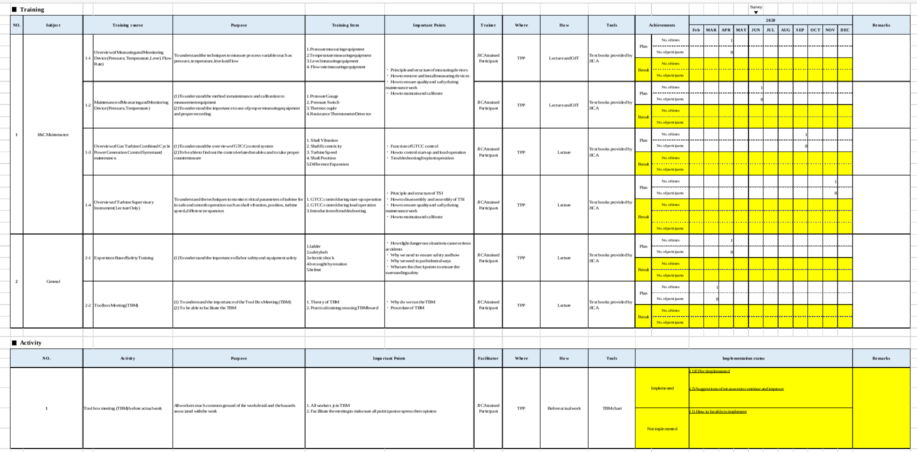
Reason of Gap

We will conduct meeting for specific job and its safety measures by using TBM template.

3-3. Making the Action Plan Format

10

We made the detail Action Plan (including schedule, magnitude, frequency etc.) as below. This format will be utilized to record our activities and report to JICA Expert Team.



4. Suggestions and Initiatives

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To make the training effective, it is imperative to have the training centers well equipped and also practical exercise of the training lectures delivered to the trainees must be conducted.

To strengthen the training capacity on O&M and to ensure effective training, well equipped training facilities such as Control valve tuning facilities, vibration conditioning monitoring system training facilities, exhibition hall for the accidents and dissemination platform among the TPPs etc need to be established.

Initiatives are required from the management end to establish well equipped training centers and on job training programs for trainees should be arranged in order to make the training program more effective.

5. Impressions Regarding the JICA Training (1/2)

Ø **Mr. Saeed Ahmed Shaikh**
The Jica Training program and procedure is very much informative and will be helpful for enhancing the quality of work in a safe manner.

Ø **Mr. Muhammad Asif Siddiqui**
I have observed a great man less with Artificial Intelligence, automation and control system. Like in railway ticketing system, door opening system, and automation in Power plants.

Ø **Mr. Muhammad Adnan Bashir**
I appreciate the efforts JICA taking to improve the performance standards of TPP. This training enhanced my technical knowledge and added a lot to my long lasting memories.

Ø **Mr. Faisal Naeem**
Labs in Techno Center of KANSAI are fully functional and very helpful to understand the basic concept as well as for hands on experience.

5. Impressions Regarding the JICA Training (2/2)

Ø **Mr. Farrukh Riaz**
JICA Training program was a great experience for me beside gaining technical knowledge to know about the Japanes culture and people was like thing of beauty. One of the best days of my life I have spent here.

Ø **Mr. Khalil Ahmed Shaikh**
I have observed lot of things here in Japan, Japnese people do very excellence specially I mention here punctuality of time and cleanliness. Japanese people do not compromise on it.

Ø **Mr. Naimat Ullah Khan**
The training program arranged by JICA was very informative. The way of teaching at JICA Training centers was very excellent and the method adopted by the KANSAI Electric and Shimadzu was upto the mark. Besides technical knowledge I have learnt social norms of Japanese culture.

Ø **Mr. Suhail Ahmed Qureshi**
I found this training comprehensive that concludes all aspects technical, procedural and administrative. It will benefit us not only in plant life but in social life also. A great long lasting memories.

Thank you for your attention.

■ Basic information

Country	**Pakistan**
Target TPP	**GHCL, Jamshoro TPS (JPCL), Guddu TPS (CPGCL), Muzaffargarh TPS (NPGCL), Nandipur TPS (NPGCL)**
Name of the Trainers (JICA-trained participants)	**Mr. Saeed Ahmed Shaikh, Mr. Asif Sildiui, Mr. Suhail Ahmed Qureshi, Mr. Naimat Ullah Khan, Mr. Adnan Bashir, Mr. Khalil Ahmed Shaikh, Mr. Faisal Naeem, Mr. Farrukh Riaz**
Overall goal	**Technology and technical skills obtained by the project are utilized in actual O&M at GENCOs power stations.**
Project goal	**Training Capacity on Maintenance of WEA and GENCOs is strengthened.**
Subjects	**[Training]** **(I&C Maintenance)** **1-1. Overview of Measuring and Monitoring Device (Lecture)** **1-2. Maintenance of Measuring and Monitoring Device (Practice)** **1-3. Overview of Turbine Supervisory Instrument** **1-4. Overview of Gas Turbine Combined Cycle Power Generation Control System and Maintenance** **(General)** **1. Tool Box Meeting (TBM)** **2. Exerience-based Safety Training** **[Activity]** **1. Tool box meeting (TBM) before actual work**

■ Training

Survey ▼

NO.	Subject		Training course	Purpose	Training Item	Important Points	Trainer	Where	How	Tools	Achievements		2020 Feb	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Remarks
(ex.)	I&C Maintenance	ex.	Overview of Measuring and Monitoring Device (Pressure, Temperature, Level, Flow Rate)	To understand the techniques to measure process variables such as pressure, temperature, level and flow	1. Pressure measuring equipment 2. Temperature measuring equipment 3. Level measuring equipment 4. Flow rate measuring equipment	・Principle and structure of measuring devices ・How to remove and install measuring devices ・How to ensure quality and safty during maintenance work ・How to maintain and calibrate	JICA trained Participant	TPP	Lecture and OJT	Manufacturer's Manuals and Text books provided by JICA	Plan	No. of times		1				1					
												No. of participants		10				10					
											Result	No. of times		1				1			1		
												No. of participants		10				9			10		
1	I&C Maintenance	1-1	Overview of Measuring and Monitoring Device (Pressure, Temperature, Level, Flow Rate)	To understand the techniques to measure process variables such as pressure, temperature, level and flow	1. Pressure measuring equipment 2. Temperature measuring equipment 3. Level measuring equipment 4. Flow rate measuring equipment	・Principle and structure of measuring devices ・How to remove and install measuring devices ・How to ensure quality and safty during maintenance work ・How to maintain and calibrate	JICA trained Participant	TPP	Lecture and OJT	Text books provided by JICA	Plan	No. of times				1							
												No. of participants				8							
											Result	No. of times											
												No. of participants											
		1-2	Maintenance of Measuring and Monitoring Device (Pressure, Temperature)	(1)To understand the method to maintenance and calibration to measurement equipment (2)To understand the importance to use of proper measuring equipment and proper recording	1. Pressure Gauge 2. Pressure Switch 3. Thermocouple 4. Resistance Thermometer Detector		JICA trained Participant	TPP	Lecture and OJT	Text books provided by JICA	Plan	No. of times						1					
												No. of participants						8					
											Result	No. of times											
												No. of participants											
		1-3	Overview of Gas Turbine Combined Cycle Power Generation Control System and maintenance.	(1)To understand the overview of GTCC control system (2)To be able to find out the control-related troubles and to take proper countermeasure	1. Shaft Vibration 2. Shaft Eccentricity 3. Turbine Speed 4. Shaft Position 5. Difference Expansion	・Function of GTCC control ・How to control start-up and load operation ・Troubleshooting for plant operation	JICA trained Participant	TPP	Lecture	Text books provided by JICA	Plan	No. of times								1			
												No. of participants								8			
											Result	No. of times											
												No. of participants											
		1-4	Overview of Turbine Supervisory Instrument (Lecture Only)	To understand the techniques to monitor critical parameters of turbine for its safe and smooth operation such as shaft vibration, position, turbine speed, difference expansion	1. GTCC control during start-up operation 2. GTCC control during load operation 3. Introduction of troubleshooting	・Principle and structure of TSI ・How to disassembly and assembly of TSI ・How to ensure quality and safty during maintenance work ・How to maintain and calibrate	JICA trained Participant	TPP	Lecture	Text books provided by JICA	Plan	No. of times											1
												No. of participants											8
											Result	No. of times											
												No. of participants											
2	General	2-1	Experience Based Safety Training	(1)To understand the importance of labor safety and equipment safety	1.ladder 2.safety belt 3.electric shock 4.be caught by rotation 5.helmet	・How slight dangerous situations cause serious accidents ・Why we need to ensure safety and how ・Why we need to put helmet always ・What are the check points to ensure the surrounding safety	JICA trained Participant	TPP	Lecture	Text books provided by JICA	Plan	No. of times				1							
												No. of participants				8							
											Result	No. of times											
												No. of participants											
		2-2	Toolbox Meeting (TBM)	(1) To understand the importance of the Tool Box Meeting (TBM) (2) To be able to facilitate the TBM	1. Theory of TBM 2. Practical training on using TBM board	・Why do we run the TBM ・Procedure of TBM	JICA trained Participant	TPP	Lecture	Text books provided by JICA	Plan	No. of times			1							
												No. of participants			8							
											Result	No. of times											
												No. of participants											

- Photograph when trainiig
- Training report
- Attendance list

■ **Activity**

NO.	Activity	Purpose	Important Points	Facilitator	Where	How	Tools	Implementation status		Remarks
(ex.)	Tool box meeting (TBM) before actual work	All workers reach common ground of the work detail and the hazards associated with the work	1. All workers join TBM 2. Facilitate the meeting to make sure all participants express their opinion	JICA trained Participant	TPP	Before actual work	TBM chart	Implemented	(1) Effect implemented > Job accidents have been reduced (2) Suggestions of measures to continue and improve > Perform TBM before all work at the power plant > Provide TBM training for all workers at the power plant	> Photograph when TBM at actual I&C maintenance work
								Not implemented	(1) How to be able to implement N/A	
1	Tool box meeting (TBM) before actual work	All workers reach common ground of the work detail and the hazards associated with the work	1. All workers join TBM 2. Facilitate the meeting to make sure all participants express their opinion	JICA trained Participant	TPP	Before actual work	TBM chart	Implemented	(1) Effect implemented (2) Suggestions of measures to continue and improve	
								Not implemented	(1) How to be able to implement	

Action Plan

Capacity Building & Strengthening
of Thermal Power Generation
Operation & Maintenance (Technician)
Pakistan
[Jan.13 – Feb.1 2020]

Index

1. Framework of the Course

Confirmation of the project framework

- ü Bilateral co-operation between the government of Pakistan & the government of Japan.
- ü Target Type of Power Generation: Conventional Type (Gas, Coal and Oil) and Gas Turbine Combined Cycle (GTCC)
- ü Target Sites: Thermal Power Plants (TPPs) of GENCOs.

Overall goal: Technology and technical skills obtained by the project are utilized in actual O&M at GENCOs power stations.

Project Goal: Training Capacity on Maintenance of WEA and GENCOs is strengthened.

Beneficiaries: Engineers & Technicians of production companies trained by JICA and their trainees.

2. Issue Analysis (1/3)

Purpose

We recognize the current issue referring the ideal situation. This issue analysis can help us make the Action Plan over what should be enhanced and what should be disseminated by us.

Method of Analysis

We analyzed the ideal conditions for proper maintenance at power plants, with three categories: Human Resources, Material Resources, Institutional Resources.

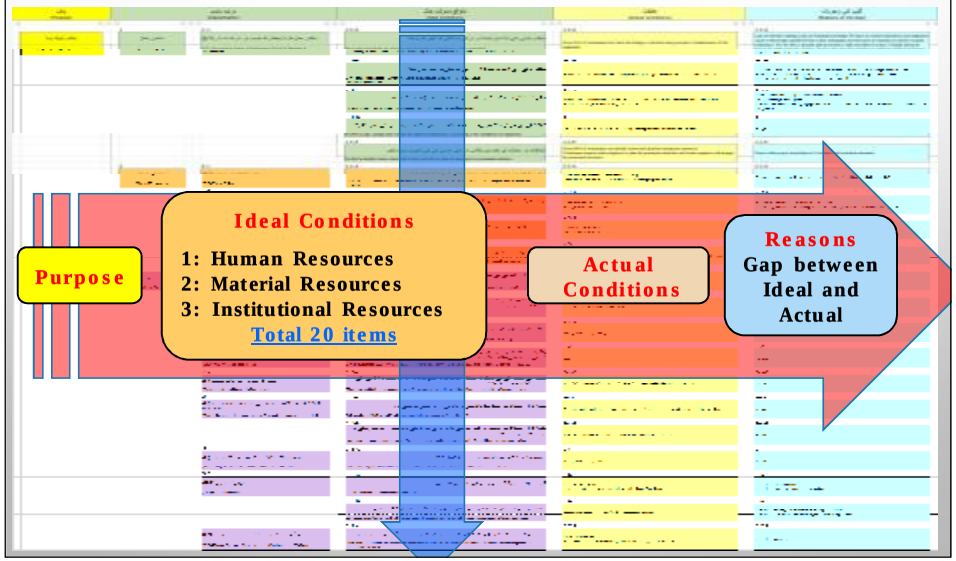
We observed and summarized the reasons of the gap between ideal and actual condition.

Course theme

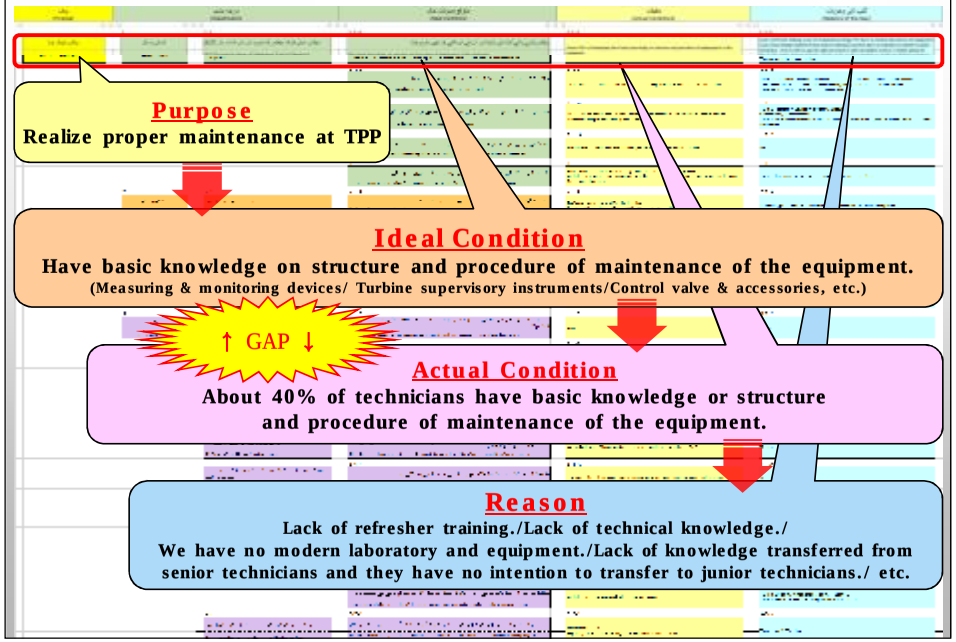
Realization of proper maintenance

2. Issue Analysis (2/3)

We analyzed the Ideal Conditions, Actual Conditions and Reason of gap between ideal and actual condition.



2. Issue Analysis (3/3)



3. Making the Action Plan

Reason for making the Action Plan

Build efficient human resources by sharing what we have learned through training for ideal power plant maintenance. And move the country towards development.

Action Plan

1. Training for technical staff on TPPs
   - (1) Overview of Measuring and Monitoring Device (Pressure, Temperature, Level, Flow Rate)
   - (2) Maintenance of Measuring and Monitoring Device (Practice)(Pressure, temperature)
   - (3) Overview of Control Valve and Accessories
   - (4) Maintenance of Control Valve and Accessories (Practice)
   - (5) Copper Pipe Flaring and Seal Taping
   - (6) Control Cable and Terminal Treatment
   - (7) Introduction of The Kansai Electric Power Co., Inc. , etc.
   - (8) Experiential Quality Training, etc.
   - (9) Tool Box Meeting (TBM)
2. Activity on actual work
   - (1) Apply practical knowledge/maintenance skill learned in Japan to actual work

3-1. Training for technical staff on TPPs (1/2)

Training Item

Overview of Measuring and Monitoring Device
(Pressure, Temperature, Level, Flow Rate)

Ideal Condition

Have basic knowledge on structure and procedure of maintenance of the equipment. (Measuring & monitoring devices/ etc.)

Actual Condition

About 40% of technicians have basic knowledge or structure and procedure of maintenance of the equipment.

Reason

Lack of technical knowledge, etc.

3-1. Training for technical staff on TPPs (2/2)

Training Item

Tool Box Meeting (TBM)

Ideal Condition

Rules for safety measures are established.

Actual Condition

There are safety rules.
However, safety rules are not well organized and functional.

Reason

There is no safety culture. There is no awareness and attention to safety.

3-2. Activity on actual work

Activity Item

Apply practical knowledge/maintenance skill learned in Japan to actual work

Ideal Condition

To perform the quality work

Actual Condition

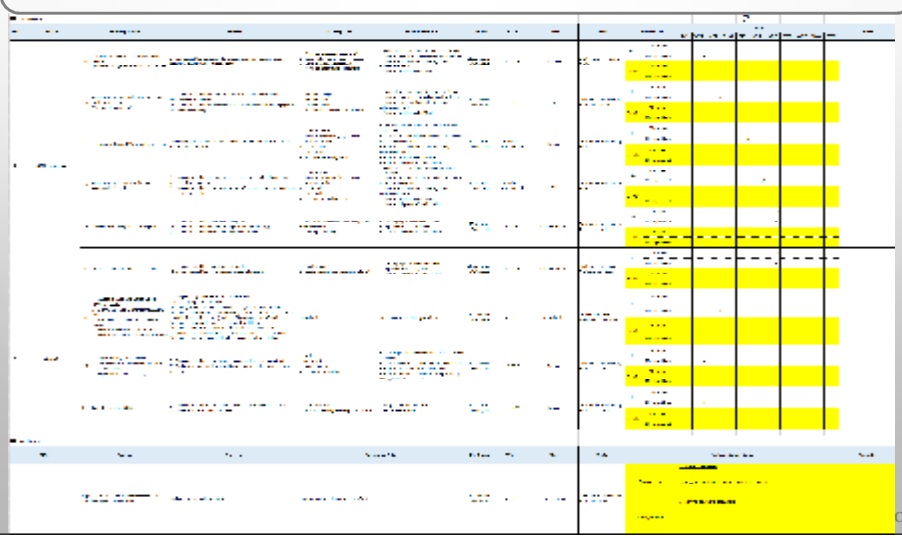
About 30% of technicians can perform maintenance work in a quality manner.

Reason

There are few relevant testing equipment for accuracy, module cards, modern equipment and electronic component.

3-3. Making the Action Plan Format

We made the detail Action Plan (including schedule, etc.) as below. This format will be utilized to record our activities and report to JICA Expert Team.



4. Suggestions and Initiatives

What:

1. Conduct training and schedule
2. Attention to staff to join training on time
3. Provide environment for refresher training and on job training

Who:

Concern Authority

5. Impressions Regarding the JICA Training

Ø **Mr. Muhammad Zahid Akhtar**

All of you gave me on unforgettable memories about your country and about your Japanese. Thanks JICA.

Ø **Mr. Muhammad Usman Khan**

I have never experienced this kind of training before.

Ø **Mr. Anwar Ali**

Excellent course and training it was way beyond our expectation and very much relevant to our scope of responsibility ahead at our work place. I miss you Mr. Kameyama in Pakistan lot off.

Ø **Mr. Abdul Toheed**

A tribute to JICA Management to complete so many programs on time.

5. Impressions Regarding the JICA Training

Ø **Mr. Shahid Masood**

JICA training is very useful for me. Thankful JICA.

Ø **Mr. Muhammad Ijaz**

Thanks JICA to provide me a great opportunity to learn and see the great country Japan.

Ø **Mr. Asad Ullah**

The JICA staff is punctual, devoted and committed with his duties.

Ø **Mr. Noor Hussain**

Thank you JICA for arrange this kind of program for us and also all training teacher and kindly Mr. Kameyama thankful.

Thank you for your attention.

■ **Basic information**

Country	**Pakistan**
Target TPP	**Kotri GTPS (JPCL), Guddu TPS (CPGCL), Muzaffargarh TPS (NPGCL), Lakhra (LPGCL)**
Name of the Trainers (JICA-trained participants)	
Overall goal	**Technology and technical skills obtained by the project are utilized in actual O&M at GENCOs power stations.**
Project goal	**Training Capacity on Maintenance of WEA and GENCOs is strengthened.**
Subjects	**[Training] (I&C Maintenance) 1. Overview of Measuring and Monitoring Device (Pressure, Temperature, Level, Flow Rate) 2. Maintenance of Measuring and Monitoring Device (Practice) (Pressure, temperature) 3.Overview of Control Valve and Accessories 4.Maintenance of Control Valve and Accessories (Practice) 5.Copper Pipe Flaring and Seal Taping 6.Control Cable and Terminal Treatment (General) 1.Introduction of The Kansai Electric Power Co., Inc. , etc. 2.Experiential Quality Training, etc. 3.Tool Box Meeting (TBM) [Activity] 1. Apply practical knowledge/maintenance skill learned in Japan to actual work**

■ **Training**

Survey ▼

NO.	Subject		Training course	Purpose	Training Item	Important Points	Trainer	Where	How	Tools	Achievements		2020 Feb	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Remarks
(ex.)	I&C Maintenance	ex.	Overview of Measuring and Monitoring Device (Pressure, Temperature, Level, Flow Rate)	To understand the techniques to measure process variables such as pressure, temperature, level and flow	1. Pressure measuring equipment 2. Temperature measuring equipment 3. Level measuring equipment 4. Flow rate measuring equipment	・Principle and structure of measuring devices ・How to remove and install measuring devices ・How to ensure quality and safty during maintenance work ・How to maintain and calibrate	JICA trained Particiant	TPP	Lacture and OJT	Manufacturer's Manuals and Text books provided by JICA	Plan	No. of times		1				1						> Photograph when trainiig > Training report > Attendance list
												No. of participants		10					10					
											Result	No. of times		1				1				1		
												No. of participants		10				9				10		
1	I&C Maintenance	1-1	Overview of Measuring and Monitoring Device (Pressure, Temperature, Level, Flow Rate)	To understand the techniques to measure process variables such as pressure, temperature, level and flow	1. Pressure measuring equipment 2. Temperature measuring equipment 3. Level measuring equipment 4. Flow rate measuring equipment	・Principle and structure of measuring devices ・How to remove and install measuring devices ・How to ensure quality and safty during maintenance work ・How to maintain and calibrate	JICA trained Particiant	All TPP /TC	Lacture	Text books provided by JICA	Plan	No. of times		1										
												No. of participants		10										
											Result	No. of times												
												No. of participants												
		1-2	Maintenance of Measuring and Monitoring Device (Practice) (Pressure, temperature)	(1) To understand the method to maintenance and calibration to measurement equipment (2) To understand the importance to use of proper measuring equipment and proper recording	1. Pressure Gauge 2. Pressure Switch 3. Thermocouple 4. Resistance Thermometer Detector	・Principle and structure of measuring devices ・How to remove and install measuring devices ・How to ensure quality and safty during maintenance work ・How to maintain and calibrate	JICA trained Particiant	All TPP /TC	OJT	Text books provided by JICA and field tools	Plan	No. of times			1									
												No. of participants			10									
											Result	No. of times												
												No. of participants												
		1-3	Overview of Control Valve and Accessories	To understand functioning, components, features and types of Control Valve and Accessories	1. Control Valve 2. Electro-Pneumatic (I/P) Converter 3. Solenoid Valve 4. Lock Valve 5. Limit Switch 6. Pressure Reducing Valve	・Principle and structure of control valve and accessories ・How to disassembly and assembly of control valve and accessories ・How to ensure quality and safty during maintenance work ・How to maintain and calibrate ・How to judgment of work quality	JICA trained Particiant	Kotri and Muzaffargarh	Lacture	Text books provided by JICA	Plan	No. of times						1						
												No. of participants						10						
											Result	No. of times												
												No. of participants												
		1-4	Maintenance of Control Valve and Accessories (Practice)	(1) To understand the method to maintenance and calibration to Control Valbe and Accessories (2) To understand the importance to use of proper measuring equipment and proper recording	1. Control Valve 2. Electro-Pneumatic (I/P) Converter 3. Solenoid Valve 4. Lock Valve 5. Limit Switch 6. Pressure Reducing Valve	・Principle and structure of control valve and accessories ・How to disassembly and assembly of control valve and accessories ・How to ensure quality and safty during maintenance work ・How to maintain and calibrate ・How to judgment of work quality	JICA trained Particiant	Kotri and Muzaffargarh	OJT	Text books provided by JICA	Plan	No. of times							1					
												No. of participants						10						
											Result	No. of times												
												No. of participants												
		1-5	Copper Pipe Flaring and Seal Taping	(1) To understand the control air piping joints (2) To understand the method of copper pipe processing (3) To understand the role of seal tape and winding	1. Air piping processing and fittings for instrumentation 2. Seal tape winding	・Use of proper maintenance tools ・Importance of quality work ・How to judgment of work quality	JICA trained Particiant	All TPP /TC	Lecture and OJT	Text books provided by JICA and field tools	Plan	No. of times							1					
												No. of participants							10					
											Result	No. of times												
												No. of participants												
		1-6	Control Cable and Terminal Treatment	(1) To understand the type of control cable (2) To understand the cable terminal treatment method	1. Control cable 2. Crimp terminal and terminal treatment	・Use of proper maintenance tools ・Importance of quality work ・How to judgment of work quality	JICA trained Particiant	All TPP /TC	Lecture and OJT	Text books provided by JICA and field tools	Plan	No. of times							1					
												No. of participants							10					
											Result	No. of times												
												No. of participants												

2	General	2-1	(1) Introduction of The Kansai Electric Power Co., Inc. (2) Central Dispatch Center tour in Kansai HQ (3) Tour of RMC (Remote Monitoring Center) (4) Tour of Himeji No.2 TPS (GTCC) (5) Tour of Mitsubishi Electric Kobe Works	(1) To grasp Japanese electrical utility situation (2)(3) To grasp latest technology (4-1) To grasp O&M current situation in Japanese electrical utility (4-2) To understand the 5S methodology("Sort", "Set in order", "Shine", "Standardize" and "Sustain") and its effects on quality of work (4-3) To understand how to operate aged-facilities well (5-1) To recognize how to ensure the quality when control and instrumentation equipment (DCS, Flow mater, etc.) is manufactured. (5-2) To recognize Japanese high level manufacturing technique.	Introduction	Each trainner give there point lecture	JICA trained Participant	All TPP /TC	Introduction	Photos and plant presentation vouchers	Plan	No. of times			1									
													No. of participants			10									
												Result	No. of times													
													No. of participants													
		2-2	(1) Experiential Quality Training (2) Prevention of Accidents and Disasters (3) Labor safety (4) Experiential Safety Training	(1) To understand the importance of personnel and equipment safety (2) To be able to properly use safety equipment ready for emergency situations	1.ladder 2.safety belt 3.electric shock 4.be caught by rotation 5.helmet	・How slight dangerous situations cause serious accidents ・How to motivate workers for ensuring safety ・How to check the surrounding safety ・How to prevent accidents at workplace (e.g. putting helmet on always)	JICA trained Participant	All TPP /TC	Lecture	Text books provided by JICA and photos	Plan	No. of times		1										
													No. of participants		10										
												Result	No. of times													
													No. of participants													
		2-3	Tool Box Meeting (TBM)	(1) To understand the importance of the Tool Box Meeting (TBM) (2) To be able to facilitate the TBM	1. Theory of TBM 2. Practical training on using TBM board	・Why do we run the TBM ・Procedure of TBM	JICA trained Participant	All TPP /TC	Lecture	Text books provided by JICA and photos	Plan	No. of times		1										
													No. of participants		10										
												Result	No. of times													
													No. of participants													

■ **Activity**

NO.	Activity	Purpose	Important Points	Facilitator	Where	How	Tools	Implementation status		Remarks
(ex.)	Tool box meeting (TBM) before actual work	All workers reach common ground of the work detail and the hazards associated with the work	1. All workers join TBM 2. Facilitate the meeting to make sure all participants express their opinion	JICA trained Participant	TPP	Before actual work	TBM chart	Implemented	(1) Effect implemented > Job accidents have been reduced (2) Suggestions of measures to continue and improve > Perform TBM before all work at the power plant > Provide TBM training for all workers at the power plant	> Photograph when TBM at actual I&C maintenance work
								Not implemented	(1) How to be able to implement N/A	
1	Apply practical knowledge/maintenance skill learned in Japan to actual work	To improve the quality of work	Improve and keeping the quality of work	JICA trained Participant	All TPP	Actual work	Text books provided by JICA and photos	Implemented	(1) Effect implemented (2) Suggestions of measures to continue and improve	
								Not implemented	(1) How to be able to implement	

(4) Action Plan (prepared in the 4th online training for Pakistan)

Action Plan

■Basic information

Country	Pakistan
Target Traing Center	Muzaffargarh
Name of the Trainers (JICA-trained participants)	
Overall goal	Technology and technical skills obtained by the project are utilized in actual O&M at GENCOs power stations.
Project Purpose	Training Capacity on Maintenance of GENCOs is strengthened.
Training Subjects	1. Vibration Analysis 2. Non Destructive Inspection

■Detailed Plan

On-line training ▼

NO.	Training Subject	Purpose	Training Item		Important Points	Trainer	Where	How	Tools	Achievements		2021 NOV	2021 DEC	2022 JAN	2022 FEB	2022 MAR	2022 APR	2022 MAY	2022 JUN	2022 JUL	2022 AUG	2022 SEP	2022 OCT	2022 NOV	2022 DEC	Remarks
ex.	Mechanical Maintenance	1. To understand the various types of vibration 2. To identify the cause of vibration 3. To take suitable countermeasures to the cause of vibration 4. To evaluate the result of countermeasures	ex-1	Basic of Vibration	・How vibration occurs in rotating equipment ・How to analyze the vibration diagrams ・How to investigate the cause ・How to take the countermeasures	JICA-Trained Participant	Training Center	Lecture	・Textbook (provided by JICA)	Plan	No. of times		1						1						1	
											No. of participants		5						5						5	
										Result	No. of times		1													
											No. of participants		5													
1	Vibration Analysis	(1)To understand the various types of vibration (2)To identify the cause of vibration (3)To take suitable countermeasures to the cause of vibration (4)To evaluate the result of countermeasures 5) To calculate the right weight and install at right place. 6) To evaluate the shim thikness to mitigate the gap between foundation and the equipment. 7) To evaluate the tightness of the festining bolts of the equipment, because the looseness of the foundation bolts of the equipemt can also create vibration.	1-1	Basic of vibration	1.Vibration due to unbalance 2.Vibration due to misalignment 3.Vibration due to loss of a component	JICA-Trained Participant	Training Center	Lecture	・Textbook ・Video (provided by JICA)	Plan	No. of times		1			1			1			1			1	
											No. of participants		4			4			4			4			4	
										Result	No. of times															
											No. of participants															
			1-2	Vibration Diagnosis		JICA-Trained Participant	Training Center	Practice	・Textbook ・Video ・Vibration model rotor (provided by JICA)	Plan	No. of times		1			1			1			1			1	
											No. of participants		4			4			4			4			4	
										Result	No. of times															
											No. of participants															
			1-3	Cause of vibration		JICA-Trained Participant	Training Center	Practice	・Textbook ・Video ・Vibration model rotor (provided by JICA)	Plan	No. of times		1			1			1			1			1	
											No. of participants		4			4			4			4			4	
										Result	No. of times															
											No. of participants															
			1-4	Taking countermeasures		JICA-Trained Participant	Training Center	Practice	・Textbook ・Video ・Vibration model rotor (provided by JICA)	Plan	No. of times		1			1			1			1			1	
											No. of participants		4			4			4			4			4	
										Result	No. of times															
											No. of participants															
			1-5	Method of Claucation to identify the hot spot.		JICA-Trained Participant	Training Center	Practice	・Textbook ・Video ・Vibration model rotor (provided by JICA)	Plan	No. of times		1			1			1			1			1	
											No. of participants		4			4			4			4			4	
										Result	No. of times															
											No. of participants															
2	Non Destructive Inspection	(1)To determine which NDI methods to take depending on the base material and failure condition (2)To be able to properly plan, implement and supervise following NDI procedure while ensuring safety - Preparation - Inspection - Observation - Cleaning	2-1	Overall the Non-destructive Test	・What are the features and mechanism of each NDI methods (e.g. pros and cons, applicable condition) ・How to select suitable NDI methods ・How to proceed for NDI (e.g. preparation, inspection, observation, cleaning) ・How to prevent NDI accidents. ・How to evaluate the result and record them for ensuring quality.	JICA-Trained Participant	Training Center	Lecture	・Textbook ・Video (provided by JICA)	Plan	No. of times		1			1			1			1			1	
											No. of participants		5			5			5			5			5	
										Result	No. of times															
											No. of participants															
			2-2	Penetrant Testing		JICA-Trained Participant	Training Center	Practice	・Textbook ・Video ・NDI kit (provided by JICA)	Plan	No. of times		1			1			1			1			1	
											No. of participants		5			5			5			5			5	
										Result	No. of times															
											No. of participants															
			2-3	Ultrasonic Testing		JICA-Trained Participant	Training Center	Practice	・Textbook ・Video ・NDI kit (provided by JICA)	Plan	No. of times		1			1			1			1			1	
											No. of participants		5			5			5			5			5	
										Result	No. of times															
											No. of participants															
			2-4	Magnetic particle Testing		JICA-Trained Participant	Training Center	Practice	・Textbook ・Video ・NDI kit (provided by JICA)	Plan	No. of times		1			1			1			1			1	
											No. of participants		5			5			5			5			5	
										Result	No. of times															
											No. of participants															

Action Plan

■Basic information

Country	Pakistan
Target Traing Center	Guddu
Name of the Trainers (JICA-trained participants)	
Overall goal	Technology and technical skills obtained by the project are utilized in actual O&M at GENCOs power stations.
Project Purpose	Training Capacity on Maintenance of GENCOs is strengthened.
Training Subjects	1. Non Destructive Inspection

■Detailed Plan

On-line training ▼

NO.	Training Subject	Purpose	Training Item		Important Points	Trainer	Where	How	Tools	Achievements		2021 NOV	2021 DEC	2022 JAN	2022 FEB	2022 MAR	2022 APR	2022 MAY	2022 JUN	2022 JUL	2022 AUG	2022 SEP	2022 OCT	2022 NOV	2022 DEC	Remarks
ex.	Mechanical Maintenance	1. To understand the various types of vibration 2. To identify the cause of vibration 3. To take suitable countermeasures to the cause of vibration 4. To evaluate the result of countermeasures	ex-1	Basic of Vibration	・How vibration occurs in rotating equipment ・How to analyze the vibration diagrams ・How to investigate the cause ・How to take the countermeasures	JICA-Trained Participant	Training Center	Lecture	・Textbook (provided by JICA)	Plan	No. of times		1						1						1	
											No. of participants		5						5						5	
										Result	No. of times		1													
											No. of participants		5													
1	Non Destructive Inspection	(1)To determine which NDI methods to take depending on the base material and failure condition (2)To be able to properly plan, implement and supervise following NDI procedure while ensuring safety - Preparation - Inspection - Observation - Cleaning	2-1	Overall the Non-destructive Test	・What are the features and mechanism of each NDI methods (e.g. pros and cons, applicable condition) ・How to select suitable NDI methods ・How to proceed for NDI (e.g. preparation, inspection, observation, cleaning) ・How to prevent NDI accidents ・How to evaluate the result and record them for ensuring quality	JICA-Trained Participant	Training Center	Lecture	・Textbook ・Video (provided by JICA)	Plan	No. of times		1			1			1			1			1	
											No. of participants		3			3			3			3			3	
										Result	No. of times															
											No. of participants															
			2-2	Penetrant Testing		JICA-Trained Participant	Training Center	Practice	・Textbook ・Video ・NDI kit (provided by JICA)	Plan	No. of times		1			1			1			1			1	
											No. of participants		3			3			3			3			3	
										Result	No. of times															
											No. of participants															
			2-3	Ultrasonic Testing		JICA-Trained Participant	Training Center	Practice	・Textbook ・Video ・NDI kit (provided by JICA)	Plan	No. of times		1			1			1			1			1	
											No. of participants		3			3			3			3			3	
										Result	No. of times															
											No. of participants															
			2-4	Magnetic particle Testing		JICA-Trained Participant	Training Center	Practice	・Textbook ・Video ・NDI kit (provided by JICA)	Plan	No. of times		1			1			1			1			1	
											No. of participants		3			3			3			3			3	
										Result	No. of times															
											No. of participants															

Annex 6

Documents for Results of Activities

(1) Pictures of Activities

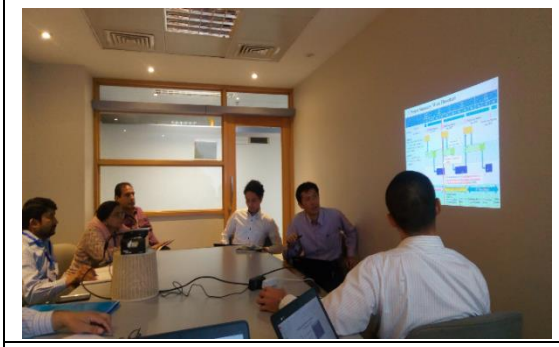
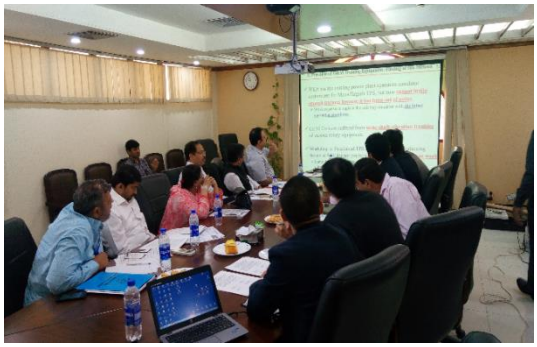
1st on-site work: From November 12 to November 25, 2017	
	
Kick-off meeting (1)	Kick-off meeting (2)
	
Site visit to WEA (1)	Site visit to WEA (2)
	
Site visit to Muzaffargarh TPS (1)	Site visit to Muzaffargarh TPS (2)
	
Site visit to Kot Addu TPS (1)	Site visit to Kot Addu TPS (2)

1st on-site work: From November 12 to November 25, 2017	
	
Site visit to Jamshoro TPS (1)	Site visit to Jamshoro TPS (2)
	
Site visit to Lakhra TPS (1)	Site visit to Lakhra TPS (2)
	
Wrap-up meeting (1)	Wrap-up meeting (2)
	
1st JCC (1)	1st JCC (2)

2nd on-site work: From September 2 to September 15, 2018	
	
Kick-off meeting	Site visit to Nandipur TPS (1)
	
Site visit to Nandipur TPS (2)	Site visit to Nandipur TPS (3)
	
Site visit to WEA (1)	Site visit to WEA (2)
	
Site visit to Faisalabad TPS (1)	Site visit to Faisalabad TPS (2)

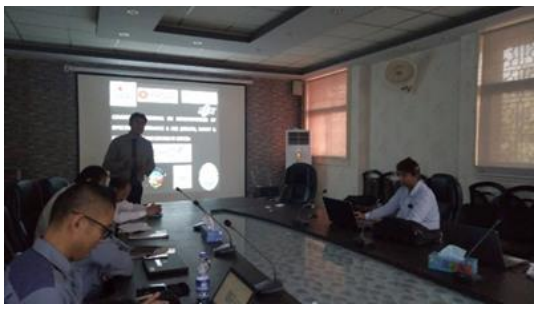
2nd on-site work: From September 2 to September 15, 2018	
	
Site visit to Faisalabad TPS (3)	Site visit to Faisalabad TPS (4)
	
Site visit to Central Gas Turbine Maintenance Workshop (1)	Site visit to Central Gas Turbine Maintenance Workshop (2)
	
Site visit to Central Gas Turbine Maintenance Workshop (3)	Site visit to Central Gas Turbine Maintenance Workshop (4)
	
Meeting with Guddu Training Center	Site visit to Muzaffargarh TPS (1)

2nd on-site work: From September 2 to September 15, 2018	
	
Site visit to Muzaffargarh TPS (2)	Site visit to Jamshoro TPS
	
Site visit to Kotri TPS (1)	Site visit to Kotri TPS (2)
	
Site visit to Kotri TPS (3)	Site visit to Kotri TPS (4)
	
Site visit to WAPDA Staff College (1)	Site visit to WAPDA Staff College (2)

2nd on-site work: From September 2 to September 15, 2018	
	
Wrap-up meeting	2nd JCC (1)
	
2nd JCC (2)	

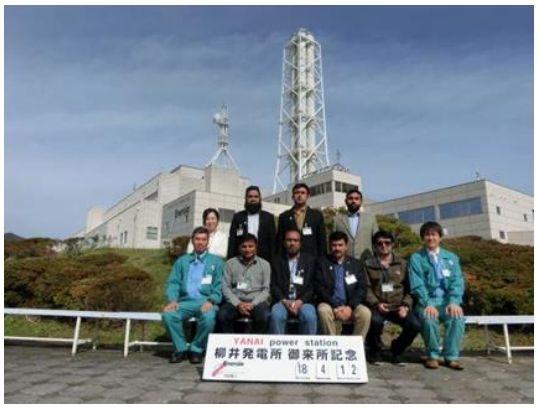
3rd on-site work: From September 30 to October 12, 2019	
	
Kick-off meeting	Site visit to Muzaffargarh TPS (1)
	
Site visit to Muzaffargarh TPS (2)	Site visit to Muzaffargarh TPS (3)
	
Site visit to Muzaffargarh TPS (4)	Site visit to Muzaffargarh TPS (5)
	
Site visit to Muzaffargarh TC	

3rd on-site work: From September 30 to October 12, 2019	
	
Site visit to Guddu TPS (1)	Site visit to Guddu TPS (2)
	
Site visit to Guddu TPS (3)	Site visit to Guddu TPS (4)
	
Site visit to Guddu TPS (5)	Site visit to Guddu TPS (6)
	
Site visit to Guddu TPS (7)	Site visit to Guddu TC (1)

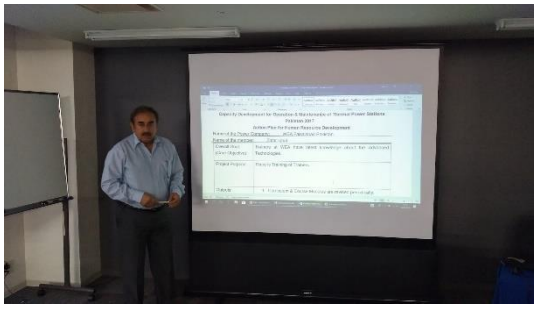
3rd on-site work: From September 30 to October 12, 2019	
	
Site visit to Guddu TC (2)	Site visit to Guddu TC (3)
	
Site visit to Guddu TC (4)	Site visit to Guddu TC (5)
	
Site visit to Guddu TC (6)	Site visit to Guddu TC (7)
	
Site visit to Jamshoro TPS (1)	Site visit to Jamshoro TPS (2)

3rd on-site work: From September 30 to October 12, 2019	
	
Site visit to Jamshoro TPS (3)	Site visit to Jamshoro TPS (4)
	
Site visit to Jamshoro TPS (5)	Wrap-up meeting
	
3rd JCC (1)	3rd JCC (2)

1st training in Japan for engineer: From March 21 to April 27, 2018	
	
Opening ceremony	Course orientation
	
Action Plan (PCM method)	TQM
	
Human resource development (1)	Human resource development (2)
	
Basic training of vibration (1)	Basic training of vibration (2)

1st training in Japan for engineer: From March 21 to April 27, 2018	
	
Nondestructive inspection (1)	Nondestructive inspection (2)
	
Remaining life assessment	TPS tour (Yanai TPS)
	
Manufacturer’s factory tour (MHPS)	Preparation of Action Plan
	
Presentation of Action Plan	Closing ceremony

1st training in Japan for technician: From March 4 to March 24, 2018	
	
Action Plan (PCM method) (1)	Action Plan (PCM method) (2)
	
Nondestructive inspection	Motor overhaul
	
Experiential quality training	TPS tour (Himeji No.2 TPS)
	
Manufacturer’s factory tour (MHPS)	Closing ceremony

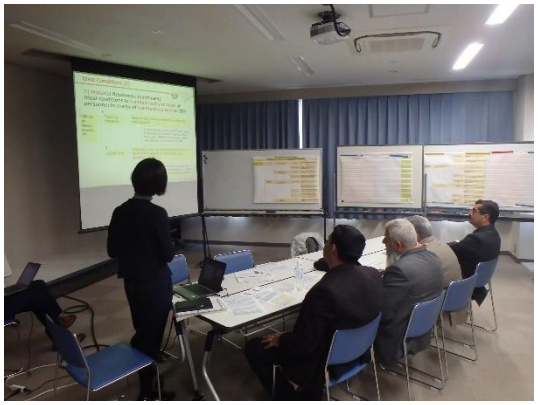
1st training in Japan for management: From March 14 to March 24, 2018	
	
Action Plan (PCM method) (1)	Action Plan (PCM method) (2)
	
Observation of training in Japan (Technician)	Manufacturer’s factory tour (MHPS)
	
Preparation of Action Plan	Presentation of Action Plan
	
Closing ceremony	

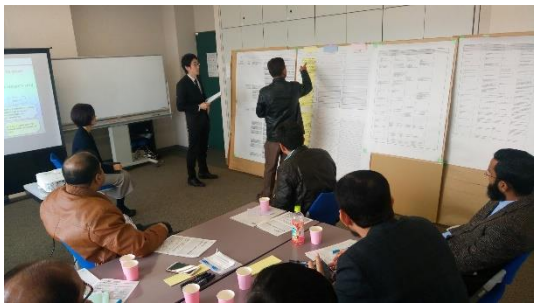
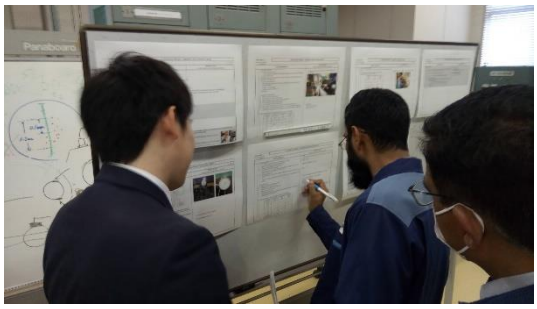
2nd training in Japan for engineer: From January 6 to February 9, 2019	
	
Action Plan (Issue Analysis)	Electric relays
	
Generators	Nondestructive inspection
	
Basic training of vibration	TPS tour (Himeji No.2 TPS)
	
TPS tour (Maizuru TPS)	Manufacturer’s factory tour (Mitsubishi Electric Corporation)

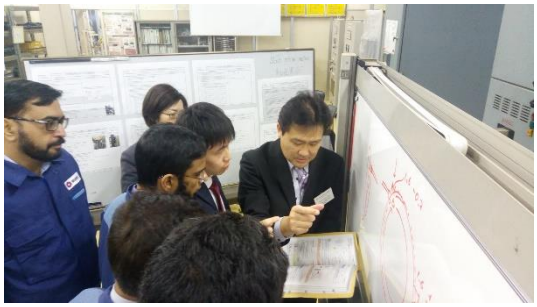
2nd training in Japan for engineer: From January 6 to February 9, 2019	
	
Manufacturer’s factory tour (Nihon Denken Industrial)	Manufacturer’s factory tour (MHPS)
	
Experiential safety training (1)	Experiential safety training (2)
	
Presentation of Action Plan	Closing ceremony

2nd training in Japan for technician: From January 6 to January 26, 2019	
	
Action Plan (Issue Analysis)	RMC tour
	
Electric relays	TPS tour (Maizuru TPS)
	
Preparation of Action Plan	Presentation of Action Plan
	
Closing ceremony	

2nd training in Japan for management: From February 3 to February 9, 2019	
	
Action Plan (Issue Analysis)	Introduction of training equipment (NDI)
	
Introduction of training equipment (Vibration Analysis Demonstrator)	Introduction of training equipment (Power Plant Operation Simulator)
	
Observation of training in Japan (Engineer)	TPS tour (Nankou TPS)
	
TPS tour (Sakaikou TPS)	TPS tour (Sakai LNG Receiving Terminal)

2nd training in Japan for management: From February 3 to February 9, 2019	
	
Preparation of Action Plan (1)	Preparation of Action Plan (2)
	
Presentation of Action Plan	Closing ceremony

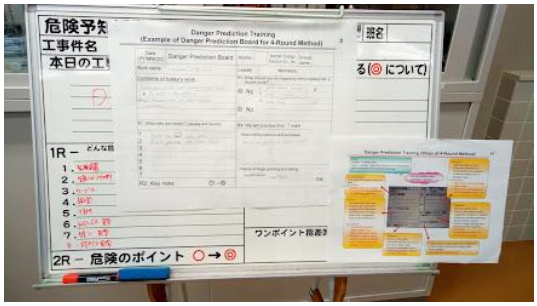
3rd training in Japan for engineer: From January 23 to February 15, 2020	
	
Course orientation	Preparation of Job Report
	
Action Plan (Issue Analysis) (1)	Action Plan (Issue Analysis) (2)
	
Turbine supervisory instrument (1)	Turbine supervisory instrument (2)
	
Turbine supervisory instrument (3)	Turbine supervisory instrument (4)

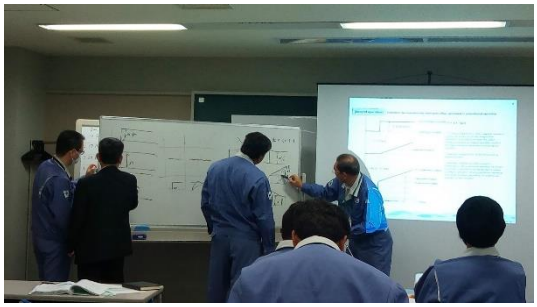
3rd training in Japan for engineer: From January 23 to February 15, 2020	
	
Turbine supervisory instrument (5)	Tool Box Meeting (TBM) (1)
	
Tool Box Meeting (TBM) (2)	Experiential safety training (1)
	
Experiential safety training (2)	Measuring and monitoring device (1)
	
Measuring and monitoring device (2)	Control valve and accessories (1)

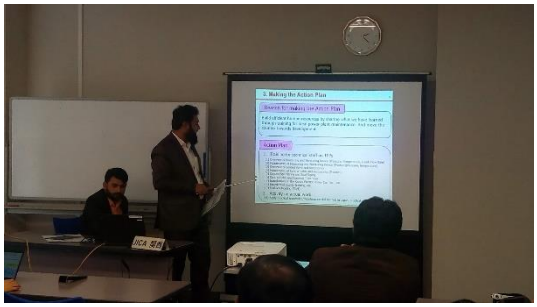
3rd training in Japan for engineer: From January 23 to February 15, 2020	
	
Control valve and accessories (2)	Basic control theory (PID) (1)
	
Basic control theory (PID) (2)	Fault tree analysis (1)
	
Fault tree analysis (2)	TC tour (Kanden Plant Technocenter)
	
TPS tour (Himeji No.2 TPS) (1)	TPS tour (Himeji No.2 TPS) (2)

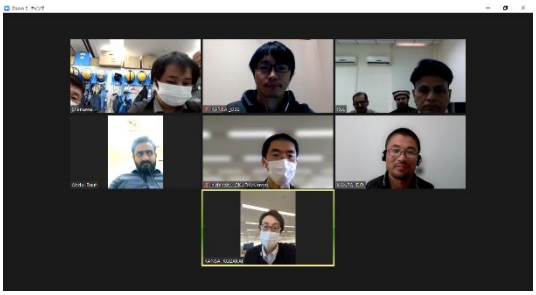
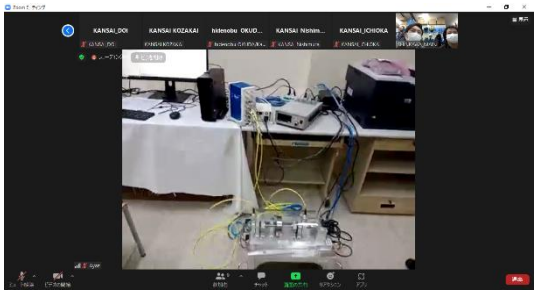
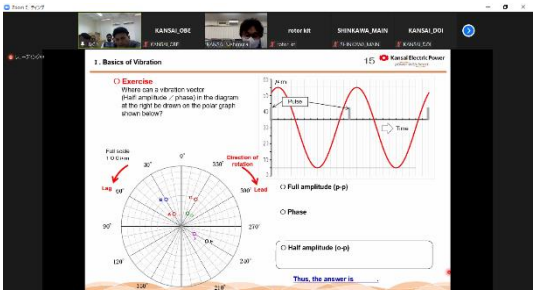
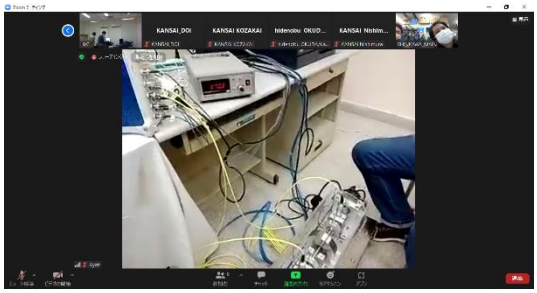
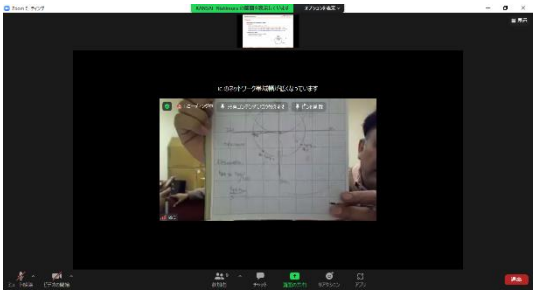
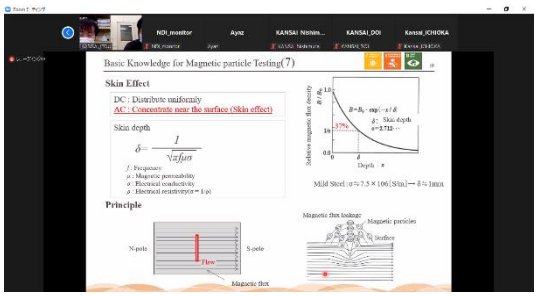
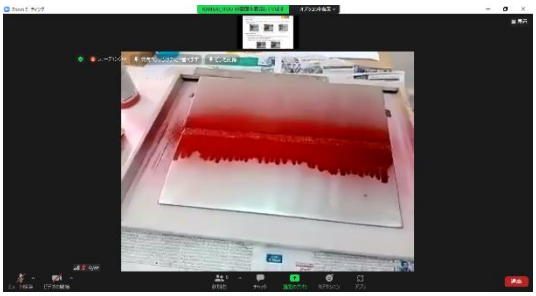
3rd training in Japan for engineer: From January 23 to February 15, 2020	
	
TPS tour (Himeji No.2 TPS) (3)	TPS tour (Himeji No.2 TPS) (4)
	
Manufacturer’s factory tour (Shimadzu Corporation)	Weekly review
	
Preparation of Action Plan (1)	Preparation of Action Plan (2)
	
Presentation of Action Plan	Closing ceremony

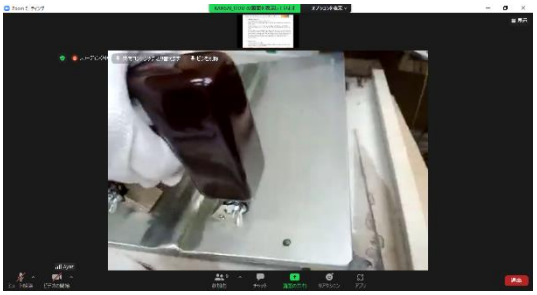
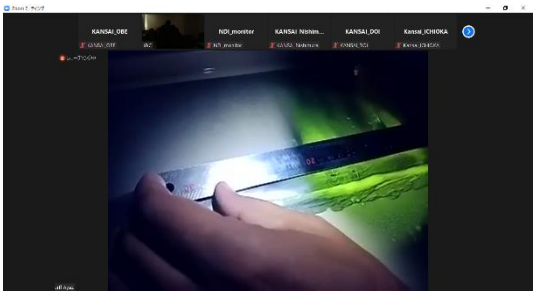
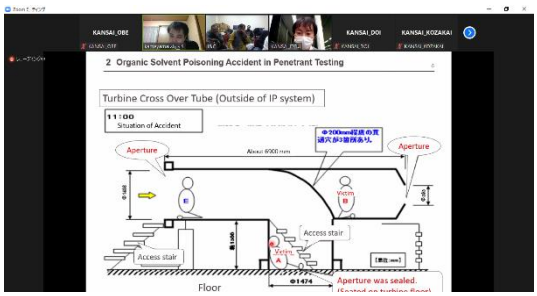
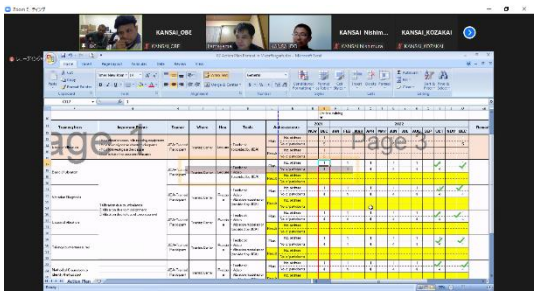
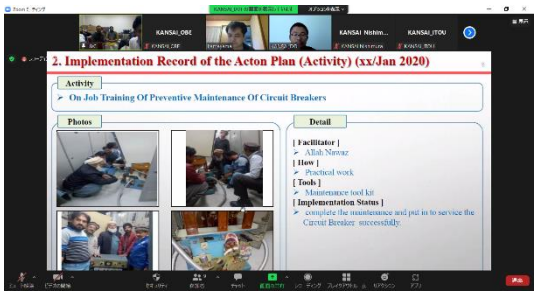
3rd training in Japan for technician: From January 13 to February 1, 2020	
	
Course orientation	Preparation of Job Report
	
Action Plan (Issue Analysis) (1)	Action Plan (Issue Analysis) (2)
	
Measuring and monitoring device (1)	Measuring and monitoring device (2)
	
Control cable and terminal treatment	Solenoid valve

3rd training in Japan for technician: From January 13 to February 1, 2020	
	
Tool Box Meeting (TBM) (1)	Tool Box Meeting (TBM) (2)
	
Control valve and accessories (1)	Control valve and accessories (2)
	
Basic control theory (PID) (1)	Basic control theory (PID) (2)
	
Basic control theory (PID) (3)	Experiential quality training

3rd training in Japan for technician: From January 13 to February 1, 2020	
	
Comprehension check test (1)	Comprehension check test (2)
	
TPS tour (Himeji No.2 TPS) (1)	TPS tour (Himeji No.2 TPS) (2)
	
RMC tour	Manufacturer’s factory tour (Mitsubishi Electric Corporation)
	
Preparation of Action Plan (1)	Preparation of Action Plan (2)

3rd training in Japan for technician: From January 13 to February 1, 2020	
	
Presentation of Action Plan (1)	Presentation of Action Plan (2)
	
Closing ceremony	

4th online training for instructor: From November 29 to December 8, 2021	
	
Opening ceremony	Unpacking
	
Installation and connection	Training of vibration model rotor (Lecture)
	
Training of vibration model rotor (Practice) (1)	Training of vibration model rotor (Practice) (2)
	
Training of non-destructive kit (Lecture)	Training of non-destructive kit (Practice) (1)

4th online training for instructor: From November 29 to December 8, 2021	
	
Training of non-destructive kit (Practice) (2)	Training of non-destructive kit (Practice) (3)
	
Training of non-destructive kit (Practice) (4)	Personal accident in non-destructive testing
	
Preparation of Action Plan	Introduction of Action Plan Report
	
Action Plan (training) demonstration by participant	Closing ceremony

(2) Record of On-site Work Activities

Record of Meeting on 1st on-site work (November 15, 2017)

Date: Sunday, November 15, 2017 14: 00 ~ 16: 00
Objective: To survey the training facilities and collect information on the responses to the questionnaire sent in advance.
Location: WAPDA Engineering Academy
Attendance: (WEA) Mr. Shahzad Bashir, Mr. Zafar Iqbal
(JICA Pakistan office) Mr. Imran Ahmad
(Kansai Electric Power Co., Inc.) Hirahata, Kawai, Doi, Furukawa, Obe

[Meeting result]

1. The WEA facility was inspected and surveyed.
2. The final answers to the questionnaire that was explained orally at the Technical Meeting (WAPDA) were shared (electronic data will be shared separately).

[Note]

- Inspection of WEA's training facilities for electrical, mechanical and civil engineering was conducted. The equipment configuration of the power plants to be inspected in the future will be confirmed, and the excess or deficiency of the training facilities will be discussed.
- The library has more than 20,000 books in its collection. The library has more than 20,000 books, including textbooks such as "Efficient Operation of Power Plants," which gave the impression of high-level training.
- The final answers to the questionnaire were shared. The electronic data will be received by e-mail separately.
- During the site visit, it was mentioned that the current training facility is outdated and they would like to update it, but due to budget constraints, they are updating it as needed, starting with the ones with the highest priority. We replied that old and new training facilities are not a big issue for the purpose of learning basic engineering theories, and that we had the impression that the current training facilities themselves were well-equipped.
- The Pa side's request for a visit to Japan was discussed again (they would like to visit a training facility for engineers for about 10 days).

Reord of Meeting on 1st on-site work (November 16, 2017)

Date: Sunday, November 16, 2017 13: 30 ~ 16: 00

Objective: To surveyt Muzaffargarh power plant (Gas/RFO) and collect information on the current status of thermal power plant operation and maintenance based on the questionnaire sent in advance.

Location: Muzaffargarh Thermal Power Station

Attendance: (Muzaffargarh TPS) Refer to the attendance sheet

(JICA Pakistan office) Mr. Imran Ahmad

(Kansai Electric Power Co., Inc.) Hirahata, Kawai, Doi, Furukawa, Obe

[Meeting result]

1. JET visited and surveyed the Muzaffargarh power plant.
2. JET explained that the answers to the questionnaires sent in advance would be submitted at a later date, as they would have to be confirmed by the GHCL before they could be submitted. For this reason, we confirmed individually those questionnaires that could be answered.

[Note]

- An inspection of the Muzaffargarh power plant was conducted. Boiler inspections are conducted once a year (shutdown period: 30 days) and major inspections once every 5 years (shutdown period: 90 days), and Unit-1 just started its boiler inspection yesterday. For Unit-1, the boiler inspection started yesterday. The boiler inspection is conducted at the power plant, and only a few SVs come for the major inspection.
- All units except for Unit-1 are in standby mode (during March to June when it is extremely hot, the boiler operates at a high level, but during this period, the boiler is often in standby mode because of the abundance of hydraulic power).
- Fuel oil is transported from Karachi to the plant by rail and/or car (about 1,000 km). Due to the chronic depletion of domestic gas, the main fuel is residue oil.
- The operation consists of four people. The total number of employees is about 10, and they work in four groups in three shifts. Manual operation during startup and shutdown, automatic operation after startup.
- Units 1-3 (made in Russia) and Unit-4 (made in China), with the COD of Unit-1 being 1992. The COD of Unit-1 is 1992, and the Unit-4 control unit was updated last year.
- There seems to be no environmental equipment (EP, denitration equipment, desulfurization equipment, etc.).
- There was a story that a large number of power plant employees were trained by Americans in Pakistan under the capacity development program by USAID. At that time, there was an inquiry, "Is there any chance of Japanese people providing training? He replied that there were none at present.
- The CEO had 6 months of training experience at Siemens.
- Only OEMs can provide manuals and life expectancy prediction.
- The CEO of GENCO III approves the maintenance budget.
- The system operator (grid operations department) approves the maintenance plan.
- With regard to technicians, there was no clear need response to the training menu (and the training itself was not yet implemented).

San.

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Meeting of Muzaffargarh Attendance List

Date: 16 November 2017

Time: 15 : 00 - 16 : 00

Place: TPS Muzaffargarh

Name	Position	Company	Signature
IMRAN AHMAD	Team Leader Energy	JICA	
Munir Ahmed Abbasi	D.M (electrical)	NPGCL, M/Garh	
Muhammad Nisar	AMM-II	NPGCL-M/Garh	
FAISAL NAEEM	A.M (I&C)	NPGCL, M/Garh	
MUHAMMAD ABUBAKAR	AM (Electrical)	NPGCL M/Garh	
Waseem Hassan	AME-II	NPGCL-M/Garh	
JAMIL HASSAN	Deputy Manager	NPGCL M/Garh	
Khalid Ali Siddiqui	Deputy Plant Manager	NPGCL M/Garh	
Ardan Abbas	Assistant Director M&E	NPGCL M/Garh	
SHAHBAZ-ILLAHI	Addl: SVS Engineer	NPGCL M/Garh	
Muhammad Muddasir	Assistant Manager Maintenance	NPGCL M/G	
Ali Asghar	CEO	NPGCL	
Ali Jafar	DD (Technical)	NPGCL	

Jafa

JICA

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Kick Off Meeting
13 November 2017

Name	Position	Company	Signature
NISAR KHAN	AM (Elect) -II	NPGCL	
Sajjad Ahmed	M.E. (Mech)-4	NPGCL	
Kamran Ali	Asstt Manager (Elect).	NPGCL, GENCO-III	
M. Shahid Pervaiz	Asstt. Manager (Elect)	NPGCL, GENCO-III	
Ashique Memon	Plant Manager	〃 〃 〃	
HAIDER ALI	ELECTRICAL ENGR	NPGCL	
Imran Bhutto	Mechanical Engr. Unit-4	NPPGCL	

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Reord of Meeting on 1st on-site work (November 17, 2017)

Date: Sunday, November 17, 2017 10: 50 ~ 14: 00

Objective: To survey KAPCO Power Company (GTCC) and collect information on the current status of thermal power plant operation and maintenance based on the questionnaire sent in advance.

Location: KAPCO

Attendance: (KAPCO) Refer to the attendance sheet
(JICA Pakistan office) Mr. Imran Ahmad
(Kansai Electric Power Co., Inc.) Hirahata, Kawai, Doi, Furukawa, Obe

[Meeting result]

1. JET visited the KAPCO power plant and conducted a survey.
2. JET did not receive any answers to the questionnaires that were sent out in advance, so we checked with each of them individually to see what they were able to answer. All responses to the questionnaire will be received by e-mail at a later date.

[Note]

- Troubleshooting by PDCA and reflected in OEM manuals
- Regarding LTSA, for Siemens, ST is also implementing it.
- Started operation in 1985 and concluded LTSA after privatization in 1996.
- Conducted analysis using FT diagram.
- In the future, the point of contact in the event of confirmation issues should be all those present today.
- Other answers to questions are shown in the Appendix.
- Monitoring at the central control room for each block. Three shifts.
- There is a Safety Performance Board at the entrance of the premises, and safety awareness is high.
- There are about 500 employees in total.
- The same central control room also monitors the switchyard for special high voltage power plants, and there are six power transmission systems.
- There are six transmission systems. There are plans to increase coal production. (Siemens - China)

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KAPCO Attendance List

Date: 17 November 2017

Time: 10 : 50 - ___ : ___

Place: KAPCO

Name	Position	Company	Signature
Waheed Sohail	SM Operations	KAPCO	
Abdul Wajid	Performance Engineer	KAPCO	
M. Arshad saqlib	PE Performance	KAPCO	

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Reord of Meeting on 1st on-site work (November 20, 2017)

Date: Sunday, November 20, 2017 10: 00 ~ 13: 00

Objective: To surveyt Jamshoro power plant (Gas/RFO) and collect information on the current status of thermal power plant operation and maintenance based on the questionnaire sent in advance.

Location: Muzaffargarh Thermal Power Station

Attendance: (Jamshoro TPS) Refer to the attendance sheet

(JICA Pakistan office) Mr. Imran Ahmad

(Kansai Electric Power Co., Inc.) Hirahata, Kawai, Doi, Furukawa, Obe

[Meeting result]

1. JET visited and surveyed the Jamshoro Power Station.
2. JET checked the answers to the questionnaire that was sent to us in advance.

[Note]

- Performance tests have not been conducted since 2013, after the facility was modified with USAID assistance.
- In relation to the coal plant construction project, we will be bidding for a supercritical boiler capacity improvement consultant (funded by Asian Development Bank and Islamic Development Bank).
- The number of people to be trained at this power plant by Siemens China is 50 people.
- Recruitment of new employees will take some time due to GHCL and MOE approval procedures (a factor that will lead to chronic understaffing).
- Chinese consultants are scheduled to visit the plant in the future to conduct performance tests.
- Procurement for equipment replacement will take time due to international competitive bidding. Also, the lack of OEM products has been mentioned as a factor in the lack of recovery in output performance.
- In terms of the training menu, Knowledge and Human Resource were given high priority. TQM and remaining life assessment were also mentioned as training needs.
- It was raised that the number of people to be trained for this project (engineers and technicians: 10 people each per year x 3 years) is low.
- The attached documents that can be shared will be sent by e-mail later.
- For other confirmation items, please refer to the attached sheet.
- Unit-1 is made in Japan, Unit-2 to Unit-4 are made in China, and all of them are shut down at the time of the inspection. The plant was remodeled from oil-fired to gas-fired dual combustion, but due to the depletion of domestic gas, only fuel oil (produced in Dubai and transported by truck via Karachi) is used.
- There was a case of IP rotor breakage. Replaced with original product.
- The EH governor controller of Unit-2 has been updated in the near future.
- The power plant premises are generally tidy, but not fully cleaned (feces damage was found on the turbine casing).
- Around the boiler, the cover of the electrical panel was left open. The boiler does not appear to be explosion-proof.

Capacity Building and Strengthening of Thermal Power Generation
Operation & Maintenance in Pakistan

Jamshoro Attendance List

Date: 20 November 2017

Time: 10 : 00 - 10 : 45

Place: JAMSHORO

Name	Position	Company	Signature
Shah Muhammad	P.D, Coal Project	JPCL	
Abdul Ghani	Asstt: Resident Engineer (Operation)	JPCL	
G.H. Soomro	Plant Manager	JPCL	
G. Qadir	CEO	JPCL	
Junki Mori	Program Officer	JICA	
IMRAN AHMAD	Sr. Program Officer	JICA	
Hiroki Hirahata	General Manager	JICA (Kansai)	
Toru Kawai	manager.	JICA (kansai)	T. Kawai
井祥宏	Mgr	JICA (Kansai)	Yoshihiro
Haruaki Furukawa	Electric Engineer	JICA (kansai)	古川晴章
Yuki OBE	I&C Engineer	ditto	Y. OBE

Record of Meeting on 1st on-site work (November 20, 2017)

Date: Sunday, November 20, 2017 14: 00 ~ 15: 30

Objective: To surveyt Lakhra power plant (Coal) and collect information on the current status of thermal power plant operation and maintenance based on the questionnaire sent in advance.To survey the training facilities and collect information on the responses to the questionnaire sent in advance.

Location: Lakhra Thermal Power Station

Attendance: (Lakhra TPS) Refer to the attendance sheet
(JICA Pakistan office) Mr. Imran Ahmad
(Kansai Electric Power Co., Inc.) Hirahata, Kawai, Doi, Furukawa, Obe

[Meeting result]

1. JET visited and surveyed the Lakhra Power Station.
2. JET checked the answers to the questionnaire that was sent to us in advance.

[Note]

- Inspection of WEA's training facilities for electrical, mechanical and civil engineering was conducted. The equipment configuration of the power plants to be inspected in the future will be confirmed, and the excess or deficiency of the training facilities will be discussed.
- The library has more than 20,000 books in its collection. The library has more than 20,000 books, including textbooks such as "Efficient Operation of Power Plants," which gave the impression of high-level training.
- The final answers to the questionnaire were shared. The electronic data will be received by e-mail separately.
- During the site visit, it was mentioned that the current training facility is outdated and they would like to update it, but due to budget constraints, they are updating it as needed, starting with the ones with the highest priority. We replied that old and new training facilities are not a big issue for the purpose of learning basic engineering theories, and that we had the impression that the current training facilities themselves were well-equipped.
- The Pa side's request for a visit to Japan was discussed again (they would like to visit a training facility for engineers for about 10 days).
- Periodic inspections have not been realized, and after-the-fact maintenance following equipment failure is the reality.
- There are approximately 400 employees in the power plant.
- Boiler tube leaks are a frequent cause of power plant shutdowns.
- While the design thermal efficiency of the power generation facility is 30%, the actual thermal efficiency is about 25%. The power generation output has also decreased from the design level due to the effect of operational restrictions on pressure conditions from the viewpoint of facility maintenance.
- Coal properties are 30% carbon, 30% ash, and 5% S. It is assumed that the fuel is Yamamoto dry coal and in-furnace desulfurization is being conducted.
- Unit-3 was idle due to generator trouble. The secondary side of the main transformer is jumpered off.
- JET has the impression that hardware measures (e.g., equipment renewal) are more effective than software measures (e.g., OM technical cooperation) for this power plant.
- JET was only able to visit the electrical control room (switchyard).
- In the turbine building, there were many broken glass windows.

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Lakhra PGCL Attendance List

Date: 20 November 2017

Time: 13 : 40 - 15 : 10

Place: Lakhra CFPP Meeting Room

Name	Position	Company	Signature
S. Shabir Tabi	Plant Manager	LPGCL	
Faizullah Dahri	CFO	LPGCL (GENCO-IV)	20/11/17
Ompar Kash	D.M (Maint)	LPGCL	20/11/17
Abdul Manan	D.M (Operation)	LPGCL	20/11/17
Rajesh Kumar	DM (MM)	LPGCL	20.11.17
Agha Shuaib	DM (I&C)	LPGCL	
Rashid Qasmi	D.M (E)	LPGCL	20/11/17
Riaz Ahmed	DM (Boiler)	LPGCL	
GOPAL DASS	D.M (Turbine)	LPGCL	
IMRAN AHMAD	Sr. Program Officer	JICA	
Junki Mori	Program Officer	JICA	
Hiroki Hirahata	General Manager	JICA (Kansai)	
Toru Kanai	Manager.	JICA (Kansai)	

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meeting title: Lahira PGCL

Name	Position	Company	Signature
上井 祥宏	Mgr	JICA (Kansai)	Yoshihiro
Haruaki Furukawa	Electric Engineer	JICA (kansai)	古川晴亮
Yuki OBE	I&C Engineer	JICA (KANSAI)	大江祐貴

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Minutes of Meeting

Project	Capacity Building and Strengthening of Thermal Power Generation Operation & Maintenance in Pakistan (follow-up survey by JICA expert)
Title	2nd survey in Nandipur TPS
Date	4th September 2018
Time	10:00 - 12:00
Place	Meeting room and site
Attendees	See Attachment “attendance list (2018_02)”

Record of Discussions

NO	ITEM DETAILS
1.	**Introduction**
1.1	This meeting was convened with the objective to discuss the below agenda point: 1) Presentation of JICA Capacity building O&M “Overview of Interim Report” 2) Others (if any)
2.	**Overview of Interim Report**
2.1	JICA expert (Kansai) made the presentation on “overview of interim report”, especially “O&M training program” and “selection criteria for next participants” for the 2nd training in Japan. 1) Considering foreseeable aging impact on O&M in TPPs, JICA expert suggested to focus on advanced mechanical field for next participants so that they could reflect fruitful comments from JICA-trained engineers & technicians on the next training program in Japan,. 2) Regarding O&M training program, Pakistan side strongly requested that next training program should be not mechanical but other field (electrical) because of covering all the scopes of thermal power plant, and mentioned that plant manager should have responsibility of the management with overall knowledge of thermal power plant, and it was necessary to focus on not only mechanical but also other fields (electrical etc.). 3) Regarding selection criteria, Pakistan side also mentioned that it would be difficult for the limited JICA-trained engineers & technicians to disseminate their knowledge & skill obtained in Japan to other colleagues through OJT more efficiently, the participants should be nominated from trainers in WEA, or some of JICA-trained engineers & technicians should be assigned as trainers in WEA. Japanese side agreed to the idea in principle, while noting the importance of knowledge sharing effort of each participants in their TPP as not all the participants can be assigned as a trainer.

NO	ITEM DETAILS
	4) The relevant information is as follows: ü The newcomers used to attend induction training in WEA for 1 year, but it has been shortened to 3 months, while there has been no recruitment recently. ü The Pakistan government policy is to place larger emphasis on private sector for thermal power development, therefore the government doesn't intend to recruit newcomers in public sector recently. Ref.) Nandipur staff would NOT participate in the next training in Japan because GHCL has made an O&M contract with Chinese company (HEPSEC).

No.

Date

Attendance List

Nandipur Power Plant
4th SEP, 2018

10:00 ~ 11:00

Name	Company	Position	Signature
Abdul Mannan	NPGCL -Nandipur	Senior Engineer	
Muhammad Jafar	GHCL	Addl. Director	
Imtiaz Hussain	NPGCL_Nandipur	Executive Engineer	
Nawed Afnan	Nandipur.	Plant Manager	
Imam Ahmed	NPGCL	Asst. Manager	
Yuki Obe	Kansai	C&I Eng.	
Shigemi Yoshitake	Kansai	Mech. eng	
Haruaki Furukawa	Kansai	Electric Engineer	
Yoshihiro Doi	Kansai	Mech Mgr	
Hiroki Hirahata	Kansai	General Manager	
Junki Mori	JICA	Assistant Deputy Director	

Minutes of Meeting

Project	Capacity Building and Strengthening of Thermal Power Generation Operation & Maintenance in Pakistan (follow-up survey by JICA expert)
Title	2nd survey in WAPDA Engineering Academy
Date	4th September 2018
Time	15:00 - 17:00
Place	Meeting room
Attendees	See Attachment “attendance list (2018_03)”

Record of Discussions

NO	ITEM DETAILS
1.	**Introduction**
1.1	This meeting was convened with the objective to discuss the below agenda point: 1) Presentation “WAPDA Engineering Academy (WEA), Faisalabad” 2) Discussion about provision of O&M training equipment. 3) Others (if any)
2.	**Presentation of WEA**
2.1	Based on the presentation, WEA made the detail explanation about the following current status. 1) Guddu Training Centre has no plant operation simulator. 2) While Guddu T/C trains only technicians, WEA trains not only engineers in GHCL but also participants at the request of private companies (KAPCO etc). 3) WEA used to train both engineers/technicians before plant plant simulator got out of work. WEA has curriculums for both engineers & technicians. On the other hands, GHCL intends to train their technicians mainly in Guddu T/C and, it seems unrealistic to train technicians in WEA at this time. 4) The number of WEA trainees is about 900 per annual. There are only 39 trainees on thermal power in 2017/18 because operation simulator has been out of work and no induction training has been implemented. 5) WEA cannot enjoy the training materials of training in Japan because no instructors in WEA participated last year. When two senior engineers in WEA are transferred to GHCL, which is expected in a few month, WEA could request GHCL to nominate the successor from JICA-trained engineers.

NO	ITEM DETAILS
	6) WEA has just only 5 trainers regarding thermal power (3 senior engineers and 2 junior engineers), and has intention to nominate their engineers as participants of 2nd training in Japan.
3.	**Discussion about provision of O&M training development**
3.1	JICA expert made the presentation on "Provision of O&M Training Report" and JICA expert suggested "power plant (operation) simulator", "vibration analysis demonstrator" and "NDI demonstrator". 1) WEA still has large interest in "power plant simulator" although the simulator is not customized for actual power plant, especially in terms of the detailed specification and operating procedure. 2) When the existing power plant simulator (ST/GT) in WEA was in operation, WEA used to receive 60 trainees per annual. 3) In case that JICA provides WEA with the simulator, WEA said that it would be suitable to install it in WEA than in Guddu. 4) WEA/GHCL mentioned they have already ensured the training equipment such as "vibration analysis demonstrator" and "NDI demonstrator". The equipment about vibration analysis has been installed in Faisalabad TPS. (JICA expert would survey this later in Faisalabad.) 5) WEA has basic training contents about vibration analysis & NDI through site visit on Faisalabad TPS.

meeting title: _____

Capacity Building and Strengthening of Thermal Power Generation
Operation & Maintenance in Pakistan

Meeting with WEA Attendance List

Date: 4th / September / 2018

Time: 15 : 30 - 17 : 10

Place: WEA.

Name	Company	Position	Signature
Waseem Hashmat	WEA FSD	Sr. Instructor	
ZAHID PERVEZ.	〃	〃	
ARZ Muhammad	WEA, FSD	Addl. Director	
Engr Malbcob Farid	WAPDA	Deputy Director	
Abdur Razaq	WAPDA	Principal.	
Zafar Iqbal	WAPDA.	Addl DG	
RIFFAT Hussain	WAPDA	GM Training	
Junki Mori	JICA	Assistant Deputy Director	
Hiroki Hachiuta	Kansai	General Manager	
Yoshihiro Doi	Kansai	Mech. Mtg.	
Haruaki Furukawa	Kansai	Electric Engineer	
Yuki Obe	Kansai	C&I Eng	
Shigeru Yoshitake	Kansai	Mech. eng	

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Minutes of Meeting

Project	Capacity Building and Strengthening of Thermal Power Generation Operation & Maintenance in Pakistan (follow-up survey by JICA expert)
Title	2nd survey in Faisalabad TPS and Workshop
Date	5th September 2018
Time	9:00 - 12:00
Place	Meeting room, site and work shop
Attendees	See Attachment "attendance list (2018_04)"

Record of Discussions

NO	ITEM DETAILS
1.	**Introduction**
1.1	This meeting was convened with the objective to discuss the below agenda point: 1) Presentation of JICA Capacity building O&M "Overview of Interim Report" 2) Others (if any)
2.	**Overview of Interim Report**
2.1	JICA expert (Kansai) made the presentation on "overview of interim report", especially "O&M training program" and "selection criteria for next participants" for the 2nd training in Japan. 1) JICA explained the following contents: Ø JICA was considering the feasibility of switching training program from mechanical to electrical/C&I. On the other hand, JICA requested GHCL to clarify the training needs for the 2nd training in Japan such as major technical troubles and failures in Pakistani TPP. Ø If not possible, JICA intended to conduct advanced mechanical as the 2nd training, and electrical/C&I as the 3rd training respectively. 2) GHCL mentioned that GHCL could not make the final decision at this time, and that this issue should be discussed in JCC on the 14th September, and GHCL would inform JICA of the electrical training needs through discussion with Faisalabad, Guddu and Muzaffargarh by e-mail. (JICA expert have already received it.) 3) Faisalabad TPS would reply the questionnaires from JICA expert by e-mail later.

NO	ITEM DETAILS
2.2	4) JICA also explained the following contents about some KSF: ü How to disseminate the knowledge and skills obtained in Japan to other colleagues at each TPS (by JICA-trained engineers/technicians). ü How to supervise training activities by them in order to improve O&M training capacity (by TPS management), ü How to keep in touch with them after training in Japan (by JICA). 5) GHCL & Faisalabad TPS mentioned that they were often too busy in their duties to disseminate their knowledge and skills to others.

meeting title: _____

Capacity Building and Strengthening of Thermal Power Generation
Operation & Maintenance in Pakistan

Site Visit Faisalabad TPS Attendance List

Date: 5th / September / 2018

Time: 9 : 00 - 10 : 40

Place: Faisalabad Power Station

Name	Company	Position	Signature
Awjad Nisar	GTPS Genco-III	Addl. Plant Manager	
Munir Bhatti	Central maintenance Workshop Fsd	Addl. Director	
Rizwan Bhatti	GTPS GENCO-III	Asst: ENGR. (I&C)	
Muhammad Arshad	SPS Genco-III	AREC(M)	
Muhammad Jafar	GHCL	Addl. Director	
Ab: Kareem Memon	ARE.O. GTPS GENCO-III Faisalabad.	Addl. RE. OP.	
Nadeem Qamar	GTPS Genco-III Faisalabad	Add: Manager (Tech)	
Shahid Suhail	GTPS GENCO-III Faisalab	RESIDENT ENGINEER.	
Junki Mori	JICA	Deputy Assistant Director	
Hiroki Hirahata	Kansai	General Manager	
Yoshihiro Doi	Kansai	Mech. Mgr.	
Haruaki Furukawa	Kansai	Electrical Engineer	
Shigeru Yoshizaki	Kansai	Mech eng	
Yuki Obe	Kansai	C&I Eng	

Minutes of Meeting

Project	Capacity Building and Strengthening of Thermal Power Generation Operation & Maintenance in Pakistan (follow-up survey by JICA expert)
Title	2nd survey in Guddu TPS
Date	6th September 2018
Time	10:00 - 12:30
Place	RAMADA Hotel, Multan Conference Room
Attendees	See Attachment “attendance list (2018_05)”

Record of Discussions

NO	ITEM DETAILS
1.	**Introduction**
1.1	This meeting was convened with the objective to discuss the below agenda point: 1) Presentation of JICA Capacity building O&M “Overview of Interim Report” 2) Outline of Guddu TPS 3) Briefing on the answers of Kansai’s questionnaire 4) Interview with JICA-trained engineers & technicians 5) Discussion about provision of O&M training equipment. 6) Others (if any)
2.	**Overview of Interim Report**
2.1	JICA expert (Kansai) made the presentation on “overview of interim report”, especially “O&M training program” and “selection criteria for next participants” for the 2nd training in Japan. 1) Guddu staff members would reply the answer from our questionnaire by e-mail ASAP. 2) Guddu staff members would urge JICA trained engineers/technicians in Guddu to reply the training activity report.

NO	ITEM DETAILS
3.	**Outline of Guddu TPS and Training center**
3.1	Guddu staff members introduced their power plant with presentation. 1) Guddu T/C has no practical training equipment such as the power plant simulator in WEA, and provides trainees with classroom lecture with some textbooks. 2) The attendees in charge of mechanical expressed their opinion that the training needs in the electrical field might be circuit breaker, switch yard and protection relay etc., and that they could not grasp the details of electrical troubles and failures. 3) Guddu T/C has seven full-assigned trainers (one of senior engineer, one of junior engineer, 3 of operator, two of foremen) 4) Guddu T/C has 3 months training curriculum for refresh members and capacity of the curriculum is up to 15 members.
4.	**Provision of O&M training equipment**
	1) One of the attendees mentioned that the JICA's suggestion on provision of O&M training equipment (power plant simulator & vibration analysis demonstrator) was suitable just for beginners/junior members, and are not efficient for experienced/skilled engineers. Therefore he requsted JICA expert to provide the equipment based on the Action Plan formulated in first training in Japan. 2) Guddu T/C has no practical training equipment for NDI, and the Faisalabad workshop has some actual maintenance equipment only which cannot be utilized for training purpose.
4.	**Interview with JICA-trained engineers & technicians**
	1) JICA trained engineers/technicians could implement their "Action Plans" on schedule and their activities could help Pakistan to improve the O&M capacity. 2) The training materials in Japan were suitable for beginners, junior & poor-skilled members. 3) The plant operation simulator in WEA is based on Muzaffargahr TPS. (used to be useful for operators).

4) Generally speaking, Kansai has installed training equipment in the training centre for beginners/junior members to obtain basic theories, and senior members would obtain skill and knowledge mainly through OJT. (Guddu agreed to Kansai's opinion.)

5) Because every TPS have some experience of rotary vibration troubles and failures, the vibration analysis demonstrator would be very useful itself. However, actually without vibration analyser at each TPS, they cannot utilize the advanced knowledge obtained in Japan.

6) JICA-trained engineers/technicians were so busy that they disseminate their knowledge and skills to other colleagues obtained in Japan through not seminar/classroom lecture but OJT, with some training materials in Japan and useful information through internet.

7) Guddu will send JICA expert the photos of training scenes in Pakistan.

8) Guddu requests "heat efficiency" and "multi-stage pump (inc. BFP and CWP)" as additional training subject in Japan. Especially, they had some technical trouble of shaft-vibration regarding multi-stage pump.

9) Guddu TPS has KPIs regarding "Heat-rate", "Availability" and" Forced Outage".

meeting title: _____

Capacity Building and Strengthening of Thermal Power Generation Operation & Maintenance in Pakistan

Meeting with Guddu TPS Attendance List

Date: 6th / September / 2018

Time: 10 : 00 - 12 : 30

Place: RAMADA Hotel, Multan

Name	Company	Position	Signature
SOSHTHRAZ-[illegible]	GENCO II	Deputy Manager	
Asif Hasan Khan	GENCO II	Assistant Manager	
Muhammad Jafar	GHCL	Addl. Director	
Maf Saad Ahmed	CPGCL	Add. Direct	
Fakharuddin	CPGCL	Asst. Director	
Muhammad Moosa	CPGCL	Foreman Mech:	
Hiroki Hirahata	Kansai	General Manager	平畑 弘樹
Junki Mori	JICA	Deputy Assistant Director	
Yoshihiro Doi	Kansai	Mech. Mgr	
Yuki Obe	Kansai	C&I Eng	
Haruaki Furukawa	Kansai	Electric Engineer	
Shigeru Yoshitake	Kansai	Mech. eng	

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Minutes of Meeting

Project	Capacity Building and Strengthening of Thermal Power Generation Operation & Maintenance in Pakistan (follow-up survey by JICA expert)
Title	2nd survey in Muzaffargarh TPS
Date	7th September 2018
Time	9:00 - 11:30
Place	Muzaffargarh TPS Conference Room
Attendees	See Attachment “attendance list (2018_06)”

Record of Discussions

NO	ITEM DETAILS
1.	**Introduction**
1.1	This meeting was convened with the objective to discuss the below agenda point: 1) Presentation of JICA Capacity building O&M “Overview of Interim Report” 2) Briefing on the answers of Kansai’s questionnaire 3) Interview with JICA-trained engineers & technicians 4) Others (if any)
2.	**Overview of Interim Report**
2.1	JICA expert (Kansai) made the presentation on “overview of interim report”, especially “O&M training program” and “selection criteria for next participants” for the 2nd training in Japan. 1) Regarding the electrical field, Mr. Jafar requested JICA expert the detail training contents as per attached. 2) The expected trainees were specialist focused on just only one field so they were beginners in other field even in the electrical field. That is why JICA expert could provide the beginner and/or middle level lectures.

NO	ITEM DETAILS
3.	**Outline of Muzaffargarh TPS**
3.1	1) Muzaffargarh TPS has 3 phase generators as follows; Ø PHASE-1 : 3×210MW、(COD)1993-1995 Ø PHASE-2 : 2×200MW、(COD)1995 Ø PHASE-3 : 1×320MW、(COD)1997 The USAID has supported the rehabilitation of heaters in 2011. 2) Muzaffargarh TPS has set goals as follows; Ø Reduction in Air pre-heaters chocking, Ø Reduction in un-burnt Carbon quantity, Ø Reduction in SOx and NOx emission, Ø Optimisation of ash pH. (2-4), Ø Decrease in Stack temperature. 3) Due to gas shortage, Muzaffargarh TPS has been mainly using crude oil which was delivered by oil trailers and trains.
4.	**Interview with JICA-trained engineers & technicians**
	1) JICA trained participants pointed out they could implement their "Action Plans" on schedule and their activities could help Pakistan to improve the O&M capacity and they had certain effect to improve their own O&M. 2) Muzaffargahr TPS has installed a portable vibration analyser after training in Japan, JICA trained engineer and technicians had held vibration lectures with using that analyser. That analyser could store the main rotary equipment vibration data limited when monitored (discontinuous data). 3) JICA trained participants had transferred their knowledge to around 70 members (mainly technicians) through OJT. They are using textbooks obtained in Japan and the new analyser in the lectures. 4) JICA trained participants would send JICA expert the photos taken the training scene. 5) JICA trained technicians have held lectures not only in Muzaffargahr TPS but also in Faisalabad work shop. 6) JICA trained technicians hoped JICA experts to provide more advanced curriculum regarding pump maintenance because they had many trouble with pumps.

meeting title: _____

Capacity Building and Strengthening of Thermal Power Generation
Operation & Maintenance in Pakistan

Site Visit Muzaffargarh TPS Attendance List

Date: 7th / September / 2018

Time: 9 : 00 - 11 : 30

Place: Muzaffargarh TPS

Name	Company	Position	Signature
ALTAF HUSSAIN	NPGCL-Genco-III	Director Technical	
Muhammad Muddasir	NPGCL-GENCO-III	Asst Manager Mechanical	
Engr. Noor Alam	GPECL-GENCO-II	Addl. C.E / PM-I	
Muhammad Jafar	GHCL	Addl. Dir.	
Pervaiz Iqbal	NPGCL-GENCO-III	TECHNICIAN	
Muhammad Arif	NPGCL-GENCO-III	TECHNICIAN	
Engr: Ayaz Ahmed	NPGCL.GENCO-III	Deputy Manager	
Hiroki Hirohata	Kansai	General Manager	平畑 弘樹
Shigemi Yoshitake	Kansai	Mech. eng	吉竹 茂
Yuki Obe	Kansai	C&I Eng.	大部 祐貴
Haruaki Furukawa	Kansai	Electric Engineer	古川 晴亮
Yoshihiro Dod	Kansai	Mech. Mgr	
Junki Mori	JICA	Deputy Assistant Director	森 淳希

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Minutes of Meeting

Project	Capacity Building and Strengthening of Thermal Power Generation Operation & Maintenance in Pakistan (follow-up survey by JICA expert)
Title	2nd survey in Jamshoro TPS and Kotri TPS
Date	10th September 2018
Time	9:00 - 11:30 (Jamshoro) and 13:40-15:30 (Kotri)
Place	Jamshoro TPS Conference Room and Kotri TPS Conference Room
Attendees	See Attachment “attendance list (2018_07)”

Record of Discussions

NO	ITEM DETAILS
1.	**Introduction**
1.1	This meeting was convened with the objective to discuss the below agenda point: 1) Presentation of JICA Capacity building O&M “Overview of Interim Report” 2) Briefing on the answers of Kansai’s questionnaire 3) Interview with JICA-trained engineers & technicians 4) Others (if any)
2.	**Overview of Interim Report**
2.1	JICA expert (Kansai) made the presentation on “overview of interim report”, especially “O&M training program” and “selection criteria for next participants” for the 2nd training in Japan. 1) Jamshoro TPS has just only PT for NDI. 2) It is only Muzaffargarh TPS that has a laser alignment device in GENCOs, therefore the other TPS including Jamshoro TPS borrow it from Muzaffargarh when necessary.

NO	ITEM DETAILS
3.	**Interview with JICA-trained engineers & technicians**
	1) JICA trained engineers/technicians mentioned that they could implement their "Action Plans" on schedule and their activities could help Pakistan to improve the O&M capacity. 2) They have transferred their knowledge and skill obtained in Japan to other colleagues (both engineers and technicians) through OJT, and PT knowledge was especially useful. 3) At the request of other colleagues about HSE (especially safety), they would conduct lecture about safety equipment such as helmet, eye goggles etc. 4) Jamshoro TPS has the latest coal fired power development project, so they requests the advanced technology regarding USC (Ultra-Super Critical) and the environmental equipment. ->JICA strongly recommended Jamshoro to reflect these training needs including simulator on EPC contract. 5) They would send JICA expert the photos taken the training scene.
3.	Outline of Kotri TPS
3.1	1) Kotori has 7 units as follows; Ø Unit #1-2 had been dismantled. Ø Unit #3-6 were installed GT Ø Unit #7 was installed HRSG/ST with using exhausted heat from Unit #3-6. 2) Due to gas shortage, all of units including GTCC is out of operation. While availability factor is over 90%, annual capacity factor is around 30%. 3) The operators has unit operation record every 4 hours by manual (not automatic).

meeting title: _____

Capacity Building and Strengthening of Thermal Power Generation Operation & Maintenance in Pakistan

Site Visit Jamshoro TPS Attendance List

Date: 10th / September / 2018

Time: 9 : 00 - 12 : 00

Place: Jamshoro TPS

Name	Company	Position	Signature
Gul Munir Abbasi	CPGCL Genco-II	Dy. Manager	
Nadeem Memon	TPS Jamshoro Genco I	Foreman	
NAZEER AHMED	JPCL, GTPS, Kotri	Senior Engineer (Mechanical)	
Asadullah	CPGCL, Gaddu	Senior Engineer (Mechanical)	
MUHIB-ALI-RAISER.	JPCL-GENCO-I	Add. Senior Mechanical	
Syed Muneer	JPCL, Genco-I	Deputy Director (MIS)	
M. Aslam Memon	JPCL, Genco-I	Plant Manager	
Muhammad Jafar	GHCL	Addl. Director	
A. Hyder	JPCL Jamshoro	RE (Maint)	
Javed Akhtar	C.E/T.D.	Genco-I.	
Liaqat Ali	Manager MM	Genco-I	
Manzoor Ahmed	Deputy Director JPCL (MIS)	DD (MIS)	10/9/18
Junki Mori	JICA	Deputy Assistant Director	

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meeting title: _____

Name	Company	Position	Signature
Yuki Obe	Kansai	C&I Eng.	大下祐貴
Shigeru Yoshitake	Kansai	Mech. eng	吉竹茂
Haruaki Furukawa	Kansai	Electric Engineer	古川晴亮
Yoshihiro Doi	Kansai	Mech Mgr	Yoshi Doi
Hisashi Hirakata	Kansai	General Manager	平方尚樹

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Minutes of Meeting

Project	The Project for Capacity Building and Strengthening of Thermal Power Generation Operation & Maintenance. in the Islamic Republic of Pakistan
Title	The 3rd survey in Muzaffargarh TPS by JICA Expert Team (Kansai EPCO)
Date	2nd October 2019
Time	09:40 – 13:00
Place	Conference Rooms
Attendees	See Attachment "Attendance list"

Record of Discussions

NO	ITEM DETAILS
1.	**Introduction**
1.1	This meeting was convened with the objective to discuss the below agenda points: 1) Presentation of JICA Capacity building O&M "OVERVIEW of INTERIM REPORT(Drafted)" ü Project Summary ü O&M Training in Japan (2nd Batch in 2019) ü Monitoring Indicators (2nd Year Completed) ü Summary on the Mission: This Follow-up Survey Reviewing O&M training activity at TPPs implemented by JICA-trained engineers & technicians. Grasping the current situation of O&M at TPPs and confirming the O&M training subjects, through discussion on the issue analysis. Suggesting next O&M training in Japan and the selection criteria for engineers & technicians: 3rd Batch, JAN/FEB in 2020. Suggesting next HRD (Human Resource Development) training in Japan and the selection criteria for management: 3rd Batch, FEB in 2020. 2) Others (if any)

NO	ITEM DETAILS
2.	**OVERVIEW of INTERIM REPORT(Draft)**
2.1	JICA expert (KANSAI) made the presentation on "OVERVIEW of INTERIM REPORT(Draft)", containing "Project Summary", "O&M Training in Japan (2nd Batch in 2019)", "Monitoring Indicators (2nd Year Completed)" and "Summary on the Mission: This Follow-up Survey" 1) JICA expert (KANSAI) explained the next training in Japan (O&M and HRD) and the importance of the selection criteria. Management understood these contents. 2) Regarding the I&C training subjects, management told that fire protection system, environmental quality control and I&C safety consideration are important and should be included in the next O&M training course in Japan. JICA expert replied that fire protection system had been already included in the previous electrical O&M training course and that the essence of remaining two subjects would also be covered by other subjects of the next training course.
3.	**Interview and discussion with JICA-trained engineers and technicians**
	1) Hearing the answers of Kansai's questionnaire, JICA's questionnaire and APs activities (E/T) They disseminated their knowledge and skills to their colleagues by utilizing JICA expert's training materials. For example, JICA-trained engineer made his own training material about safety modifying JICA expert's training materials. JICA expert received their activity reports and pictures. (E/T) Some JICA-trained engineers and technicians made the presentation on their dissemination activity. The contents were about vibration analysis of rotating machine, maintenance of electrical equipment, safety training and so on. (E) They told that O&M training in Japan was very useful because the training contents were comprehensive and included the latest technology. They started some activities that they had learned in the training in Japan such as time-management. (T) Technicians disseminated their knowledge to their colleagues with the support from management. (T) Technicians mentioned that their APs can help to improve whole technical skills of their workplace such as technicians are now able to conduct maintenance work by themselves.

NO	ITEM DETAILS
	2) Discussion about the Issue Analysis of O&M at TPPs. (E) Though there is no HSE (Health, Safety and Environment) section at their TPPs, safety culture is now being improved because of their dissemination activities. (E) They have interest in CMMS (Computerized Maintenance Management System) and ERP because now they manage the TPP information manually using spreadsheet and they are not so effective.
4.	**Site visit to existing training facility in Muzaffargarh**
	The customized operator training simulators are designed for operators from not only Muzaffargarh but Jamshoro TPPs which was installed by Chinese manufacturer. These existing simulators seems out of order and so obsolete that it is difficult to help operator's practical skill to be strengthened, without enough upgrade or refurbishment. Although there are more than 10 small classrooms (each capacity is less than 10 trainees) for lecture and practical training in this facility, they also seems old-fashioned and not used at this time. After enough upgrade or refurbishment, the training facility seems to have some good potential of strengthening O&M training facility for TPPs with neighboring colony as guest house.

The Project for Capacity Building and Strengthening of Thermal Power Generation Operation & Maintenance. in the Islamic Republic of Pakistan

Muzaffargarh Attendance List

Date: 2 / Oct. / 2019

Time: 9 : 30 - :

Place: Muzaffargarh TPS

No.	Name	Position	Company	Signature
1	IRFAN BASHIR	Addl. Manager	GENCO III	
2	Focal Person, Abbasi Munir Ahmed	Deputy Manager Electrical	NPGCL GENCO-III	
3	Muqarrab Iqbal	Chief HR & Admin.	NPGCL GENCO-III	
4	MUHAMMAD. MUDDASIR	Ass: Manager Mechanical	NPGCL GENCO-III	
5	Arslan Abbas	AD(MMS)	GENCO-III	
6	ZAHID ALI	Dy. MANAGER	GENCO-III	Zahid
7	Muhammad ARIF	Fitter	Genco III	
8	ALLAH NAWAZ	Test Inspector	Genco III	
9	PERVAIZ IQBAL	FOREMAN MECHANICAL	GENCO-III	
10	Muhammad Jafar	Addl. Dir	GHCL	

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Muzaffargarh Attendance List

No.	Name	Position	Company	Signature
1	IMRAN AHMAD	SR. PROGRAMME MANAGER	JICA PAKISTAN OFFICE	
2	Saboeeh uz Zaman	CEO	GENCO-III	
3	Nioki Hirahata	General Manager	Kansai Electric	平畑孔樹
4	Akira Kozakai	Mech & Operation Engineer	JICA Expert Kansai Electric	Akira Kozakai
5	Yoshihiro Doi	Mech Eng.	JICA Expert Kansai EPCO	
6	Hidenobu Ichioka	Elec. Engineer	JICA Expert Kansai Electric	一岡栄喜
7	Yuki Obe.	C&I Eng.	JICA Expert Kansai Electric	大江祐貴
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Minutes of Meeting

Project	The Project for Capacity Building and Strengthening of Thermal Power Generation Operation & Maintenance. in the Islamic Republic of Pakistan
Title	The 3rd survey in Guddu TPS by JICA Expert Team (Kansai EPCO)
Date	3rd October 2019
Time	10:10 – 13:30
Place	Conference Rooms
Attendees	See Attachment "Attendance list"

Record of Discussions

NO	ITEM DETAILS
1.	**Introduction**
1.1	This meeting was convened with the objective to discuss the below agenda points: 1) Presentation of JICA Capacity building O&M "OVERVIEW of INTERIM REPORT(Drafted)" ü Project Summary ü O&M Training in Japan (2nd Batch in 2019) ü Monitoring Indicators (2nd Year Completed) ü Summary on the Mission: This Follow-up Survey Reviewing O&M training activity at TPPs implemented by JICA-trained engineers & technicians. Grasping the current situation of O&M at TPPs and confirming the O&M training subjects, through discussion on the issue analysis. Suggesting next O&M training in Japan and the selection criteria for engineers & technicians: 3rd Batch, JAN/FEB in 2020. Suggesting next HRD (Human Resource Development) training in Japan and the selection criteria for management: 3rd Batch, FEB in 2020. 2) Others (if any)

NO	ITEM DETAILS
2.	**OVERVIEW of INTERIM REPORT(Draft)**
2.1	JICA expert (KANSAI) made the presentation on "OVERVIEW of INTERIM REPORT(Draft)", containing "Project Summary", "O&M Training in Japan (2nd Batch in 2019)", "Monitoring Indicators (2nd Year Completed)" and "Summary on the Mission: This Follow-up Survey" 1) JICA expert (KANSAI) explained the next training in Japan (O&M and HRD) and the importance of the selection criteria. Management understood these contents.
3.	**Interview and discussion with JICA-trained engineers and technicians**
	1) Hearing the answers of Kansai's questionnaire, JICA's questionnaire and APs activities (E) They disseminated their knowledge and skills to their colleagues although they were busy with their work. JICA expert guess that further support from management such as giving them more opportunity to implement dissemination activity would be more effective. JICA expert received their activity reports and pictures. (E) They try to improve safety at work by utilizing what they learned in the training in Japan. But, it seems to take time to fully establish safety culture and mind at their workplace. JICA expert told them that continuous effort was important to do so. (E) They told that the training in Japan had improved their attitude, way of thinking and approach to problem. For example, they started keeping record of troubles, introducing some concept of RBM (Risk Based Maintenance). (E) They said that some training subjects such as "boiler water quality control" was very effective to other colleague through dissemination while O&M training in Japan seems general. (E) They suggested that in case of next phase (after this JICA project), it would be more beneficial to focus on specific item for skilled member. For example, "vibration analysis" and "facility diagnosis based on lifetime assessment" for main equipment provided by Japanese manufacturer: Steam turbine (FUJI ELECTRIC) and Boiler (MES) at Jamshoro TPS. (T) Technicians disseminated their knowledge to their colleagues with the support from management. (T) Technicians mentioned that their APs can help to improve quality of their maintenance work. (T) Through implementing APs by participants, maintenance workers are keeping maintenance tools and parts tidy and in order during overhaul work. In addition, time management has been improved through Japanese culture and training in Japan. (T) Maintenance reports have been originally created for work related to equipment without OEM manual, and are utilized for similar work.

NO	ITEM DETAILS
	2) Discussion about the Issue Analysis of O&M at TPPs. (E) They have interest in CMMS (Computerized Maintenance Management System) and ERP because now they manage the TPP information manually using spreadsheet and they are not so effective.

The Project for Capacity Building and Strengthening of Thermal Power Generation Operation & Maintenance.
in the Islamic Republic of Pakistan

Meeting with Guddu TPS Attendance List

Date: 3 / Oct. / 2019

Time: 10 : 00 - 13 : 30

Place: Guddu TPS

No.	Name	Position	Company	Signature
1	EJAZ HUSSAIN	Chief HR Head Training	GENCO-II	
2	Muhammad Jafer	Addl. Dir	GHCL	
3	IMRAN AHMAD	SR. PROGRAMME MANAGER	JICA	
4	Ahmed Ali Buriro	Co ordinator JICA + Admin & (Fuel)	CPGCL.	
5	Abdul Shaffar Noonari	Addl. PM-V	GENCO-II	
6	Mahmood-ul-Hasan	AM	GENCO-II	
7	Asadullah Babar	Dy. Manager	Genco-II	
8	SHAHBAZ-UL-HAQ	Dy: Manager	GENCO II	
9	Asif Hasan Khan.	Addl Dy Manager.	Genco-II	
10	Muhammad Moosa	Mech: Fop	GENCO: II Guddu	

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Meeting with Guddu TPS Attendance List

No.	Name	Position	Company	Signature
11	Mughees-ul-Muneer Khan	Dy. Manager (M/S)	GENCO-II TPS Guddu	
12	Ijaz Ahmed Channa	Mech Foreman	GENCO-II Guddu	
13	GUL MUNIR ABBASI	Dy. Manager	GENCO-II	
14	MOHAMMAD SALEEM	TEST. INSPECTOR	GENCO-II 600 M.W.	
15	Muhammad Ishaque	Foreman	Genco-II TPS Guddu	
16	Moula Bux	Foreman	GENCO-II TPS Guddu	
17	~~Mahmood-ul-Hasan~~	~~AM(F&C)~~	~~CPGCL~~	
18	Abdul Ghaffar	Personal Assistant to Chief HR officer	CPGCL Genco-II	
19	Nasim Khan.	Asstt. manager	C.P.G.C.L. Genco-II.	
20	Muhammed Saleem	IT Expert	CPGCL	
21	Hiroki Hiraiata	General Manager	Kansai Electric	平畑弘樹
22	Hidenobu Ichioka	Elec. Engineer JICA Expert	Kansai Electric	一岡栄喜
23	Akira Kozakai	Operation & Mech Engineer, JICA Expert	Kansai Electric	小堺瑛
24	Yoshihiro Doi	Mech. Engineer JICA Expert	Kansai Electric	
25	Yuki Obe	JICA Expert C&I Eng.	Kansai Electric	大江祐貴

Minutes of Meeting

Project	The Project for Capacity Building and Strengthening of Thermal Power Generation Operation & Maintenance. in the Islamic Republic of Pakistan
Title	The 3rd survey in Guddu TPS T/C by JICA Expert Team (Kansai EPCO)
Date	4th October 2019
Time	10:00 – 13:00
Place	Guddu TPS and Training Centre
Attendees	Ejaz Hussain (Chief Human Resource & Admin Officer), JICA experts

Record of Discussions

NO	ITEM DETAILS
1.	**Site visit to Guddu TPS and Training Centre**
	JICA expert (KANSAI) surveyed the 747MW gas turbine combined cycle (GTCC) plant and the training centre. 1) GTCC plant The plant is composed of 2 GT (GE: 9FA) and 1 ST (Harbin), and started commercial operation in 2014. The plant was partially upgraded in 2018, and the thermal efficiency and the heat rate were improved. JICA expert surveyed central control building, turbine building (mainly gas turbine), and electrical rooms of the plant. The plant seems to be kept relatively clean and set in order rather than other TPSs. But, JICA expert recognized that there was still room for improvement in O&M of the plant (e.g. inefficient data collection, drainage in instrument panel). 2) Training Centre The training centre is operated for engineers and technicians. It has several class rooms, working room (mechanical) and library room. From a viewpoint of JICA expert, the training facility and training material seems a little old, but to have some good potential of strengthening O&M training facility for TPPs in case of overall refurbishment.

NO	ITEM DETAILS
2.	**Presentation on Training Centre from Chief Human Resource Officer**
2.1	Chief Human Resource Officer made the presentation on training centre in Guddu. 1) He explained the following contents about training centre. PROFILE Staff/Faculty/Resource Person LEARNING OBJECTIVES and FOUR OTHER OBJECTIVES BASIC RATIONALE BEHIND TRAINING EXISTING TRAINING COURSES TRAINEES/SKILLED PASS OUT DURING 2018-19 PROPOSED TRAINING COURSES REQUIREMENTS FOR UP-GRADATION Especially he emphasized the necessity of overall refurbishment for the existing training facility due to old-fashioned specification. 2) JICA expert told that this Project and the refurbishment of the existing training facility should be considered separately and that GHCL should communicate with JICA Pakistan office about this issue. CPGCL fully understood the JICA expert's opinion. Attachment: Presentation on Training Centre (Central Power Generation Company Limited GENCO-II)

Minutes of Meeting

Project	The Project for Capacity Building and Strengthening of Thermal Power Generation Operation & Maintenance. in the Islamic Republic of Pakistan
Title	The 3rd survey in Jamshoro TPS by JICA Expert Team (Kansai EPCO)
Date	7th October 2019
Time	09:10 – 12:30
Place	Conference Rooms
Attendees	See Attachment "Attendance list"

Record of Discussions

NO	ITEM DETAILS
1.	**Introduction**
1.1	This meeting was convened with the objective to discuss the below agenda points: 1) Presentation of JICA Capacity building O&M "OVERVIEW of INTERIM REPORT(Drafted)" ü Project Summary ü O&M Training in Japan (2nd Batch in 2019) ü Monitoring Indicators (2nd Year Completed) ü Summary on the Mission: This Follow-up Survey Reviewing O&M training activity at TPPs implemented by JICA-trained engineers & technicians. Grasping the current situation of O&M at TPPs and confirming the O&M training subjects, through discussion on the issue analysis. Suggesting next O&M training in Japan and the selection criteria for engineers & technicians: 3rd Batch, JAN/FEB in 2020. Suggesting next HRD (Human Resource Development) training in Japan and the selection criteria for management: 3rd Batch, FEB in 2020. 2) Others (if any)

NO	ITEM DETAILS
2.	**OVERVIEW of INTERIM REPORT(Draft)**
2.1	JICA expert (KANSAI) made the presentation on "OVERVIEW of INTERIM REPORT(Draft)", containing "Project Summary", "O&M Training in Japan (2nd Batch in 2019)", "Monitoring Indicators (2nd Year Completed)" and "Summary on the Mission: This Follow-up Survey" 1) JICA expert (KANSAI) explained the next training in Japan (O&M and HRD) and the importance of the selection criteria. Management understood these contents, especially the importance of dissemination activity implemented by JICA-trained engineers and technicians. 2) Participants told that the equipment for "Remaining Life Assessment" is need to be provided for the improvement of O&M. JICA expert replied that the purpose of providing the training equipment was to make their dissemination activity more effective, and that the provision of the training equipment should fit the purpose.
3.	**Interview and discussion with JICA-trained engineers and technicians**
	1) Hearing the answers of Kansai's questionnaire, JICA's questionnaire and APs activities (E) They disseminated their knowledge and skills to their colleagues although they were busy with their work. JICA expert received their activity reports and pictures. (E) Some JICA-trained engineers made the presentation on their dissemination activity. One of the engineer plan to deliver the dissemination activity not only to Jamshoro TPP, but also to other GENCOs. (E) They try to improve safety at work by utilizing what they learned in the training in Japan. But, it seems to take time to fully establish safety culture and mind at their workplace. JICA expert told them that continuous effort was important to do so. (E) They told that the practical training would be more effective if the training equipment was provided compared with only delivering theoretical lecture. (E/T) They told that there were no major technical failure/accident about I&C, but some technicians told that there some minor troubles such as limit-switch caused by dust. (T) They disseminated their knowledge to their colleagues by utilizing JICA expert's training materials. JICA expert received their activity reports and pictures. (T) They mentioned that their APs can help to improve whole technical skills of their workplace. (T) They told that FTA (fault tree analysis) method obtained in the training in Japan is useful for on-site troubleshooting. (T) They told that it took more time to procure safety equipment such as helmet and safety glasses (goggles) etc.

NO	ITEM DETAILS
	2) Discussion about the Issue Analysis of O&M at TPPs. (E) They have interest in CMMS (Computerized Maintenance Management System) and ERP because now they manage the TPP information manually using spreadsheet and they are not so effective.

The Project for Capacity Building and Strengthening of Thermal Power Generation Operation & Maintenance. in the Islamic Republic of Pakistan

Meeting with Jamshoro/Lakhra TPS Attendance List

Date: 7 / Oct. / 2019

Time: 9 : 30 - 13 : 00

Place: Jamshoro TPS

No.	Name	Position	Company	Signature
1	SYED T. JAFRI	CEO	JPCL/GENCO-I	
2	RUSTAM ALI GHAURI	CE / T.D	JPCL- GENCO-I.	7.10.19
3	Nazeer Ahmed	Sr: Engr: (Mech)	G.T.PS Kotri (JPC)	7.X.19
4	Imdad Hussain	Electrician	Genco IV Lakhra	
5	Ali Akbar Memon	Operator	GENCO IV Lakhra	07/10/19
6	NANDLAL	Assistant manager	GENCO-IV Lakhra.	7/X
7	Naseer Ahmed Seelro	Foreman	GENCO - I	7/10/19
8	Sajid Hussain Ansari	Addl. Mgr. (I&C) - PIU	GENCO-I	
9	Rajesh Kumar	Addl. Mgr.	Genco-IV	
10	Muhib Ali Rajper	Add. Senior Engr.	GENCO-I	

Meeting with Jamshoro/Lakhra TPS Attendance List

No.	Name	Position	Company	Signature
11	Muhammad Jafar	Addl. Dir.	GHCL	
12	IMRAN AHMAD	SR. PROGRAM MANAGER	JICA	
13	Zeeshan Muzammil Khan	Sr. Engr.	JPCL	
14	Toheed Khan	Operator	JPCL	
15	Nadeem Memon	Foreman	JPCL	
16	Muhammad Azeem	Operator	JPCL	
17	Nirahata Hiroki	General Manager	Kansai Electric	平畑弘樹
18	Yoshihiro Doi	Mech Engineer	Kansai Electric	Yoshi Doi
19	Akira Kozakai	Mech&Operation Engineer, JICA Expert	Kansai Electric	小堺 瑛
20	Hidenobu Ichioka	Elec. Engineer JICA Expert	Kansai Electric	一岡栄喜
21	Yuki Obe	C&I Eng. JICA Expert	Kansai Electric	大下祐貴
22				
23				
24				
25				

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Annex 7

List of outputs of the project

List of outputs of the project

(1) Reports

№	Title of report	Time of submission
1	Work Plan	June 2018
2	Baseline Survey Report	August 2018
3	Project Progress Report (No. 1)	September 2018
4	Project Progress Report (No. 2)	October 2019
5	Project Progress Report (No. 3)	March 2021
6	Project Monitoring Sheet Ver.1	September 2018
7	Project Monitoring Sheet Ver.2	March 2019
8	Project Monitoring Sheet Ver.3	October 2019
9	Project Monitoring Sheet Ver.4	April 2020
10	Project Monitoring Sheet Ver.5	December 2020
11	Project Monitoring Sheet Ver.6	February 2022
12	Project Completion Report	February 2022

(2) Other Outputs

№	Title of output	Time of submission
1	Training Curriculum and Textbook for the 1st Training in Japan (engineer / technician / management)	March 2018
2	Training Syllabus, Curriculum and Textbook for the 2nd Training in Japan (engineer / technician / management)	February 2019
3	Training Syllabus, Curriculum and Textbook for the 3rd Training in Japan (engineer / technician)	January 2020
4	Training Syllabus, Curriculum and Textbook for the 4th Online Training (instructor)	November 2021

Annex 8

List of equipment provided by Japan

List of equipment provided by Japan

(1) Nondestructive testing kit (for Muzaffargarh and Guddu Training Center)

Item No.	Item name	Manufacturer/ Model Number	Quantity	
			Muzaffargarh	Guddu
1	NDT introduction(DVD)	The Japanese Society for Non-Destructive Inspection	2	2
1	DVD player	Pioneer	2	2
2	NDE Educational Kit	Dakota Japan	2	2
3	Non-destructive Testing Materials (PT)	Eishin Kagaku Co., Ltd.	6	6
4	Test panel for PT (Weld of a plain stainless steel plate)	Eishin Kagaku Co., Ltd.	6	6
5	Penetrant R -1 A (NT) Type 450	Eishin Kagaku Co., Ltd.	30	30
6	Developer R -1 S (NT) 450 Type	Eishin Kagaku Co., Ltd.	30	30
7	Remover R -1 M (NT) 450 Type	Eishin Kagaku Co., Ltd.	48	48
8	Paper Wiper(white)	NIPPON PAPER CRECIA	72	72
9	Paper Wiper(brown)	NIPPON PAPER CRECIA	48	48
10	Single Cartridge Respirator	3M 3200 Medium/Large	20	20
11	Organic Vapor Cartridge	3M 3301 J -55	200	200
12	Test panel for MT JIS Z 2320-1 type A(round)	Eishin Kagaku Co., Ltd.	15	15
13	Test panel for MT (Weld of a plain stainless steel plate)	Eishin Kagaku Co., Ltd.	6	6
14	Fluorescent magnetic particles(SY-7500)	Eishin Kagaku Co., Ltd.	18	18
15	Non-fluorescent magnetic particles(MK-15)	Eishin Kagaku Co., Ltd.	18	18
16	LED Black light (S-35LC)	Eishin Kagaku Co., Ltd.	6	6
17	Down trance(TDG-100) for black lights	TOEI HENSEIKI Co., Ltd.	6	6
17	Magnetic yoke (Handy Magna A-6)	Eishin Kagaku Co., Ltd.	6	6
17	Down trance(TDG-6) for magnetic yokes	TOEI HENSEIKI Co., Ltd.	6	6
18	Step test place for UT	Eishin Kagaku Co., Ltd.	6	6
19	Contact medium for thickness measurement (Soni coat BSL -150)	TAIYO PRODUCTS CO.,LTD.	10	10
20	Ultrasonic Precision Thickness Gauge (Elcometer PTG8)	Elcometer Limited	6	6

(2) Rotor dynamics simulator kit (for Muzaffargarh Training Center)

Item No.	Item name	Manufacturer/ Model Number	Quantity
			Muzaffargarh
21	Rotor Kit	AA31-016/Z01	1
21	Measurement Box	AA31-002	1
21	Duralumin Case	AA31-017	1
21	Mounting Base	AA31-018	1
21	Sensor	FL-202F05L-M1-00-03-10	5
21	Extension Cable	FW-202FL-40	5
21	Driver	FK-202F1-1-2	5
21	Acceleration Transducer	CA-302-00-0/Z37	2
21	Portable Data Acquisition Unit	KJ-2000B-30-A118-000-000-000	1
21	Analysis Software	XJ-2100-01/RB1/RB2/SU0	1
21	Power transformer	Primary (input): 220-240(VAC) Secondary (output): 100(VAC)	1
21	Balance weight	0.2(g)*5, 0.4(g)*5, 0.6(g)*5, 0.8(g)*5, 1.0(g)*5	1 set
21	Tool kit	Hexagonal wrench, Small monkey wrench, Box wrench	1 set
21	Spare fuse	5(A), Spare fuse of Measurement Box	2
21	Power cable	For Measurement Box	1
21	Mounting bolt	M6*40(mm)	4
21	BNC-BNC cable	Cable length: 1.5(m)	5
21	Coupling	CPBSC25-10-10 (MISUMI Japan) ※NBK(Manufacturer) Model: MFBS-25C-10-10	1
21	Ball bearing unit for the spare	Unit incorporating normal bearings	1
21		Unit incorporating bearings of outer ring damage	1
21	Motor power cable	Cable length: 3.0(m)	1
21	Motor encoder cable	Cable length: 3.0(m)	1

Item No.	Item name	Manufacturer/ Model Number	Quantity
			Muzaffargarh
21	Personal Computer	(HP) HP Prodesk 600 G6 SFF/CT	1
21	LCD Monitor	(Iiyama) ProLite XB3270QS-2	1
21	Color Laser Printer	(HP) HP LaserJET Pro Color CP5225dn	1
21	UPS (Uninterruptible Power Supply)	(Schneider Electric) SMT750IC	1
21	Electric Balance	(A&D) EK-4100i	1
21	Power Conversion Adapter	(SANWA SUPPLY) Boxer 1500 RW79	1
21	LAN Cable	(ELECOM) LD-CTT/BU10/RS	2
21	BNC-BNC Cable	(MISUMI) BNCP50-1.5D2V-BNCP50-5	10
21	HDMI Cable	(ELECOM) DH-HDP14SS18BK	1
21	Power Cord	(MISUMI) CEE3P-MS-1.8	2
21		(MISUMI) CESTM-1.8	2
21		(MISUMI) CCC2P-W-3	1
21	Power Conversion Adapter	(SANWA SUPPLY) TR-AD14	5
21	Toner Cartridge	(HP) CE740A	10
21		(HP) CE741A	10
21		(HP) CE742A	10
21		(HP) CE743A	10

Certificate of Receipt

To: Ogawa Seiki Co., Ltd.

Address: 22 Sankyo Bldg. 2-9, Okubo 2-Chome, Shinjuku-ku, Tokyo, 169-0072 Japan.

From: Northern Power Generation Company Limited

Address: Thermal Power Station, Mehmood Kot Road, Muzaffargarh

Contract. NO.: 2020-006

Project for Capacity Building and Strengthening Of Thermal Power Generation Operation and Maintenance

This is to confirm and certify that we have received the Product as below in satisfactory quality.

Item	Description	Quantity
1	DVD set "Introduction to Non-Destructive Testing"	2 Sets
2	Welding Defect Test Piece Introductory Set Demo Set (KT-CS91)	2 Sets
3	24S aluminum burn crack test piece (For penetrant inspection)	6 Sets
4	welding plate type crack test piece (For penetrant inspection)	6 Sets
5	Penetrant test penetrant	30 Sets
6	Developer for penetrant inspection	30 Sets
7	Cleaning solution for penetrant inspection	48 Sets
8	Paper Wiper (white)	72 Sets
9	Paper Wiper (brown)	48 Sets
10	Gas mask for organic solvent work (facet / size L)	20 Sets
11	Gas mask for organic solvent work (absorbent can)	200 Sets
12	A type standard test piece (For magnetic particle inspection)	15 Sets
13	Welding plate type crack test piece (For magnetic particle inspection)	6 Sets
14	Fluorescent magnetic particle liquid for magnetic particle inspection	18 Sets
15	Ordinary black magnetic particle liquid for magnetic particle inspection	18 Sets
16	Handy black light (LED) for magnetic particle inspection	6 Sets
17	Interpole magnetic particle inspection device for magnetic particle inspectio	6 Sets
18	Test Piece for ultrasonic thickness measurement	6 Sets
19	Contact medium for UT Sound velocity	10 Sets
20	Ultrasonic thickness meter Measurement	6 Sets
21	Vibration analysis model rotor	1 Set

Signature: _____ Assistant Store Manager, Thermal Power Station NPGCL, Muzaffargarh

Name: _____

Title, Department: ASSISTANT STORE MANAGER (SUPPLY CHAIN)

Northern Power Generation Company Limited

Date: 20-11-2021

Certificate of Receipt

To: Ogawa Seiki Co., Ltd.

Address: 22 Sankyo Bldg. 2-9, Okubo 2-Chome, Shinjuku-ku, Tokyo, 169-0072 Japan.

From: Central Power Generation Company Limited

Address: Thermal Power Station, Guddu District Kashmore (Sindh) Pakistan

Contract. NO.: 2020-006

Project For Capacity Building And Strengthening Of Thermal Power Generation Operation And Maintenance

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17	Interpole magnetic particle inspection device for magnetic particle inspectio	6 Sets
18	Test Piece for ultrasonic thickness measurement	6 Sets
19	Contact medium for UT Sound velocity	10 Sets
20	Ultrasonic thickness meter Measurement	6 Sets

Deputy Manager (Training)
CPGCL (GENCO-II) TPS Guddu

Signature: _____

Name: Khurram Shamsher

Title, Department: Deputy Manager Training

Central Power Generation Company Limited

Date: 24-12-2021

Annex 9

Project Monitoring Sheet: Updated Version of Ver.6

・**TO Chief Representative of JICA Pakistan Office**

Project Monitoring Sheet

Project Title: The Project for Capacity Building and Strengthening of Thermal Power Generation Operation and Maintenance in The Islamic Republic of Pakistan

Version of the Sheet: Ver.6 （Term: December 2020 – February 2022）

Name: Muhammad Imran Mian
Title: Project Director
Name: Okuda Hidenobu
Title: Chief Advisor/Thermal Power Generation O&M

Submission Date: 17th February, 2022

I. Summary

1 Progress

1-1 Progress of Inputs

➢ *The Japanese side provided the following items from December 2020 to February 2022.*

- Training equipment for Muzaffargarh and Guddu training center
  Muzaffargarh training center
  - Vibration Analysis Demonstrator / Non Destructive Inspection (NDI) Demonstrator

  Guddu training center
  - NDI Demonstrator
- Online training for instructors from Muzaffargarh and Guddu training center
  - 8 instructors, from 29th November 2021 to 8th December 2021
- Although the Japanese side was planning to dispatch the Japanese experts for the final survey (the 4th follow-up survey) during this reporting period, the dispatch of the Japanese experts was not conducted as planned due to the Covid-19 pandemic.

➢ *The Pakistan side provided the following items from December 2020 to February 2022.*

- Assignment of counterpart personnel
- Dispatch of participants for the online training
- Implementation and reporting of action plan activities

1-2 Progress of Activities (up-date with in the this reporting period)

The progress of activity set for each output is as follows.

- *Output 1: Current situation of O&M of thermal power stations is analyzed and training needs are identified.*
  - [1.1] To analyze the current situation of O&M at thermal power stations
    - ✓ Already completed.
  - [1.2] To review the training system of thermal power generation, and analyze the current situation and issues of O&M personnel
    - ✓ Already completed.
  - [1.3] To specify the training needs
    - ✓ As agreed at the 4th JCC online meeting on 19th November 2020, JICA Expert Team (JET) decided to provide the additional training (4th batch training) using the training equipment (Vibration Analysis Demonstrator / NDI Demonstrator) provided by JET.

- *Output 2: Capacity of ~~WEA and~~ GENCOs' Instructors is enhanced*
  - [2.1] To set the target O&M skills that instructors & potential instructors should obtain
    - ✓ JET set the target skills to be acquired in the additional mechanical maintenance training using the training equipment provided by JET.
  - [2.2] To formulate the program of training in Japan
    - ✓ JET formulated the additional mechanical maintenance training program using the training equipment provided by JET.
  - [2.3] To set selection criteria for the training in Japan
    - ✓ JET created selection criteria based on the additional mechanical maintenance training and shared it with counterparts.
  - [2.4] To conduct trainings in Japan
    - ✓ Due to the spread of covid-19 infection, additional training has been changed to online training instead of on-site training.
    - ✓ 8 instructors belonging to each GHCL training center were trained in the additional online training.
  - [2.5] To modify the contents of training in Japan at ~~WEA and~~ GENCOs' thermal power stations (OJTs) in Pakistan
    - ✓ Already completed.

- *Output 3: Trainings as well as On-the-Job Training (OJT) at ~~WEA and~~ GENCOs are improved*
  - [3.1] To develop action plans of trainings (OJTs) for O&M of thermal power

stations

- ✓ In the 4th batch online training, instructors made the action plans for improvement of O&M capacity of TPSs.

- [3.2] To disseminate obtained knowledge and technical skills to O&M personnel based on the action plans and verify the skilled up level by checklist developed at the above [2.4]
  - ✓ According to regular training reports from the participants trained in Japan (24 engineers & 24 technicians), they conducted a total of 822 trainings and they trained a total of 6,329 trainees of GENCOs during this project.
  - ✓ According to training reports from the participants (8 instructors) from each GHCL training center who trained in the online training, they conducted a total of 13 trainings using training equipment provided by JET and they trained a total of 85 trainees of GENCOs.
  - ✓ The results of reports from those who participated in the training conducted by JICA-trained participants shows that the training was highly evaluated and improved their O&M ability at TPSs. (as shown in Chart 1-1)

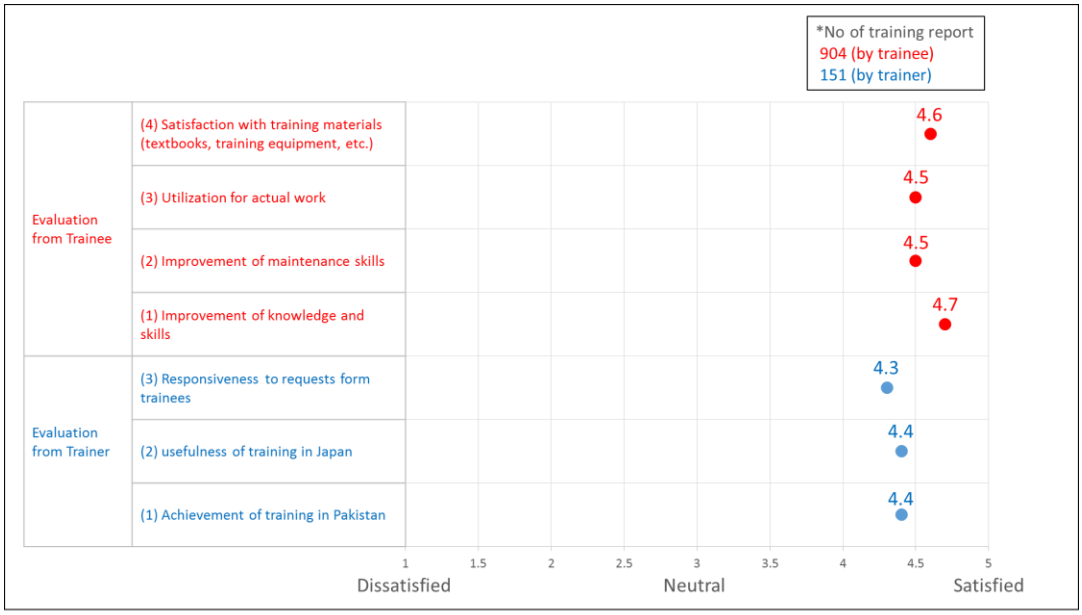

Chart 1-1: Evaluation of Training provided by JICA trained participants (based on report surveys)

- [3.3] To review the results of action plans to improve the training at ~~WEA and~~ GENCOs' thermal power stations (OJTs) in Pakistan
  - ✓ JET conducted a remote survey to confirm the implementation status of the action plans of 1st/2nd/3rd batch participants trained in Japan.
    It seems that 46% of the participants trained in Japan were able to implement

the Action Plan as planned. The remaining 56% seemed to be able to implement only partial Action Plans due to Covid-19 pandemic as shown in Chart 1-2.

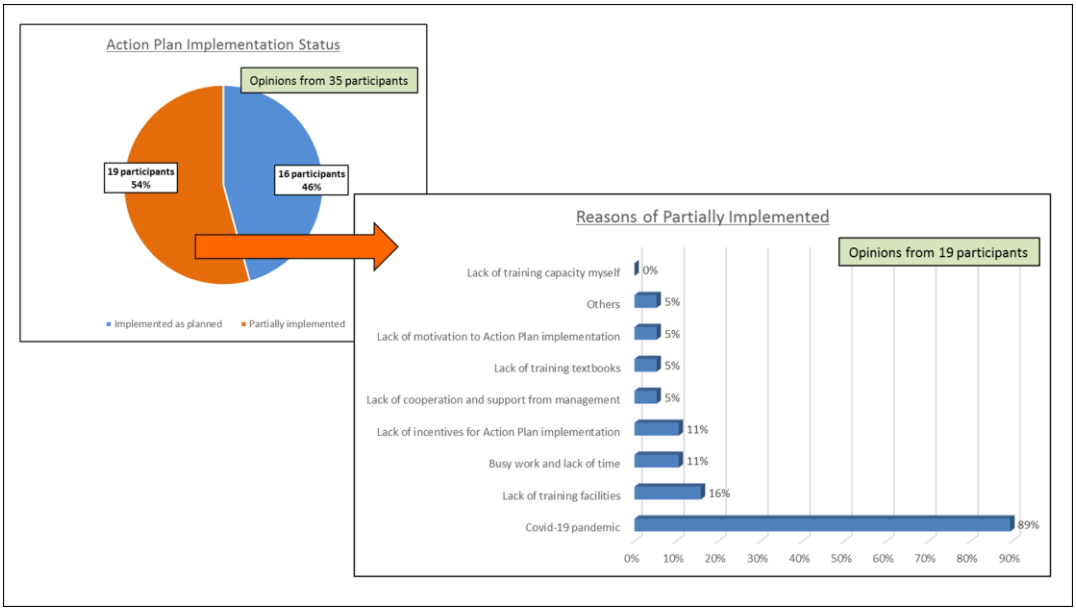

Chart 1-2: Action Plan Implementation Status (based on report surveys)

✓ JET conducted a remote survey to confirm the implementation status of the action plans of 4th batch participants who received online training.
JET confirmed that the instructors at the Muzaffargarh and Guddu training centers are implementing their own action plans as planned.

✓ JET has obtained the following good results through reports from JICA-trained participants.
(Engineer and Technician)

- JICA-trained participants disseminated their knowledge and skills to their colleagues not only by utilizing training materials provided by JICA Expert Team, but also by creating and arranging the materials by themselves. JET recognize that the training ability in TPSs is steadily increasing by using the training material of high-quality instead of conventional verbal technical transfer.
- Some JICA-trained participants implemented dissemination activity not only for staff of his own TPS, but also for staff of other TPSs (e.x. Jamshoro to Kotri).
- The trainings conducted by JICA-trained participants is not limited to the lecture, they are provided in a more practical and easy-to-understand way, such as practical training using wasted materials in TPS, and OJT

style.

- In addition to technical skills, JICA-trained participants also provide training on safety and quality learned in the training in Japan. Especially for TBM (Tool Box Meeting), this safety measure was already incorporated into usual operation in some TPSs, and it contributes to raise safety awareness of O&M personnel and building safety culture in the workplace.

(Management)

- Action Plan made by the participant of the HRD training in Japan, efficiently accelerated the establishment of the training center for GENCOs in Muzaffargarh TPS. Engineers and technicians who participated in the training in Japan, are also assigned to the trainers in this training center.

(Instructor)

- The instructors at each training center conducted unprecedented practical training using the training equipment provided by JET according to the action plan created by themselves.

1-3 Achievement of Output (with in the project period)

➢ *Output 1: Current situation of O&M of thermal power stations is analyzed and training needs are identified.*

- Output 1 was achieved as follows.
  - ✓ JET analyzed the current situation of O&M and training needs of Pakistan's TPS through the 3 times on-site survey and 1 time online survey.
  - ✓ JET summarized the current status of O & M at TPSs in Pakistan in the baseline report and 3 interim reports of this project. In those reports, JET considers that it is necessary to improve the knowledge and technology required for basic maintenance at TPS, ensure safety and improve quality of work.
  - ✓ JET and GHCL have confirmed at the JCC that there is no gap in their perception of that needs. Below is a summary of the main training needs.
    - Basic training needs (reflected in 1st to 3rd training in Japan)
      HRD / Safety management / Quality control / Efficiency management / Optimal maintenance / TBM / Overview of thermal power plant (including site visit) / Manufacturer factory tour related to thermal power generation / etc.
    - Training needs for mechanical maintenance (reflected in 1st training in

Japan)

Metal materials / Vibration analysis and suppression technology / Non-destructive inspection / Residual life diagnosis / Boiler water quality management / GTCC power generation technology / etc.

- Training needs for electrical maintenance (reflected in 2nd training in Japan)
  Generator / Motor / Cable / Breaker / Transformer / Insulation standard / Vibration analysis and suppression technology / non-destructive inspection / etc.
- Training needs for I & C maintenance (reflected in 3rd training in Japan)
  Measuring and monitoring device / Turbine supervisory instrument / Control valve and accessories / Basic control theory (PID control) and optimal tuning / GTCC control system and maintenance / Periodic maintenance of measuring and monitoring device / etc.
- Additional training needs for mechanical maintenance (reflected in 4th online training)
  Vibration Analysis / Non Destructive Inspection

➢ *Output 2: Capacity of ~~WEA and~~ GENCOs' Instructors is enhanced.*

- Output 2 was achieved as follows.
  - ✓ Based on the analysis of training needs shown in Output 1, JET prepared and provided the 3 training programs (Mechanical maintenance / Electrical maitenance / I&C maitenance) in Japan as the measures to fill the gap between the actual conditions and the ideal conditions for the O&M of TPSs.
  - ✓ Total of 24 engineers,24 technicians and 6 managements were trained as expected instructors in the 1st, 2nd, and 3rd trainings in Japan. The participants who participated in respective trainings answered that they had almost achieved the training objective (“Training Capacity of the participants for O&M of TPSs will be strengthened.”), and that the knowledge and experience they acquired can be directly applied or adaptable to their work as shown in Table 1-1 and 1-2.

Table 1-1: Achievement level of the training objective in the training in Japan

	← Fully Achieved			Not Achieved →
	4	3	2	1
Engineer Training (23 participants)	15 (65%)	8 (35%)	-	-
Technician Training (24 participants)	14 (58%)	10 (42%)	-	-
Management Training (6 participants)	3 (50%)	3 (50%)	-	-

Table 1-2: Usefulness level of the training results from the training in Japan

	Be directly applied to work	Be adaptable to work	Not be directly applied and adapted to work	Not useful
Engineer Training (23 participants)	17 (74%)	1 (5%)	5 (21%)	-
Technician Training (24 participants)	16 (67%)	8 (33%)	-	-
Management Training (6 participants)	3 (50%)	3 (50%)	-	-

In the evaluations of the 1st and 2nd participants, some results with low satisfaction were found, but the results of the 3rd participants were generally satisfactory.

This may have been improved because the 3rd training menu was adjusted with the results of the JET's on-site surveys and training needs from GHCL/GENCOs, and more practical training was provided compared to the previous year.

- ✓ Most of the participants answered by questionnaire that they were able to improve their own thermal power plant maintenance and management capacity through the training in Japan provided in line with the training needs of Output1. During the training in Japan, they created the action plans as shown in Output3, and after returning to Pakistan, they are training themselves at each TPS as instructors based on these improved knowledge and skills.

- ✓ Based on the analysis of additional training needs shown in Output1, JET prepared and provided the additional online training program (Mechanical maintenance) along with the equipment (Vibration Analysis Demonstrator / NDI Demonstrator) used for the training.
- ✓ Total of 8 instructors from each GHCL training center were trained as the additional online training.

  The objective of the online training ("Training Capacity of the participants for O&M of TPSs will be strengthened.") was achieved, and the training equipment provided by JET was made available to the training centers.

➢ *Output 3: Trainings as well as On-the-Job Training (OJT) at ~~WEA and~~ GENCOs are improved.*

- Output 3 was achieved as follows.
  - ✓ In the 1st, 2nd, and 3rd trainings in Japan, engineers and technicians made the action plans for improvement of the O&M capacity of TPSs.
  - ✓ Through the implementation of the 1st, 2nd and 3rd participant's action plans, their dissemination activities helped to enhance the basic technical knowledge of the

O&M staff of TPSs and safety culture is now being improved.

✓ According to the regular training reports from the 1st, 2nd and 3rd participants trained in Japan (24 engineers and 24 technicians), they conducted a total of 822 trainings and they trained a total of 6,329 trainees of GENCOs as of December 2021 based on action plans.

Table 1-3 shows the implementation status of the action plan that was prepared in the 1st, 2nd and 3rd trainings in Japan as of December 2021.

Table 1-3: Status of implementation of the action plan by participants in the 1st to 3rd training in Japan (as of December 2021)

		Number of training implementation times	Number of trainees
1st participants trained in Japan	7 Engineers	233	2,692
	8 Technicians	268	1,907
	Total	501	4,599
2nd participants trained in Japan	8 Engineers	102	495
	8 Technicians	128	620
	Total	230	1,115
3rd participants trained in Japan	8 Engineers	50	334
	8 Technicians	41	281
	Total	91	615
Total		822	6,329

JET confirmed that the action plan was being implemented as planed with active support from management.

✓ In this project, not only the number of participants but also the quality of training is important. Therefore, in order to ensure the quality of the training to be implemented after returning to Pakistan, the purpose and important points of the training were included in the Action Plan as an OJT checklist with reference to the training syllabus prepared by JET.

In addition, JET asked all participants trained by JICA to give a presentation on implementation status of own action plan. Due to the influence of COVID-19, the follow-up survey was not a field survey but a remote survey, but JET was able to obtain detailed information on the activities of trainees by referring to these presentation materials.

✓ In previous surveys of participants trained in Japan, many have expressed the opinion that practical training is necessary for effective training. Therefore, JET asked each counterpart to cooperate with the request for the use of training equipment.

- ✓ In addition to this project, JET selected necessary training equipment for training to improve O&M capacity of thermal power plants through field surveys and discussions with GHCL/GENCOs, provided the training equipment to the Muzaffargarh and Guddu training centers, and trained instructors from each training center to conduct online training using the equipment.
- ✓ According to training reports from the participants (8 instructors) from each GHCL training center who trained in the online training, they conducted a total of 13 trainings using training equipment provided by JET and they trained a total of 85 trainees of GENCOs.

  Table 1-4 shows the implementation status of the action plan that was prepared in the 4th training conducted online as of December 2021.

Table 1-4: Status of implementation of the action plan by participants in the 4th training (as of December 2021)

Training Center	Training equipment provided by JET	Number of training implementation times	Number of trainees
Muzaffargarh Training Center	Vibration Analysis Demonstrator	5	25
	NDI Demonstrator	4	28
	Total	9	53
Guddu Training Center	NDI Demonstrator	4	32
Total		13	85

1-4 Achievement of the Project Purpose

- ➢ *Project Purpose: Training capacity on O&M of GENCOs is strengthened.*

  Project Purpose has been achieved as follows. However, in order to further strengthen the training capacity on O&M of TPSs, the HRD action plan needs to be continued and developed by the management.
  - ✓ JICA-trained engineers & technicians almost implemented their Action Plan as previously arranged with support from management, and a series of their dissemination activities can help to improve the O&M capacity at TPSs. According to the reports from JICA-trained participants, they conducted 822 trainings for a total of 6,329 O&M personnel at TPSs. The results of questionnaire from those who participated in the training conducted by JICA-trained participants shows that the training was highly evaluated and improved their O&M ability at TPSs.
  - ✓ Until now, transfer of technical knowledge within TPS in Pakistan have mainly

oral lecture style based on the work experience and notes of trainers. JICA-trained participants disseminated their knowledge and skills to their colleagues not only by utilizing training materials provided by JICA Expert Team, but also by creating and arranging the materials by themselves. JICA Expert Team recognize that the training ability in TPSs is steadily increasing by using the training material of high-quality instead of conventional verbal technical transfer. Furthermore, some JICA-trained engineers & technicians implemented dissemination activity not only for staff of their own TPS, but also for staff of other TPSs.

- ✓ Until now, transfer of technical skill in TPS has been mainly during actual work. However, through this project, technical knowledge education has begun to be implemented effectively using textbooks and the like in a state separated from actual work.
- ✓ Until now, practical training excepted OJT had been conducted only at training centers, but some participants trained in Japan have conducted practical training within TPS using surplus equipment and waste equipment. It can be seen that the training capacity at TPS has improved.
- ✓ In addition to technical skills, JICA-trained participants also provide training on safety and quality learned in the training in Japan. Especially for TBM (Tool Box Meeting), this safety measure was already incorporated into usual operation in some TPSs, and it contributes to raise safety awareness of O&M personnel and building safety culture in the workplace.
- ✓ Action Plan made by the participant of the 2nd HRD training in Japan, efficiently accelerated the establishment of the training center for GENCOs in Muzaffargarh TPS. JICA-trained engineers & technicians are also assigned to the trainers in this training center.
- ✓ As an additional project, JET provided training equipment (Vibration Analysis Demonstrator and NDI Demonstrator) to the Muzaffargarh and Guddu training centers. These equipment was selected based on field surveys and discussions with GHCL/GENCOs in order to strengthen the training capacity of GHCL/GENCOs.
- ✓ JET has also trained a total of 8 instructors from each training center through online training as the 4th training program of the project in order to provide autonomous training using these training equipment. JET has already received reports from the instructors at each training center on the use of the equipment provided, and according to the reports, each training center has conducted total of 13 training sessions with 8 trainees.

- *Project Evaluation by DAC Evaluation Criteria*

  The Project is evaluated in accordance with the five criteria set by DAC (Development Assistance Committee) Evaluation Criteria, namely (1) relevance, (2) effectiveness, (3) impact, (4) efficiency and (5) sustainability.

(1) Relevance

Relevance is considered "high" for the following reasons.

Priority	✓ In the GENCOs, it is an urgent task to efficiently operate and maintain thermal power generation, which is consistent with the goal of the Project.
Adequacy of Project Approach	✓ As for the approach of the Project, it is appropriate that O&M personnel in leading positions are trained as instructors through O&M training in Japan including practical training, and the trained instructors implement dissemination activities at their power stations. ✓ In addition to the original project, JICA Expert Team provided training equipment (Vibration Analysis Demonstrator and NDI Demonstrator) to public training centers in Pakistan (Muzaffargarh Training Center and Guddu Training Center) and trained instructors to train using the equipment. ✓ These are appropriate approaches to achieving the goals of this project.
Consistency with the Japanese ODA policy	✓ The Project is consistent with Japanese Official Development Assistance (ODA) policy for Pakistan.

(2) Effectiveness

Effectiveness is considered "high" for the following reasons.

Achievement of Project Outputs	✓ The Output 1 and 2 have been achieved. ✓ As for the Output 3, there are the unimplemented Action Plans by some participants due to Covid-19 pandemic so far, but the trainings conducted by the participants were highly evaluated, so it is considered that Output 3 has been mostly achieved. ✓ In addition to the initial project, JICA Expert Team provided training equipment to each training center based on the field survey in Pakistan, discussions with the management of GHCL/GENCOs, and follow-up surveys to the participants trained in Japan. ✓ In addition, JICA Expert Team conducted online training for instructors who conduct training using these equipment. ✓ From these, it can be concluded that this project including

	additional projects was achieved at a satisfactory level.
Achievement of Project Purpose	✓ As per the questionnaire surveys for management and participants, the implementation of Action Plans by participants has led to the improvement of O&M performance at TPSs, so it is considered that the Project Purpose has been achieved.
Beneficiaries of Project	✓ As per the beneficiaries of the Project, each participant has been able to disseminate the knowledge and skills learned during O&M Training in Japan to 6,414 colleagues in the Project.

(3) Impact

Impact is considered "high" for the following reasons.

Prospect of achieving overall goal	✓ Improvements of training capacity on O&M at TPSs have been confirmed. In addition, as per the questionnaire surveys for management and participants, improvements of O&M performance at TPSs have already been confirmed. Therefore, it is highly possible that Overall Goal will be achieved.
Ripple effects	✓ The participants not only have implemented training to disseminate the knowledge and skills learned during O&M Training in Japan, but have worked on the improvement activities through 4S (Sort, Set in order, Shine and Standardize) activities and TBM (Tool Box Meeting) learned in Japan. The improvement activities have a positive impact on the safety and quality at TPSs.

(4) Efficiency

Efficiency is considered "relatively high" for the following reasons.

Inputs	✓ As for the inputs of the Japanese side, the dispatch of the Japanese experts was not conducted as planned due to the cancellation of the 4th survey (the 3rd follow-up survey) and final survey (the 4th follow-up survey and on-site training) added to the original project. However, those activities could be carried out by substituting email, web conference and online training, which was appropriate to produce the outputs as planned. ✓ As for the inputs of the Pakistan side, the scheduled 3rd management training was canceled and the 3rd training period for engineers was shortened due to insufficient coordination.

Improvement of efficiency	✓ Since the Project was conducted as the same program including other countries, synergistic effects could be achieved by laterally applying the activity results of each project. In addition, the efficiency of the Project was able to be improved.

(5) Sustainability

Sustainability is considered “high” for the following reasons.

Policy / Institutional aspect	✓ It is not predicted any policy or institutional change that may affect the sustainability of the Project effects.
Organization aspect	✓ As a change in the organization that affects the sustainability of the effects created by this project, a training center for GENCOs (Muzaffragarh Training Center) was newly established according to the HRD Action Plan created by the GHCL management. ✓ As the engineer training of GENCOs, by utilizing this training center instead of the training at WEA so far, it has become possible to acquire skills more specialized in thermal power generation technology. ✓ At the training centers of GENCOs, engineers and technicians trained in Japan are appointed as instructors, and it can be confirmed that the organization is trying to sustain and develop this project.
Technical aspect	✓ In JICA training, engineers and technicians prepared the Action Plans for improvement of the O&M capacity of TPSs. Due to the dissemination of knowledge through the implementation of the Action Plans, basic technical and safety knowledge of the O&M staff at TPSs were enhanced, which lead to reduction in accidents at TPSs, and improvement of O&M quality of the staff at TPSs. ✓ Furthermore, in order to sustain and develop activities for the O&M capacity of thermal power plants, as described in the “Organizational aspect" of the previous section, the dedicated training center specializing in thermal power generation has been established and operated.
Financial aspect	✓ At the GENCOs training centers, practical training was limited in some items due to lack of finances and equipment, but JICA Expert Team provided the necessary training equipment based on field surveys, discussions with management, and the results of questionnaires from participants trained in Japan. ✓ In addition, JICA Expert Team trained instructors to use those equipment to train for many O&M personnel in

	thermal power plants, so that they can continue their training activities autonomously even after the completion of this project.

1-5 Changes of Risks and Actions for Mitigation

N/A

1-6 Progress of Actions undertaken by JICA

N/A

1-7 Progress of Actions undertaken by Gov. of Pakistan

N/A

1-8 Other remarkable/considerable issues related/affect to the project (such as other JICA's projects, activities of counterparts, other donors, private sectors, NGOs etc.)

- Action Plan made by the participant of the 2nd HRD training in Japan, efficiently accelerated the establishment of the training center for GENCOs in Muzaffargarh TPS. JICA-trained engineers & technicians are also assigned to the trainers in Muzaffargarh TPS training center and Guddu training center.
- Due to government realignment, WEA deviated from thermal power generation on their mandate. With the realistic circumstance, GENCO become an only counterpart under the project.

2 Delay of Work Schedule and/or Problems (if any)

2-1 Detail

- Although JET planned to conduct the 4th survey (the 3rd follow-up survey) and final survey (the 4th follow-up survey) in Pakistan, JET won't be able to conduct the survey in Pakistan due to the Covid-19 pandemic.

2-2 Cause

- Covid-19 pandemic.

2-3 Action to be taken

- Regarding the activities to be carried out in the 4th survey (the 3rd follow-up survey) and final survey (the 4th follow-up survey), JET substituted the activities with exchanging e-mails with each participants and conducting the questionnaire surveys for participants.

- The both sides obtained the mutual understanding on achievement of the Project and future issues by holding the 4th Joint Coordination Committee (JCC) and final JCC, online instead of face-to-face.

2-4 Roles of Responsible Persons/Organization (JICA, Gov. of Pakistan, etc.)

- N/A

3 Modification of the Project Implementation Plan

3-1 PO

Based on the Minutes of the Meeting agreed on 2nd October 2020, WAPDA Engineering Academy (WEA) is removed from Project Purpose, Outputs 2, Activities 2-5 &3-3, Objectively Verifiable Indicators, Means of Verification and Important Assumptions in Project Design Matrix (PDM) and Plan of Operation.

3-2 Other modifications on detailed implementation plan

(Remarks: The amendment of R/D and PDM (title of the project, duration, project site(s), target group(s), implementation structure, overall goal, project purpose, outputs, activities, and input) should be authorized by JICA HDQs. If the project team deems it necessary to modify any part of R/D and PDM, the team may propose the draft.)

N/A

4 Preparation of Gov. of Pakistan toward after completion of the Project

N/A

II. Project Monitoring Sheet I & II *as Attached*

Project Design Matrix (PDM)

Project Title: The Project for Capacity Building and Strengthening of Thermal Power Generation Operation and Maintenance in The Islamic Republic of Pakistan

Implementing Agency: ~~WAPDA Engineering Academy (WEA) and~~ GENCO Holding Company Ltd.

Target Group: ~~WEA instructors and~~ O&M staff of GENCOs

Version No. 6

Period of Project: October, 2017 - March, 2022

Dated: 17th February, 2022

Project Site: ~~WEA and~~ GENCOs' thermal power stations

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	Achievement	Remarks
Overall Goal Technology and technical skills obtained by the project are utilized in actual O&M at GENCOs power stations.	- Number of GENCOs power stations which utilize obtained technology and technical skills.	- Questionnaire to ~~WEA and~~ GENCOs including regular training reports at ~~WEA &~~ GENCOs provided by trained instructors.		-6 TPSs (Jamshoro, Kotri, Guddu, Muzaffargarh, Nandipur and Lakhra) utilized knowledge and skill obtained in Japan as scheduled. - 2 Training Centers (Muzaffargarh and Guddu) used training equipment and educational materials provided by JICA Expert Team to train O&M personnel. - Through the implementation of the Action Plans, their dissemination activities enhanced the basic technical & safety knowledge of the O&M staff of TPSs, reduced accidents at TPSs, and improved the O&M quality of the O&M staff of TPSs. In addition to technical skills, JICA-trained participants also provide training on safety and quality learned in the training in Japan. Especially for TBM (Tool Box Meeting), this safety measure was already incorporated into usual operation in some TPSs, and it contributes to raise safety awareness of O&M personnel and building safety culture in the workplace.	
Project Purpose Training capacity on O&M of ~~WEA and~~ GENCOs is strengthened.	- 100% of GENCOs power stations where participants come from, implement trainings (OJTs) based on the Action Plan prepared by trained instructors. ~~- Improvement of WEA training contents based on the Action Plan developed by trained instructors.~~	- Project Monitoring Sheet, including regular training reports at ~~WEA and~~ GENCOs provided by trained instructors.	- Trained instructors wiil not resign and/or transfer outside of ~~WEA and~~ GENCOs.	- 24 engineers and 24 technicians were trained in Japan to share what they learned to other colleagues at TPSs. JICA-trained participants disseminated their knowledge and skills to their colleagues not only by utilizing training materials provided by JICA Expert Team, but also by creating and arranging the materials by themselves. JET recognize that the training ability in TPSs is steadily increasing by using the training material of high-quality instead of conventional verbal technical transfer. The trainings conducted by JICA-trained participants is not limited to the lecture, they are provided in a more practical and easy-to-understand way, such as practical training using wasted materials in TPS, and OJT style. Some engineer and technician implemented dissemination activity not only for staff of there own TPS, but also for staff of other TPSs. - 6 managers were trained in Japan to improve O&M capacity of TPS and ability of Training Centers. Action Plan made by 2nd dispatched management, could accelerate efficiently establishment of the training center for GENCOs in Muzaffargarh TPS. - 8 instructors at each GHCL training center were trained in the additional online training. They conducted a total of trainings using training equipment provided by JET.	- 1 engineer and 1 technician have retired.

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	Achievement	Remarks
Outputs 1. Current situation of O&M of thermal power stations is analyzed and training needs are identified.	- Training needs are compiled based on the current situation.	- Project Monitoring Sheet		- JET analyzed the current situation of O&M and training needs of TPSs/TCs through the 3 times of field survey, interviews with participants (engineers, technicians and managers) in Japan and communication with each counter part.	
2. Capacity of ~~WEA and~~ GENCOs' instructors is enhanced.	- Training program is formulated based on the training needs. - Total number of trained instructors. - Total number of training in Japan.	- Project Monitoring Sheet	- Trained instructors continue to work for ~~WEA and~~ GENCOs during the project period.	- Based on the analysis of current situation of O&M and training needs shown in Output1, JET prepared training program which was held 3 times in Japan and the additional online training program. - 24 engineers and 24 technicians were trained as expected instructors in the 1st, 2nd, and 3rd trainings in Japan. - 6 managers were trained in Japan to improve O&M capacity of TPS and ability of Training Centers. -8 instructors from each GHCL training center were trained to conduct training using training equipment provided by JET.	- 1 engineer and 1 technician have retired. - The 3rd training in Japan for management was canceled due to inadequate approval procedures in Pakistan.
3. Training as well as OJT at ~~WEA and~~ GENCOs are improved.	- Achievement level of Action Plans developed by trained instructors. - The results of checklists.	- Project Monitoring Sheet, including regular training reports at ~~WEA and~~ GENCOs provided by trained instructors. - Progress report of each Action Plan. - Checklist.		- According to regular training reports from the participants trained in Japan (24 engineers & 24 technicians), they conducted a total of 822 trainings and they trained a total of 6,329 trainees of GENCOs. - According to training reports from the participants (8 instructors) from each GHCL training center who trained in the online training, they conducted a total of 13 trainings using training equipment provided by JET and they trained a total of 85 trainees of GENCOs. - The results of reports from those who participated in the training conducted by JICA-trained participants shows that the training was highly evaluated and improved their O&M ability at TPSs.	- 1 engineer and 1 technician have retired.

Activities	Inputs		Important Assumption
	The Japanese Side	**The Pakistan Side**	
1-1 To analyze the current situation of O&M at thermal power stations. 1-2 To review the training system of thermal power generation, and analyze the current situation and issues of O&M personnel. 1-3 To specify the training needs.	a. Dispatch of Experts - Chief Advisor / Thermal Power Generation Operation & Maintenance - Thermal Power Generation Operation - Thermal Power Generation Maintenance (Mechanical) - Thermal Power Generation Maintenance (Electrical) - Thermal Power Generation Maintenance (C&I) b. Training in Japan c. Training equipment	a. Assignment of Counterpart personnel - Project Chairperson - Project Director - Project Manager - Project Coordinator - Counterpart members b. Office space and necessary facilities for Japanese experts c. Other operational cost	
2-1 To set the target O&M skills that instructors & potential instructors should obtain. 2-2 To formulate the program of training in Japan. 2-3 To set selection criteria for the training in Japan. 2-4 To conduct trainings in Japan. 2-5 To modify the contents of training in Japan at ~~WEA and~~ GENCOs' thremal power stations (OJTs) in Pakistan.			**Pre-Conditions**
3-1 To develop action plans of trainings (OJTs) for O&M of thermal power stations. 3-2 To disseminate obtained knowledge and technical skills to O&M personnel based on the action plans and verify the skilled up level by checklist developed at the above 2-4. 3-3 To review the results of action plans to improve the training at ~~WEA and~~ GENCOs' thermal power stations (OJTs) in Pakistan.			**<Issues and countermeasures>**

Project Monitoring Sheet II (Revision of Plan of Operation)

Version No. 6

Dated: 17th February, 2022

Project Title: The Project for Capacity Building and Strengthening of Thermal Power Generation Operation and Maintenance in The Islamic Republic of Pakistan

Inputs	Plan/Actual	2017		2018				2019				2020				2021				2022		Remarks	Monitoring: Issue	Monitoring: Solution
		III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II			
Expert	Month	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 4 5 6 7 8 9 10 11 12				1 2 3 4 5 6				
Chief Advisor/ Thermal Power Generation O&M	Plan																							
	Actual																							
Thermal Power Generation Operation	Plan																							
	Actual																							
Thermal Power Generation Maintenance (Mechanical)	Plan																							
	Actual																							
Thermal Power Generation Maintenance (Electrical)	Plan																							
	Actual																							
Thermal Power Generation Maintenance (C&I)	Plan																							
	Actual																							
Equipment																						JICA Expert Team (JET) provided the necessary training equipment (Vibration Analysis Demonstrator Kit and Non Destructive Inspection Demonstrator)based on field surveys, discussions with management, and the results of questionnaires from participants trained in Japan.		
Necessary Equipment if any	Plan																							
	Actual																							
Training in Japan																						The 4th training was conducted online for instructors belonging to two GHCL training centers.		
Training on O&M of thermal power stations	Plan																							
	Actual																							
In-country/Third country Training																								
	Plan																							
	Actual																							

Activities / Sub-Activities	Plan/Actual	2017		2018				2019				2020				2021				2022		Responsible Organization: Japan	Responsible Organization: ~~WEA and GENCOs~~	Achievements	Issue & Countermeasures
		III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II				
Output 1: Current situation of O&M of thermal power stations is analyzed and training needs are identified.																									
1.1 To analyze the current situation of O&M at thermal power stations.	Plan																							1.1 / 1.2 JET analyzed the current status of O&M situation and training system at TPSs through 3 times of field surveys, interviews with participants trained in Japan and communication with each counter part.	
	Actual																								
1.2 To review the training system of thermal power generation, and analyze the current situation and issues of O&M personnel.	Plan																								
	Actual																								
1.3 To specify the training needs.	Plan																							1.3 Based on these analysis results, JET summarized the training needs to improve the O&M of TPSs in Pakistan.	
	Actual																								

Activities / Sub-Activities	Plan / Actual	2017		2018				2019				2020				2021				2022		Responsible Organization		Achievements	Issue & Countermeasures
		III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	Japan	~~WEA and~~ GENCOs		
Output 2: Capacity of ~~WEA and~~ GENCOs' Instructors is enhanced.																									
2.1 To set the target O&M skills that instructors and potential instructors should obtain.	Plan																							2.1 / 2.2 / 2.3 Based on the analysis of training needs shown in Output1, JET prepared training program which was held 3 times in Japan and additional online training program. For engineer and technician, the 1st training specialized in the mechanical maintenance field, the 2nd training specialized in the electrical maintenance field and the 3rd training specialized in the I&C maintenance field. For managment, the 1st and 2nd training specialized in the HRD. For instructors at each GHCL training center, the online training specialized in the online training using training equipment provided by JET.	
	Actual																								
2.2 To formulate the program of Training in Japan for instructors.	Plan																								
	Actual																								
2.3 To set selection criteria for the Training in Japan.	Plan																								
	Actual																								
2.4 To conduct Trainings in Japan.	Plan																							2.4 In the 3 times training in Japan and 1 time online trainig, 24 engineers, 24 technicians, 6 managers and 8 instructors were trained.	The 3rd training in Japan for management was canceled due to inadequate approval procedures in Pakistan.
	Actual																								
2.5 To modify the contents of Training in Japan as necessary based on feedbacks of trainings at ~~WEA and~~ GENCOs' thermal power stations (OJTs) in Pakistan.	Plan																							2.5 JET prepared training curriculum for each training through the field survey, training needs and feedbacks from Pakistan.	
	Actual																								
Output 3: Trainings as well as On-the-Job Training (OJT) at ~~WEA and~~ GENCOs are improved.																									
3.1 To develop Action Plans of trainings (OJTs) for O&M of thermal power stations.	Plan																							3.1 In the 1st/2nd/3rd training in Japan and additional online trainig, engineers, technicians, managers and instructors created the action plan for improvement of O&M capacity of TPS.	The 3rd training in Japan for management was canceled due to inadequate approval procedures in Pakistan.
	Actual																								
3.2 To disseminate obtained knowledge and technical skills to O&M personnel based on the Action Plans and verify the skilled up level by checklist developed at the above 2-4.	Plan																							3.2 / 3.3 According to regular training reports from the the participants trained in Japan (24 engineers & 24 technicians), they conducted a total of 822 trainings and they trained a total of 6,329 trainees of GENCOs. Action Plan made by 2nd dispatched management, could accelerate efficiently establishment of the training center for GENCOs in Muzaffargarh TPS. According to training reports from the participants (8 instructors) from each GHCL training center who trained in the online training, they conducted a total of 13 trainings using training equipment provided by JET and they trained a total of 85 trainees of GENCOs.	
	Actual																								
3.3 To review the results of Action Plans to improve the trainings at ~~WEA and~~ GENCOs' thermal power stations (OJTs) in Pakistan.	Plan																								
	Actual																								

Duration / Phasing																									Remarks	Issue	Solution
	Plan																										
	Actual																										

Monitoring Plan		2017		2018				2019				2020				2021				2022		Remarks	Issue	Solution
	Actual	Ⅲ	Ⅳ	Ⅰ	Ⅱ	Ⅲ	Ⅳ	Ⅰ	Ⅱ	Ⅲ	Ⅳ	Ⅰ	Ⅱ	Ⅲ	Ⅳ	Ⅰ	Ⅱ	Ⅲ	Ⅳ	Ⅰ	Ⅱ			
Monitoring																								
JCC (Joint Coordination Committee)	Plan																						Cancellation of the 3rd on-site monitoring mission (incl. the 4th JCC) and the final on-site monitoring mission (incl. the final JCC) due to the spread of the COVID-19.	The 4th and final JCC were held online instead of face-to-face.
	Actual																							
Submission of Monitoring Sheet	Plan																						The monitoring sheet was not submitted as scheduled because the 3rd on-site monitoring mission and the final on-site monitoring mission were canceled due to the spread of the COVID-19.	The 5th monitoring sheet was submitted after the 4th JCC conducted online. The 6th and 7th monitoring sheets at the time of planning were submitted after the final JCC conducted online as the 6th monitoring sheet due to the cancellation of the final on-site monitoring mission.
	Actual																							
Monitoring Mission from Japan	Plan																						Cancellation of the 3rd on-site monitoring mission and the final on-site monitoring mission due to the spread of the COVID-19.	The 3rd and final on-site monitoring missions were conducted online.
	Actual																							
Reports/Documents																								
Work Plan	Plan																							
	Actual																							
Baseline Survey Report	Plan																							
	Actual																							
Progress Report	Plan																							
	Actual																							
Project Completion Report	Plan																							
	Actual																					Due to the extension of the project period, Project Completion Report was submitted in February 2022.		
Public Relations																								
	Plan																							
	Actual																							
	Plan																							
	Actual																							