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討議議事録（R/D）及び会議議事録

(1)　討議議事録（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

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

Dated November, 2016

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>**

別紙3

Dated ●●,●●,●●

Plan of Operation

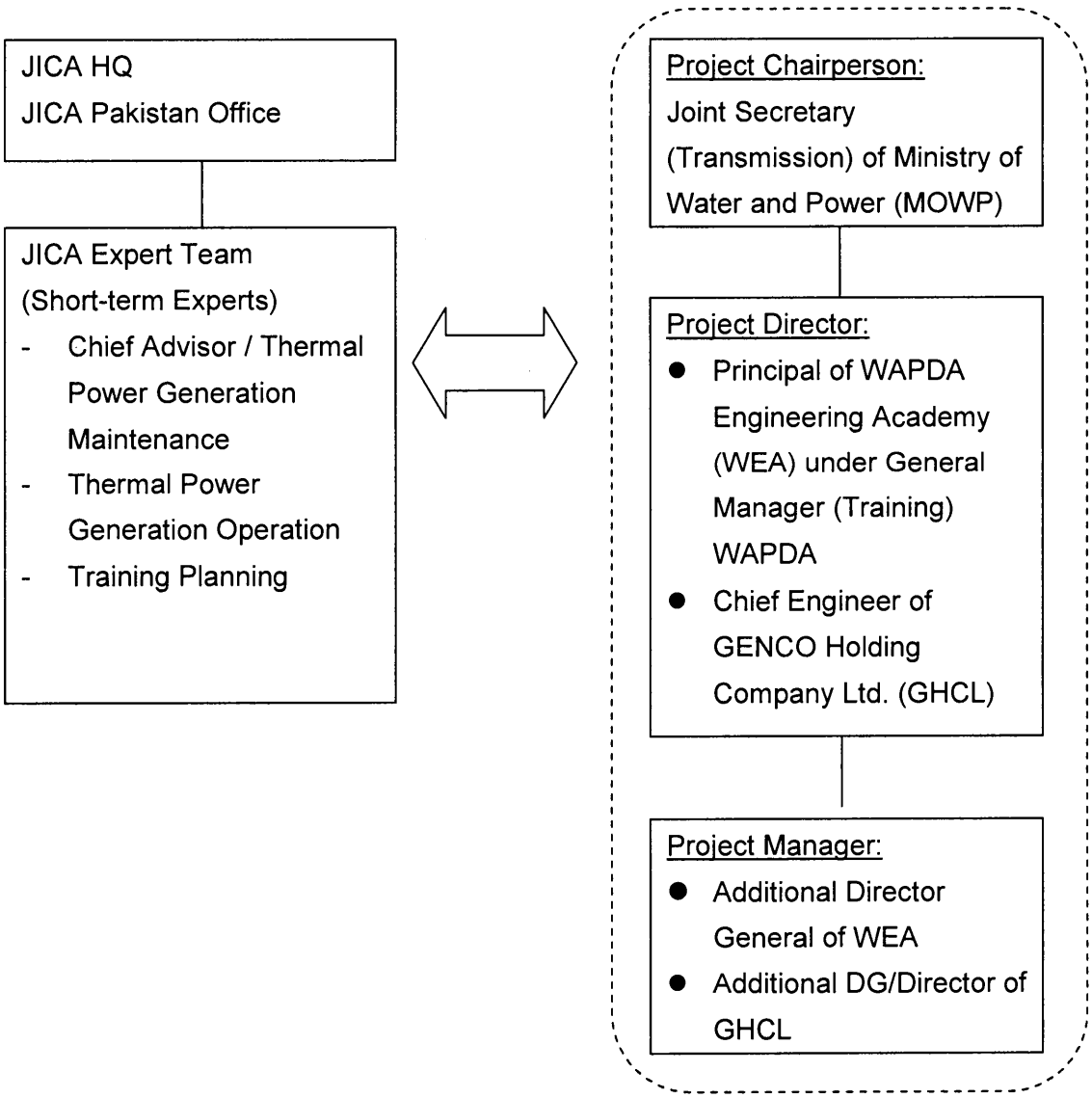
Project Title: Project for Capacity Building and Strengthening of Thermal power Generation Operation and Maintenance

Inputs	Plan / Actual	2016	2017	2018	2019	2020	2021	2022	Remarks	Monitoring: Issue	Monitoring: Solution
Expert											
Chief Advisor	Plan / Actual										
Other Experts	Plan / Actual		To be assigned by JICA								
	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										

Activities / Sub-Activities	Plan / Actual	2016	2017	2018	2019	2020	2021	2022	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	2017	2018	2019	2020	2021	2022	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)　R/D 修正に係る議事録

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 / 2019

FURUTA Shigeki
Chief Representative
JICA Pakistan

Economic Affairs Division,
Ministry of Economic Affairs

Zafar Abbas
Joint Secretary
Ministry of Energy (Power Division)

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

添付資料 6-1-2

短期専門家派遣実績

短期専門家派遣実績

本プロジェクトに従事した短期専門家、その派遣期間及び業務従事 M/M は以下のとおりである。

担　当	氏　名	現地業務従事期間 （移動期間を含む）	現地業務 従事 M/M
チーフアドバイザ／ 火力発電（運転・保守）	平畑　弘樹	2017 年 11 月 12 日～11 月 25 日（14 日間） 2018 年 9 月 2 日～9 月 15 日（14 日間） 2019 年 9 月 30 日～10 月 12 日（13 日間）	1.37
副チーフアドバイザ／ 火力発電（運転・保守）	河合　徹	2017 年 11 月 12 日～11 月 25 日（14 日間）	0.47
	小堺　瑛	2019 年 9 月 30 日～10 月 12 日（13 日間）	0.43
火力発電（保守・機械）	吉竹　茂	2018 年 9 月 2 日～9 月 15 日（14 日間）	0.47
	土井　祥宏	2017 年 11 月 12 日～11 月 25 日（14 日間） 2018 年 9 月 2 日～9 月 15 日（14 日間） 2019 年 9 月 30 日～10 月 12 日（13 日間）	1.37
火力発電（保守・電気）	古川　晴亮	2017 年 11 月 12 日～11 月 25 日（14 日間） 2018 年 9 月 2 日～9 月 15 日（14 日間）	0.93
	一岡　栄喜	2019 年 9 月 30 日～10 月 12 日（13 日間）	0.43
火力発電（保守・制御）	大部　祐貴	2017 年 11 月 12 日～11 月 25 日（14 日間） 2018 年 9 月 2 日～9 月 15 日（14 日間） 2019 年 9 月 30 日～10 月 12 日（13 日間）	1.37
		（合計）	**6.84**

添付資料 6-1-3

JCC 議事録

(1)　第 1 回 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
Yoshihiro Ohee	Senior Representative JICA	JICA Pakistan	
Junki Mori	Program Officer	Jica HQ	
Kenji Ogawahara	Representative	JICA Pakistan	
IMRAN AHMAD	SR. PROGRAM OFFICER	JICA PAKISTAN	
Muhammad Khalid	Addl. DG	GHCL	
ZAFAR IQBAL	Addl: DG	NEA FSD.	
SHAHZAD BASHIR	Chief Engineer	NEA FSD	
RIFFAT ARA	GM	WAPDA	
M. IMRAN	CEO	GHCL	
SAJID NAZIR GONDAL	Director	GHCL	
MUHAMMAD SHAHID	C.F.O	GHCL	
Naoki Nisiota	General Manager	JICA (Kansai)	
Toru Kami	Manager	JICA (Kansai)	

Kansai Electric Power
power with heart

meeting title: JCC

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

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

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

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>

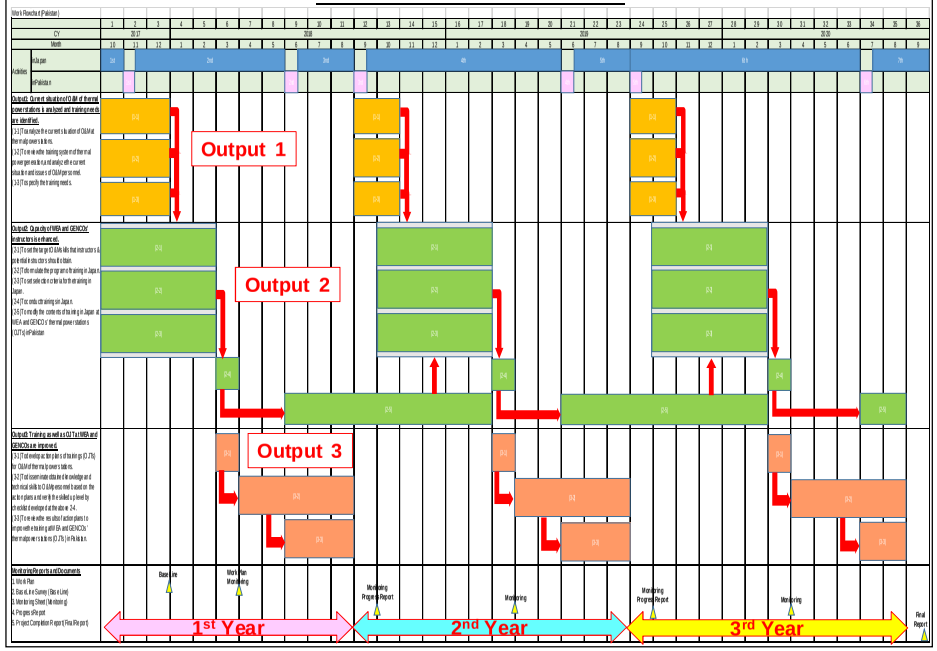
Power generation	Conventional Type (Gas, Coal and Oil) and Gas Turbine Combined Cycle (GTCC) including advanced environmental practices in Japan
Project Sites	WEA in Faisalabad & GENCOs' thermal power station in Jamshoro etc.
Counterpart	MOE, WEA, GHCL, GENCOs
Beneficiaries	O&M instructors of WEA and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

5



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

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1. Project summary
2. **O&M training program in Japan**
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(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

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<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

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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

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

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1. Project summary
2. O&M training program in Japan
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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.

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Monitoring Indicators for Overall Goal

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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

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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)　第 2 回 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 (HRAA)	
Muhammad Jafar	GHCL	Addl. Director	
RIFFAT ARA QUREISHI	WAPDA	G. M. Training	
Eng. MAHBOOB FARID	WAPDA	Deputy Director (Training)	
Engr. Abdur Rauf	WAPDA	P/CE WEA	
Hiroki Hirahata	Kansai	General Manager	
Yoshihiro Doi	Kansai	Mech Mgr.	
Harunaki Furukawa	Kansai	Electric Engineer	
IMRAN AHMAD	JICA	SR. PROGRAM OFFR	
Junki Mori	JICA	Deputy Assistant Director	
Kenji Ogasawara	JICA	Representative	
Yoshihisa Onoe	JICA	Senior Rep	

Kansai Electric Power
power with heart

meeting title: _____

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

Kansai Electric Power
power with heart

SURVEY REPORT and NEXT ACTION

September 2018

Japan International Cooperation Agency (JICA)

The Kansai Electric Power Co., Inc.

Contents

1. **Project Summary**
2. HRD Framework in Pakistan
3. Action Plan Implementation
4. O&M Training in Japan: JAN/FEB, 2019
5. Provision of O&M Training Equipment
6. Summary on the Mission for Next Step

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

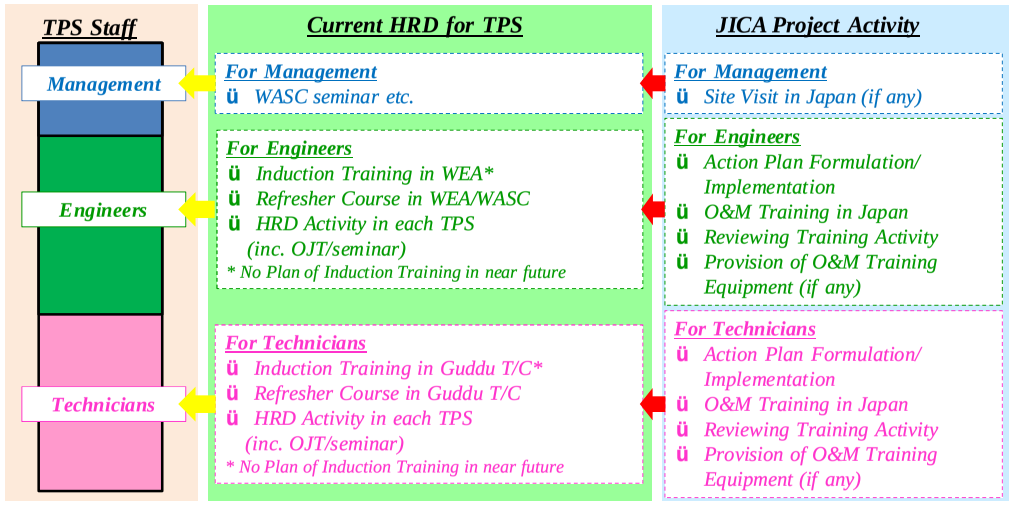
Overall Goal	Technology and technical skills obtained by the project are utilized in actual O&M at GENCOs power stations.
Project Goal	Training capacity on O&M of WEA and GENCOs is strengthened.

Project Output

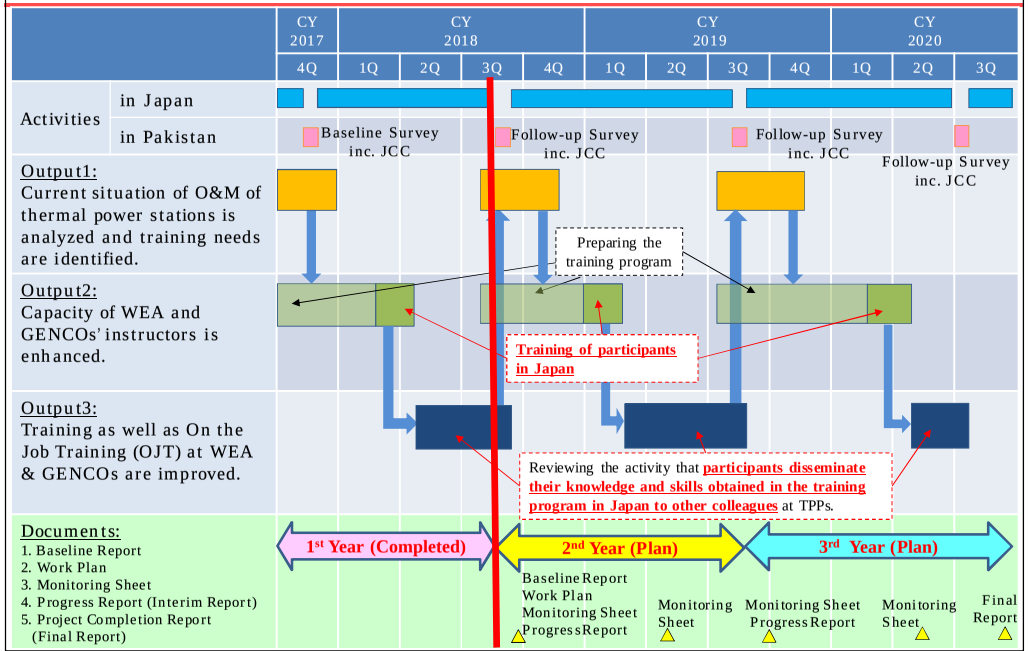
Output 1	Current situation of O&M of thermal power stations is analyzed and training needs are identified.
Output 2	Capacity of WEA and GENCOs' instructors is enhanced.
Output 3	Training as well as On the Job Training (OJT) at WEA & GENCOs are improved.

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

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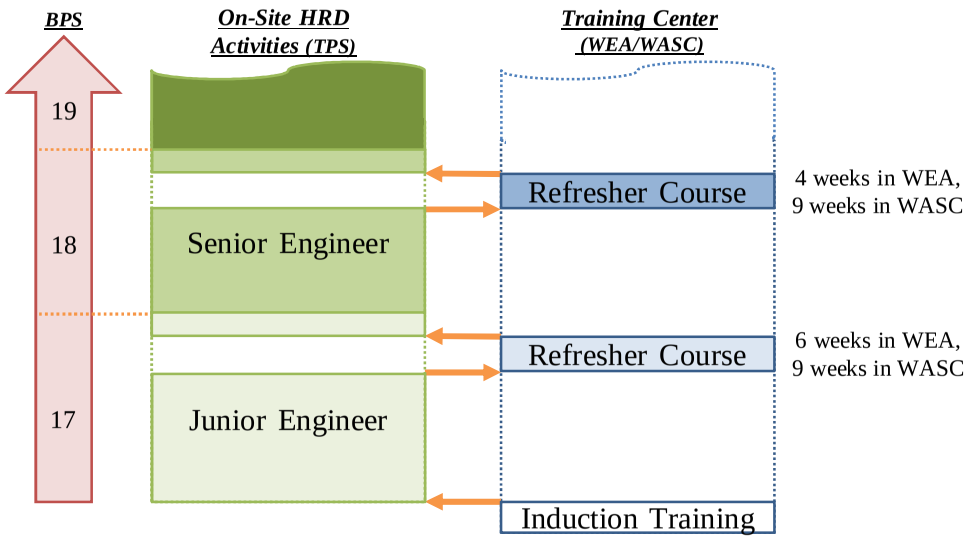
2. HRD Framework in Pakistan: Structure

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

- 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.

③Induction 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.

➡ Some of the items shall be accessed under this Project

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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?

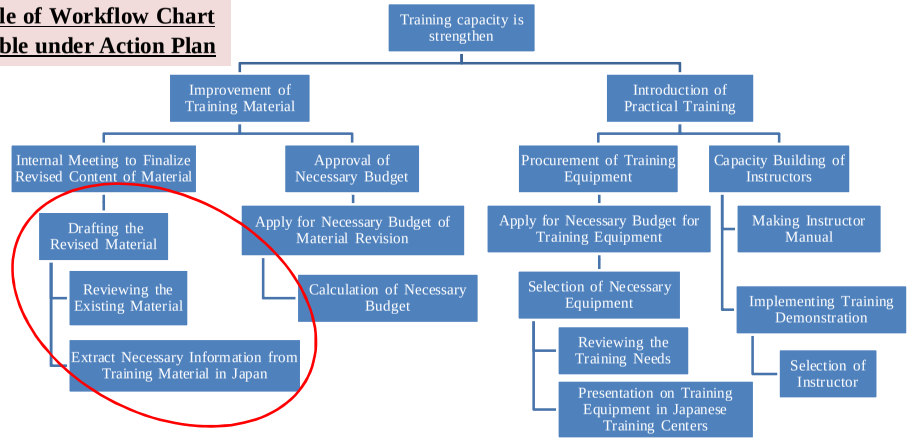
- ü ①Refresher courses in training centers ➡ for training centers
- ü ②HRD Activities in each TPS ➡ for each power station
- ü (③Induction Training, if there were any plan)

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

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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

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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)

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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

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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.

4. O&M Training in Japan: Selection Criteria

24

Items	Qualification (Engineers)	Qualification (Technicians)
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	

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

1. Project Summary
2. HRD Framework in Pakistan
3. Action Plan Implementation
4. O&M Training in Japan: JAN/FEB, 2019
5. **Provision of O&M Training Equipment**
6. Summary on the Mission for Next Step

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

- 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.**
  - WEA requests to replace the existing simulator with **the latest operation simulator.**
- GENCOs have suffered from **some shaft-vibration troubles** of various rotary equipment.
- Workshop in Faisalabad TPS has dynamic rotor balancing device & NDI for not practical training but **maintenance work.**
  - 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)

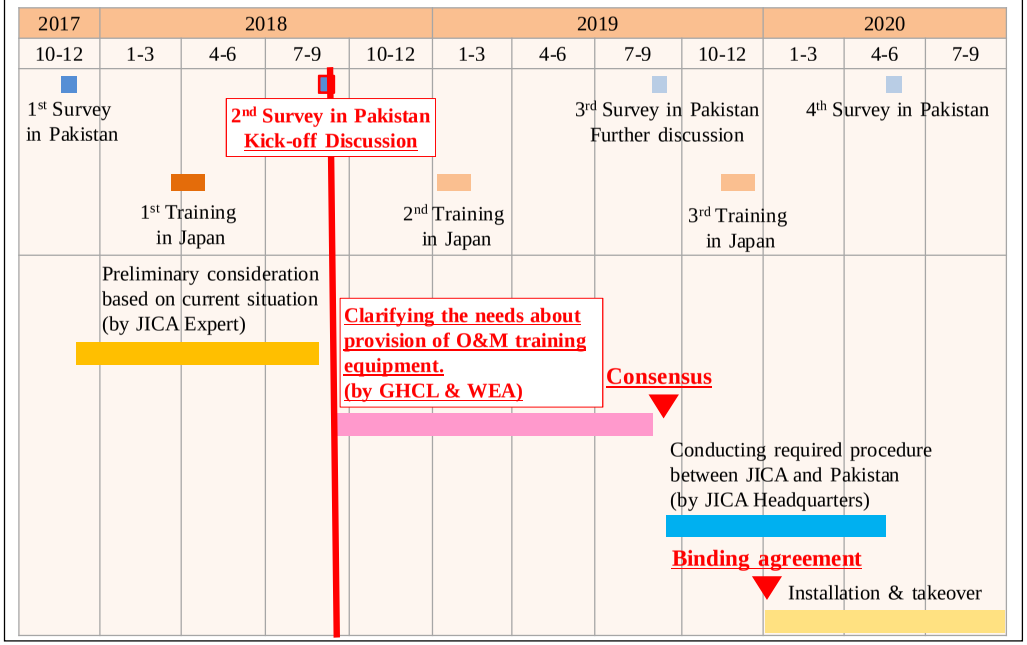
5. Provision of O&M Training Equipment: JICA's Evaluation

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

1. Project Summary

2. HRD Framework in Pakistan

3. Action Plan Implementation

4. O&M Training in Japan: JAN/FEB, 2019

5. Provision of O&M Training Equipment

6. **Summary on the Mission for Next Step**

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,

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

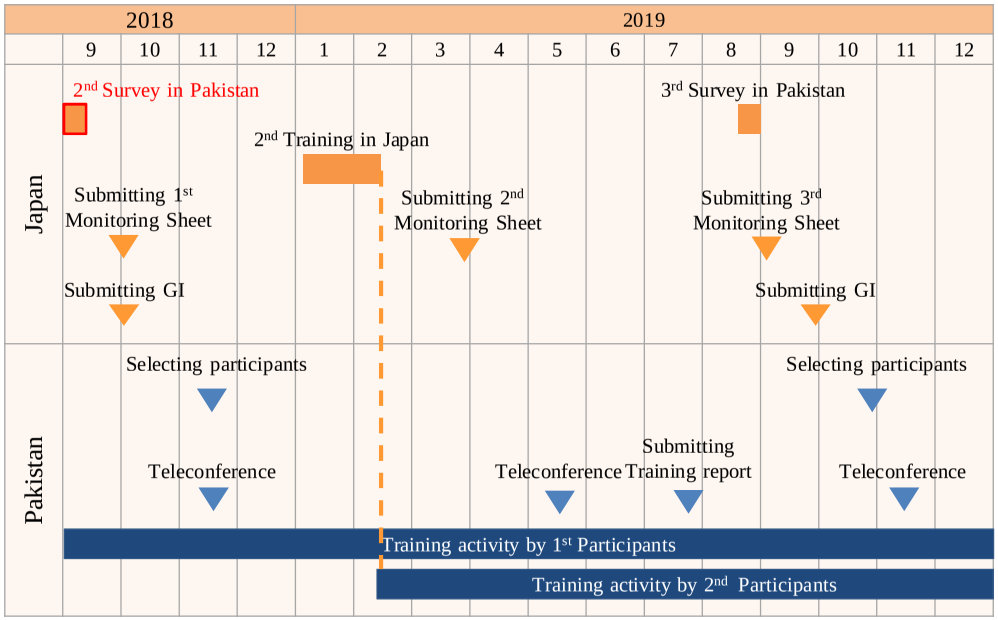
ü **Undertaking by Pakistani Side:**

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

ü **Undertaking by Japanese Side:**

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

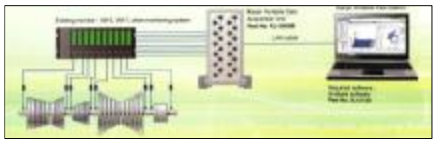
Introduction of O&M training equipment (2/2)

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)　第 3 回 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	
2	Muhammad Imran	MD & CEO	GHCL	
3	Mushtaq Ahmad	DGHRAA	GHCL	
4	Muhammad Jafar	Addl. Director	GHCL	
5	IFTIKHAR AHMAD	Asst. Director	GHCL	
6	Yuka Okada	Program Officer	JICA	
7	Akihiro Takashima	Sr. Rep	〃	高島
8	Noryuki Tsuruoka	Sr. Rep	〃	鶴岡
9	Hiroki Hirakata	General Manager	Kansai Electric	平方 浩樹
10	Akira Kosaka	Supervising Advisor Engineer, JICA Expert	Kansai Electric	小坂

Kansai Electric Power
power with heart

JCC Meeting Attendance List

No.	Name	Position	Company	Signature
11	Yoshihiro Dou	Mech Eng. JICA Exp.	Kansai Elec.	
12	Hidenobu Ichioka	Elec. Engineer JICA Expert	Kansai Electric	一岡栄喜
13	Yuki Obe	I&C Eng. JICA Expert	Kansai Electric	大部 祐貴
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Kansai Electric Power
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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**
2. O&M Training in Japan (2nd Batch in 2019)
3. Action Plan Implementation
4. Next O&M Training in Japan for Engineer & Technician
5. Next HRD Training in Japan for Management including Provision of O&M Training Equipment
6. Summary on the Mission for Next Step

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.

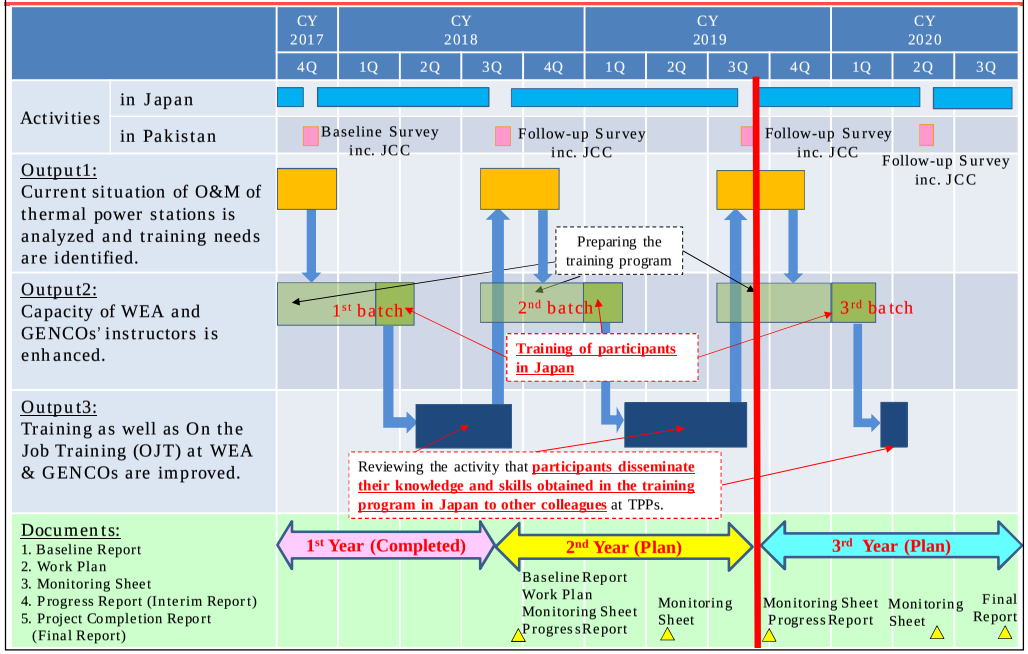
Project Output

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

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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)

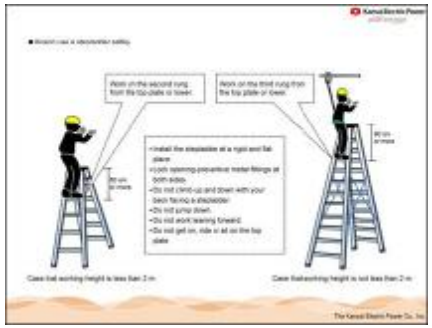
Example: Experience-based Safety Training (Practical Training)

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)

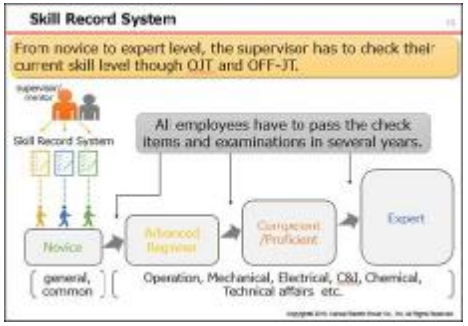
Example: Human Resource Development in Kansai (Lecture)

Training Item

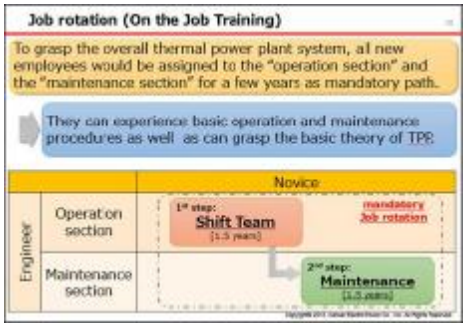
Introduction of KANSAI's Human Resource Development

- 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

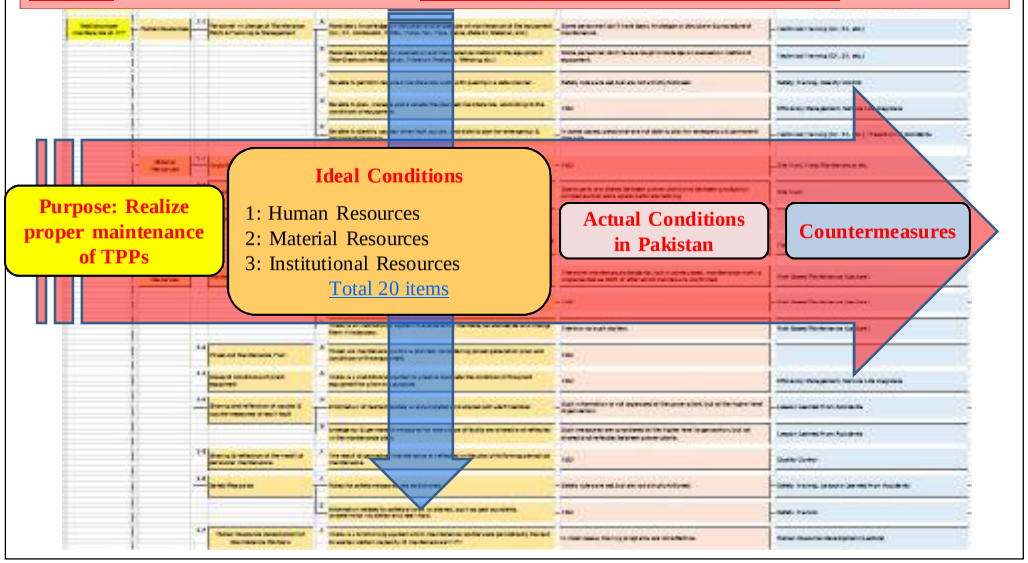
1. Largest TPP of KANSAI (4,119 MW)
2. Introduced latest GTCC technology, and achieved high thermal efficiency of 60%
3. LNG terminal is adjacent to TPP, and integratedly operated

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

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Implementing their action plan in TPPs enables **not only participants but also their colleagues** to improve their O&M knowledge & skills.

About Action Plan

- Participants will be core instructors, and disseminate the knowledge and skills learned during O&M Training in Japan when they come back to Pakistan.
- 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

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We provided the participants with comprehensive O&M training as well as **opportunities to learn Japanese culture.**

- **Japanese Language Lesson:**

- **Home-Visit Program for Engineers**

- **Sightseeing in Kyoto: for Engineers & Technicians**

2. HRD Training in Japan: Overview

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- We provided management with Human Resource Development (HRD) training in Japan **to realize more effective capacity building for O&M at TPPs**.
- 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

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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	Vibraton	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

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We 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.
- 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	✓
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

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	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

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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

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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)

- ü **There is probably room for improving HRD more effectively & more systematically** because training function still remains in WEA although TPPs are managed under GHCL.
- ü GHCL is considering to **upgrade their training facilities at Muzaffargarh TPS and Guddu TPS**.
- ü **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)

- ü 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

- ü 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**

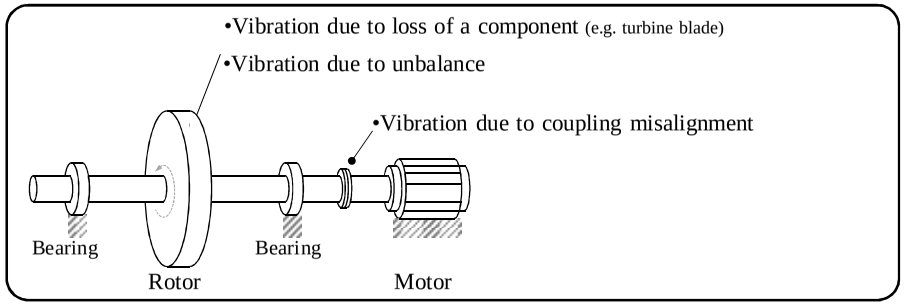
		Case 1	Case 2	Case 3	Case 4
Power Plant Operation Simulator		**1 set**	None	None	None
Vibration Analysis Demonstrator*		None	**2 sets**	**1 set**	None
NDI Demonstrator** (PT/UT/MT)		None	None	**4 sets**	**7 sets**
Expected effect	Number of trainees	✓ Limited & far from TPPs	✓✓ Limited &far from TPPs	✓✓✓ 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:

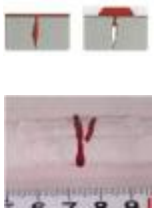
Middle to expert level engineers (mechanical & electrical)

5. NDI Demonstrator (Tentative)

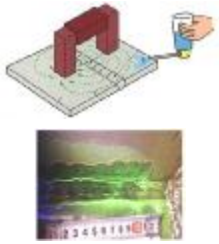
(1) Specification [PT/MT/UT]:

This demonstrator can provide principles, correct inspection procedure, how to ensure the quality and how to record correctly.

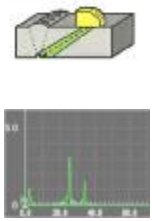
Dye penetrant inspection



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)

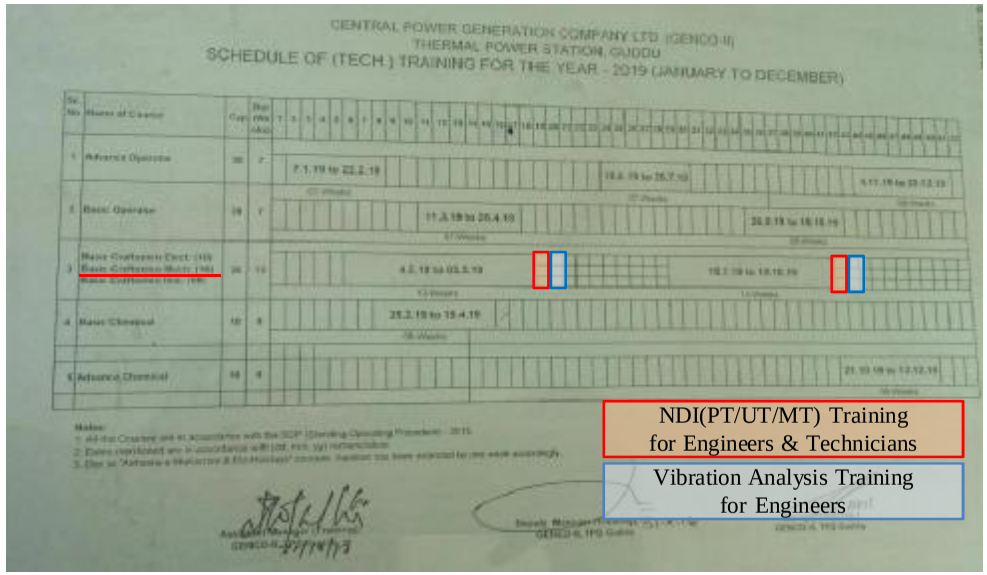
5. Feasible Training Plan (Tentative)

	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

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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

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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.

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2. O&M Training in Japan (2nd Batch in 2019)
3. Action Plan Implementation
4. Next O&M Training in Japan for Engineer & Technician
5. Next HRD Training in Japan for Management including Provision of O&M Training Equipment
6. **Summary on the Mission for Next Step**

6. Summary on the Mission for Next Step

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ü **Request for Next Step:**

Giving us any comments from Pakistan side for Minute of Meeting on JCC **by OCT 14, 2019**

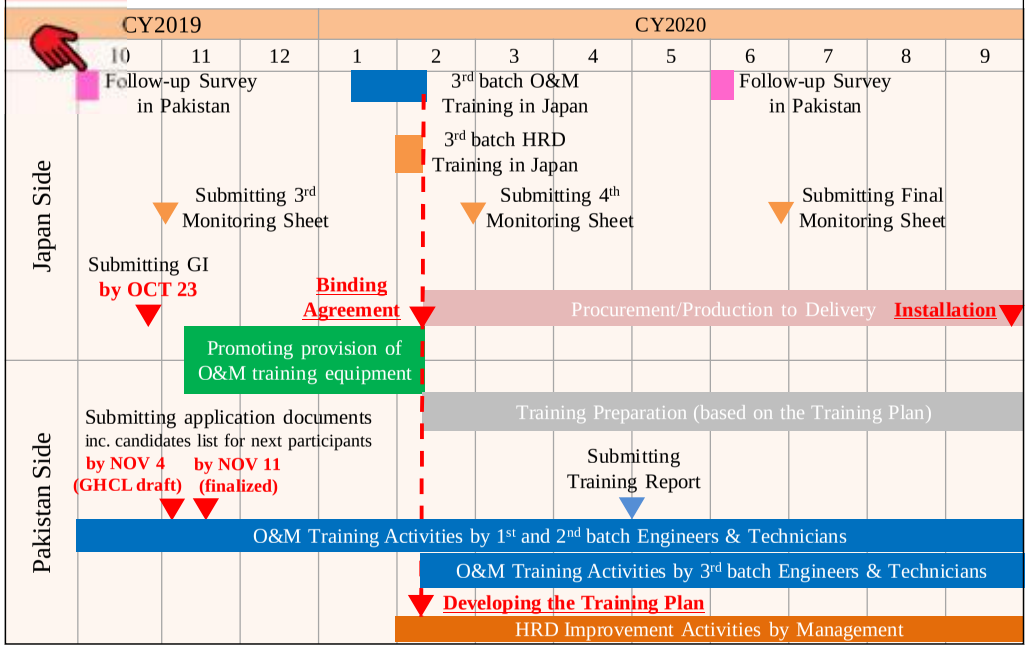
ü **Undertaking by Pakistan Side:**

- 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)
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Thermal Power Division
The Kansai Electric Power Co.,Inc.

(4)　第 4 回 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**
2. O&M Training in Japan (3rd Batch in 2020)
3. Action Plan Implementation
4. Issue Analysis of O&M in TPS
5. Next Phase of the Project
6. Summary for Next Step

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.

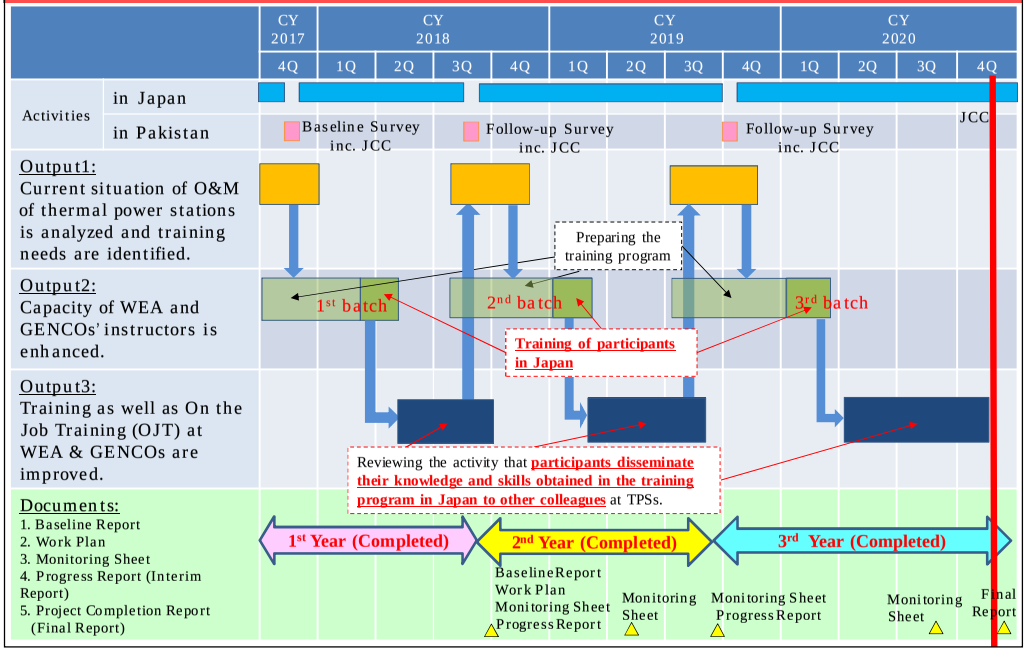
Project Output

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

1. Project Summary
2. **O&M Training in Japan (3rd Batch in 2020)**
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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 Introduction of the latest technology in TPS (inc. USC)
	ü Experience-based Safety Training	ü Experiential Safety Training
	ü Human Resource Development	ü Experiential Quality Training
	ü Quality Management	ü Prevention of Accidents and Disasters
	ü Thermal Efficiency Management	ü Occupational HSE (especially Safety)
	ü Tool Box Meeting (for Safety)	ü Tool Box Meeting (for Safety)
	ü Lessons Learned from Accidents	
	ü Human Error Prevention	
	ü Effective Maintenance for Quality Electric Power Infrastructure	
I&C Maintenance	ü Monitoring Device (Pressure, Temperature, Level, Flow Rate)	ü Monitoring Device (Pressure, Temperature, Level, Flow Rate)
	ü Pneumatic Control Valve and Accessories	ü Pneumatic Control Valve and Accessories
	ü Copper Tube Processing and Terminal Treatment	ü Copper Tube Processing and Terminal Treatment
	ü Sequence Control	ü Sequence Control
	ü Tuning of PID 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	
Site Visit	ü Site Visit on TPS	ü Site Visit on TPS
	ü Site Visit on Manufacturer's factory	ü Site Visit on Manufacturer's factory
JICA Original	ü Issue Analysis	ü Issue Analysis
	ü Methodology to Formulate Action Plan	ü Methodology to Formulate Action Plan

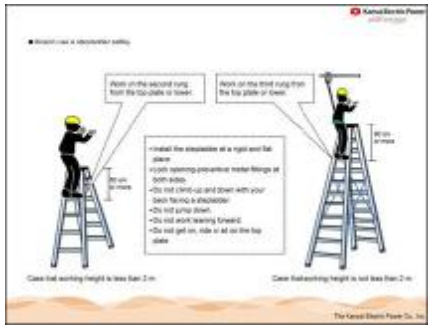
2. O&M Training in Japan: Course Examples (1)

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

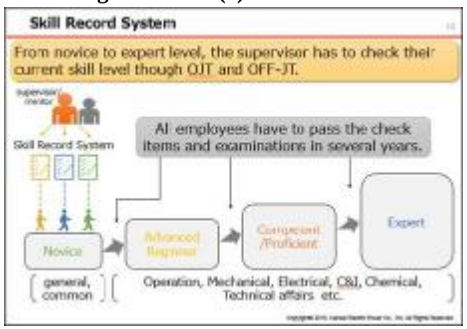
2. O&M Training in Japan: Course Examples (2)

Example: Human Resource Development in Kansai (Lecture)

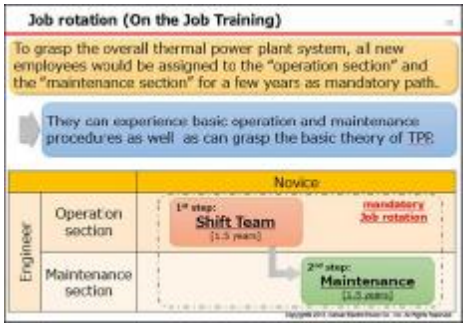
Training Item

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

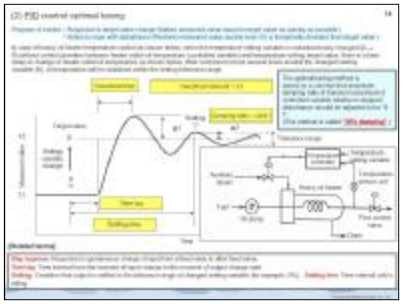
2. O&M Training in Japan: Course Examples (3)

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:**

- **Home-Visit Program for Engineers**

- **Sightseeing in Kyoto: for Engineers & Technicians**

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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	Vibraton	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.**

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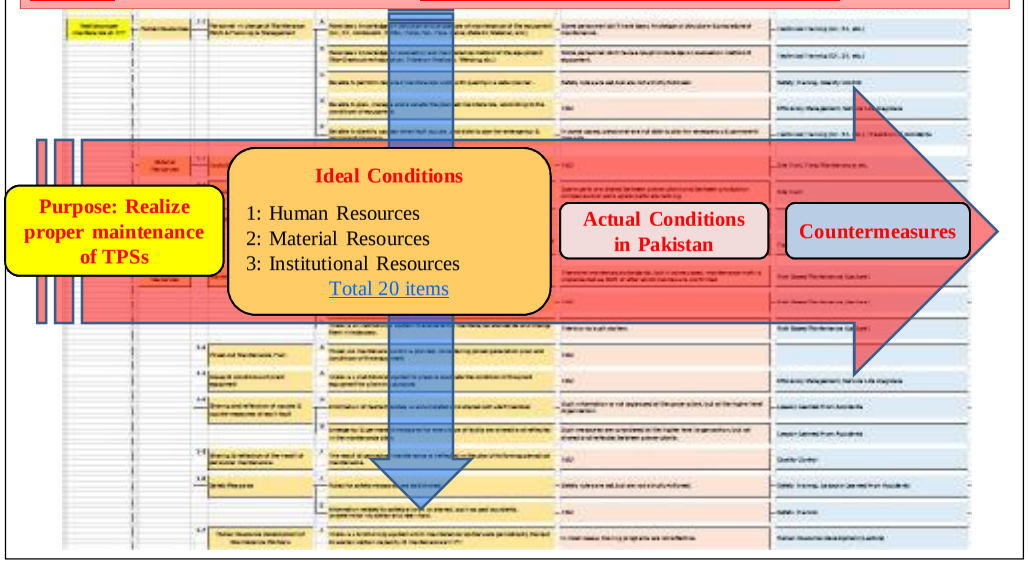
4. Issue Analysis of O&M in TPS

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

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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

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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

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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

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(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.

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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.**

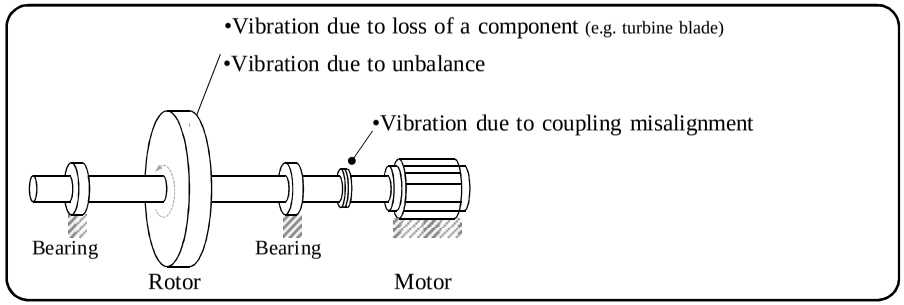
- In order to secure sufficient time **to develop GENCO's training abilities by using the equipment** (Vibration analysis demonstrator, Non-destructive inspection demonstrator) to be provided under this Project, **the Project was extended to March 2022.**

	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.

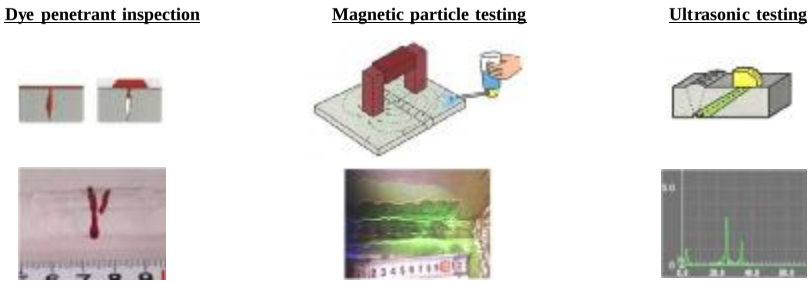
(2) Target:

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.



These phenomena are **NOT required high level knowledge** to understand.

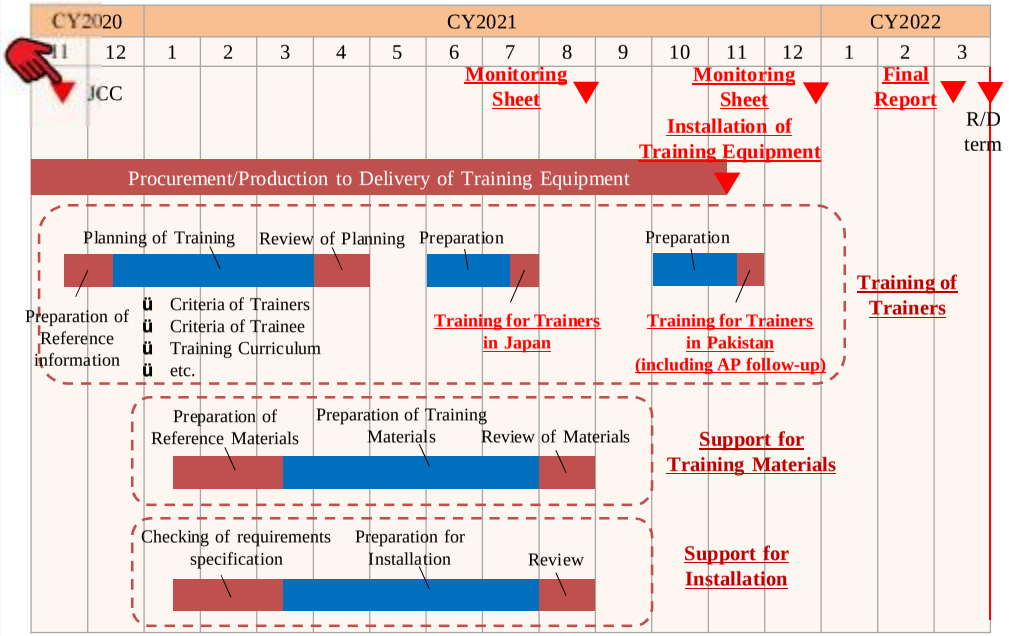
(2) Target:

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



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6. Summary for Next Step

- **Request for Next Step:**
  Giving us any comments from Pakistan side for Minute of Meeting on JCC **by NOV 30, 2020**
- **Undertaking by Pakistan Side:**
  - **Supporting, promoting and supervising JICA-trained Participants' Action Plan implementation by Management.**
  - Planning of Training in Pakistan using the equipment (Vibration analysis demonstrator and NDI demonstrator) **by MAR, 2021**
    - Selection of location for the equipment installation
    - Selection of candidates for Trainers
    - Making training curriculum for vibration analysis and NDI
  - Making Training Materials (textbooks, manuals, etc.) **by JUL, 2021**
  - Preparing for installation of the equipment **by JUL, 2021**
- **Undertaking by Japan Side:**
  - Installing the equipment (Vibration analysis demonstrator and NDI demonstrator) **by NOV, 2021**
  - Supporting the above activities by Pakistan side
  - 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

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

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

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Ministry of Energy

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GENCO Holding Company, Ltd

Riffat Ara Qureshi
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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) ✓ Non-Destructive Inspection	✓ Electrical Protection Systems (inc. intro. & usage) ✓ Modern Maintenance Techniques of Facilities Systems
✓ Electrical Protection Systems (inc. intro. & usage) ✓ Modern Maintenance Techniques of Facilities Systems	✓ Control Circuit (mainly Protection Relay) ✓ Preventive Maintenance (inc. Lubricant & Wire Ropes)
✓ Control Circuit (mainly Protection Relay)	✓ Fire Protection for Electrical Circuit/Equipment
✓ Preventive Maintenance (inc. Lubricant & Wire Ropes)	✓ Insulation standard for Electrical Circuit/Equipment
✓ Fire Protection for Electrical Circuit/Equipment	✓ Occupational HSE (especially Safety)
✓ Insulation standard for Electrical Circuit/Equipment ✓ Site Visit at TPP and Manufacture's factory	✓ Site Visit at 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 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)　第 5 回 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)

(Attachment 1)

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
2. O&M and HRD Training in Japan
3. Provision of O&M Training Equipment
4. Action Plan Implementation
5. Issue Analysis of O&M in TPS
6. KANSAI's Technical Proposal
7. Conclusion

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

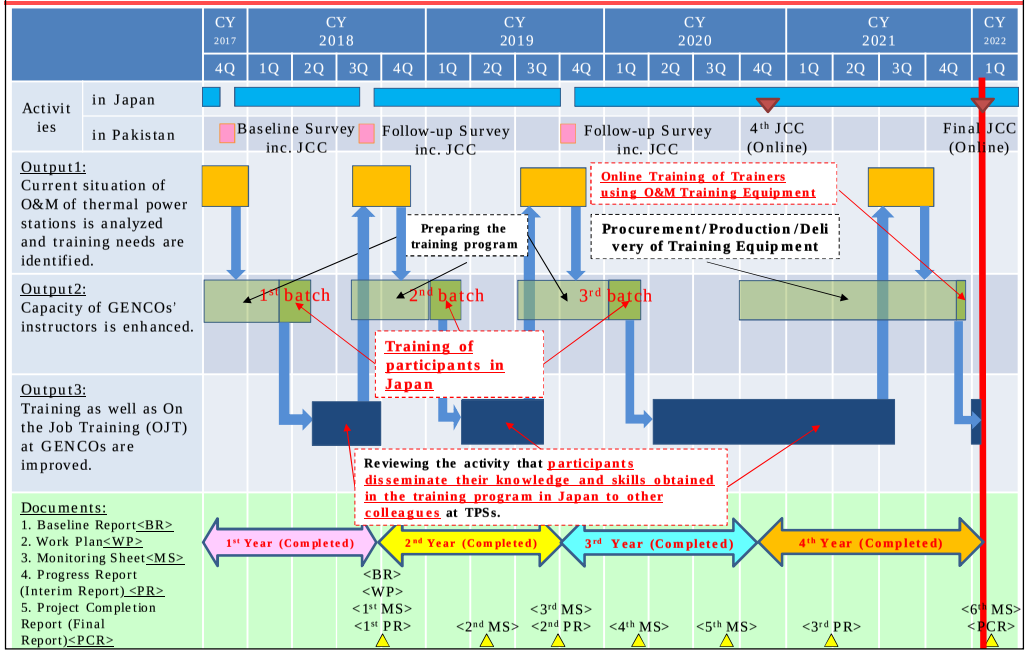
Output 1	Current situation of O&M of thermal power stations is analyzed and training needs are identified.
Output 2	Capacity of GENCOs' instructors is enhanced.
Output 3	Training as well as On the Job Training (OJT) at GENCOs are improved.

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.

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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.

+

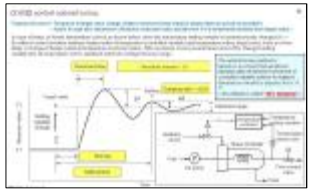
Site visit to Kansai's TPSs and Japanese manufacturer's factory: Passive
To understand high-level safety & quality management at their sites directly.

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

- We provided management with Human Resource Development (HRD) training in Japan to realize more effective capacity building for O&M at TPSs.
- 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. O&M Training Equipment: Amendment of R/D

- 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.

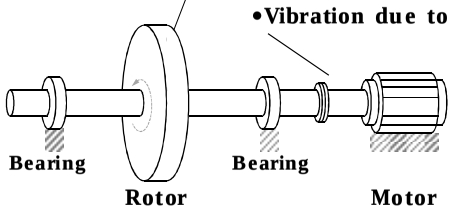
Pakistan side and JICA Expert Team amended Record of Discussion on the Project in September 2020.

	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:

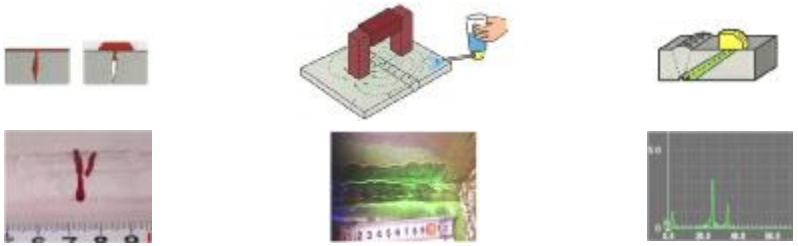
Middle to expert level engineers (mechanical & electrical)

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.

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)

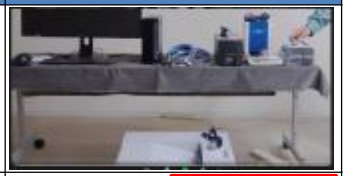
3. O&M Training Equipment: Online Training for Trainers

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		✓	✗
	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 (Wed)	Making Action Plan of vibration & NDT	Demonstrating the training by lecturing each other	✓	✓

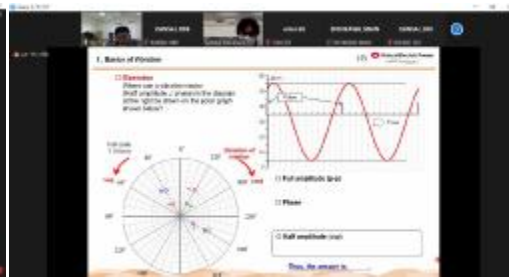
3. O&M Training Equipment: Points for Effective Training

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



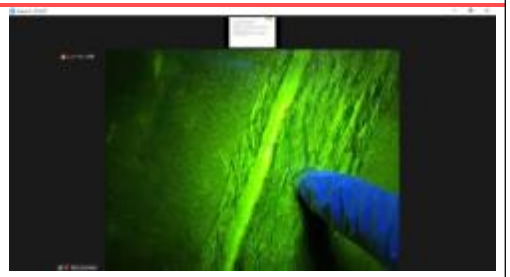
Online Lecture (Vibration Analysis)

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)

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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.

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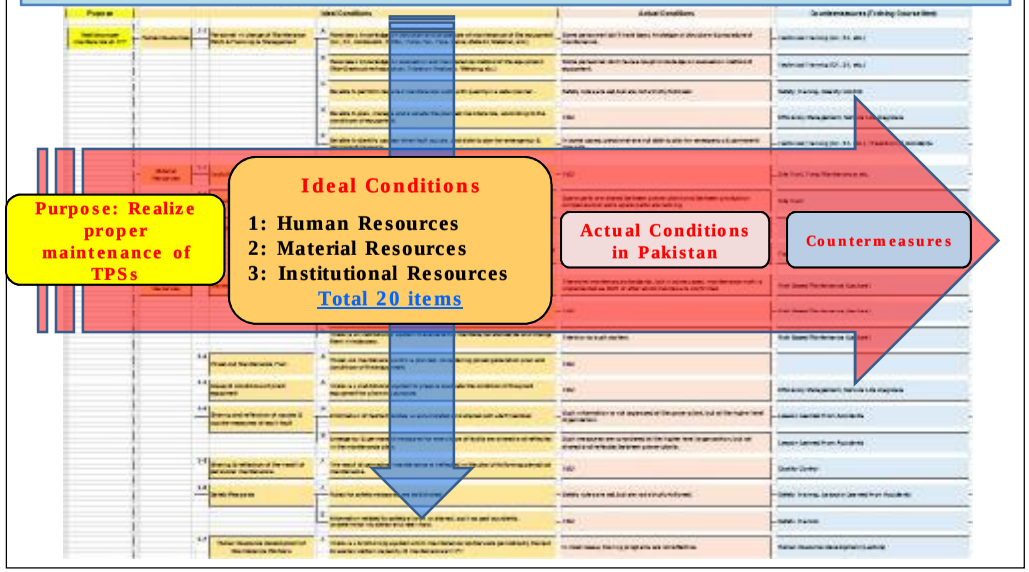
5. Issue Analysis of O&M in TPS

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.**

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6. KANSAI's Technical Proposal: Suggestion

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(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.

6. KANSAI's Technical Proposal : Technical Training

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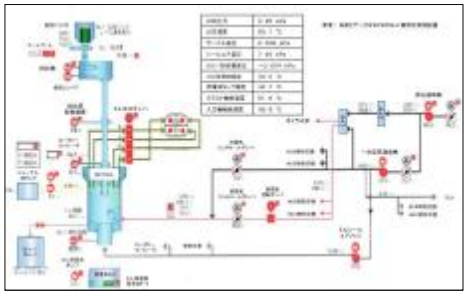
(1) Training Course of Plant Operation

(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.

6. KANSAI's Technical Proposal : Technical Training

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(2) Training Course of more practical skills (Root Cause Analysis)

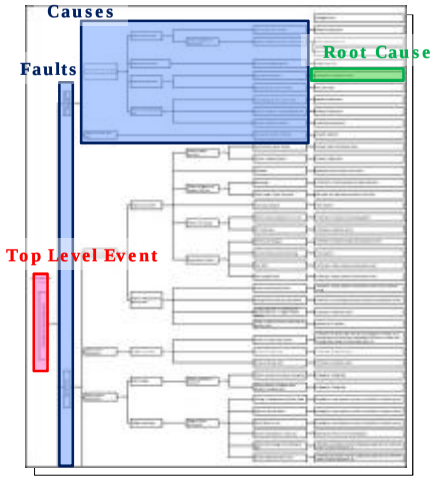
About Fault Tree Analysis (FTA)

- 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.

6. KANSAI's Technical Proposal : Technical Training

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(3) Training Course of more practical skills (CPM for Maintenance Scheduling)

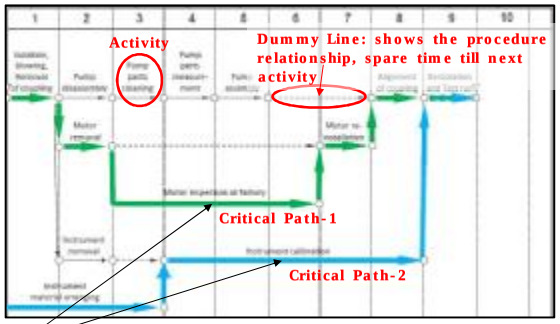
About Critical Path Method (CPM)

- 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

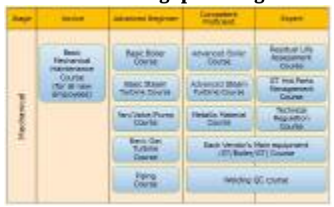
ü Critical Path Method (CPM) can help engineers and technicians to easily optimize maintenance schedule planning, management and revising, that leads to improve productivity and reduce maintenance cost.

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.

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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.

(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)

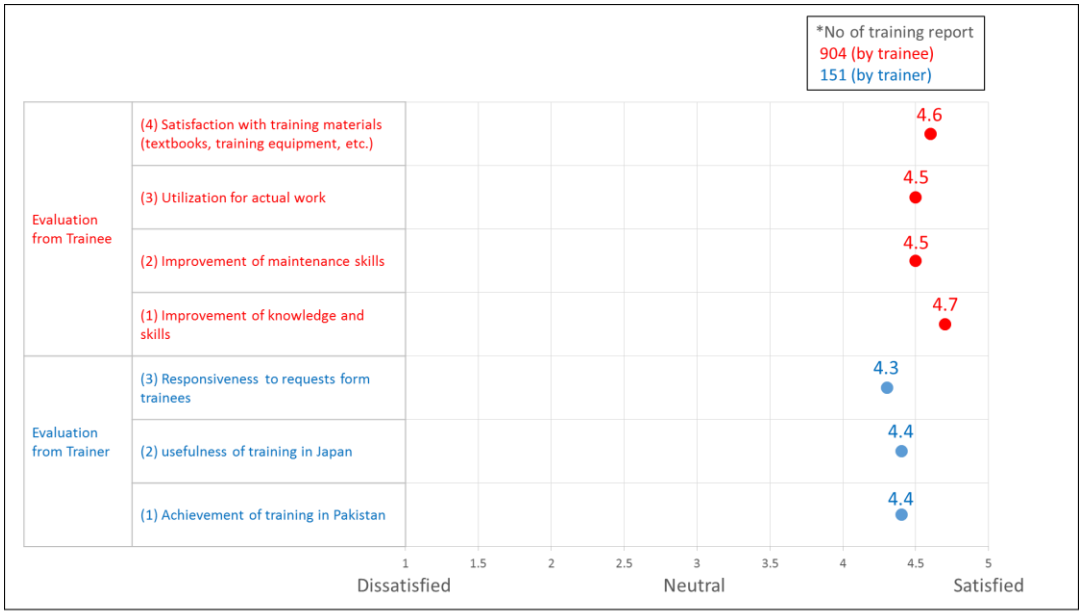


Chart 1-1: Evaluation of Training provided by JICA trained participants (based on report surveys)

- [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.

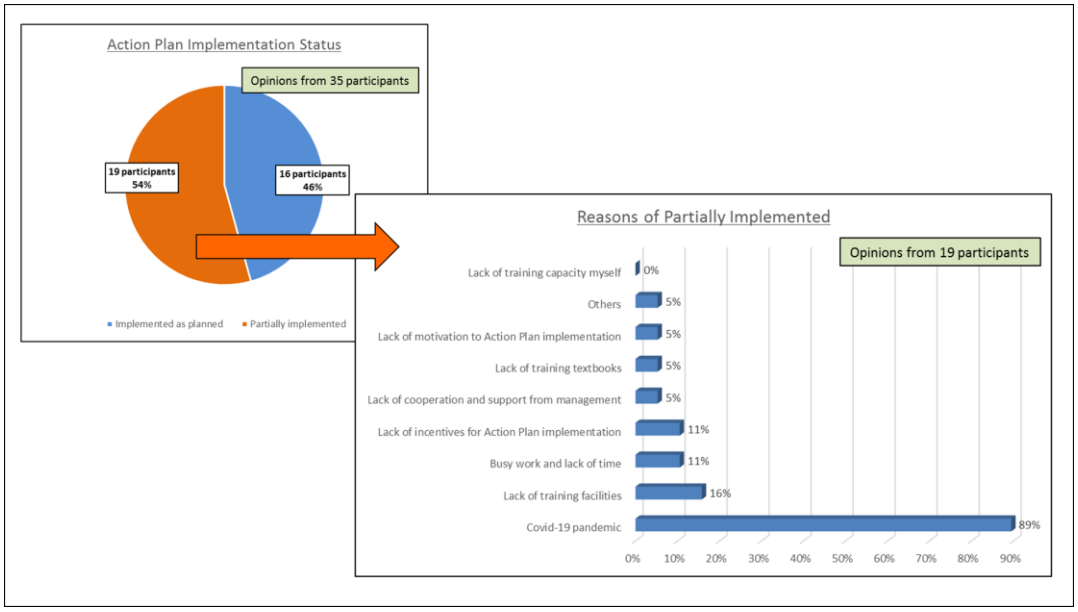


Chart 1-2: Action Plan Implementation Status (based on report surveys)

- ✓ 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

Period of Project: October, 2017 - March, 2022

Project Site: ~~WEA and~~ GENCOs' thermal power stations

Version No. 6

Dated: 17th February, 2022

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	# # #	1 2 3	4 5 6	7 8 9	# # #	1 2 3	4 5 6	7 8 9	# # #	1 2 3	4 5 6	7 8 9	# # #	1 2 3	4 5 6	7 8 9	# # #	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	Plan	2017		2018				2019				2020				2021				2022		Responsible Organization		Achievements	Issue & Countermeasures
Sub-Activities	Actual	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				
	Plan			
	Actual			

Monitoring Plan		2017		2018				2019				2020				2021				2022		Remarks	Issue	Solution
		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																					Due to the extension of the project period, Project Completion Report was submitted in February 2022.		
	Actual																							
Public Relations																								
	Plan																							
	Actual																							
	Plan																							
	Actual																							

添付資料 6-1-4

研修実績

(1)　第 1 回本邦研修

第 1 回本邦研修

(1) エンジニア研修（2018 年 3 月 21 日～4 月 27 日）

日程	時間	研修項目	研修場所
3/21 (水)	-	来日	―
3/22 (木)	9:30～16:00	ブリーフィング	JICA 中国
		プログラムオリエンテーション	
3/23 (金)	9:30~11:30	ジェネラルオリエンテーション（日本の経済）	JICA 中国
	13:00～14:00	開講式	
	14:10～17:00	ジョブレポート発表会	
3/24 (土)	-	休日	-
3/25 (日)	-	移動（JICA 中国→国際ホテル宇部）	-
3/26 (月)	9:00～12:00	コースオリエンテーション／アクションプラン作成（PCM）	PET
	13:00～16:00	アクションプラン作成（PCM）	
3/27 (火)	9:00～16:00	日本の TQM 活動	PET
3/28 (水)	9:00～12:00	日本の TQM 活動	PET
	13:00～16:00	火力発電所の人材育成	
3/29 (木)	9:00～12:00	火力発電所の人材育成	PET
	13:00～16:00	USC 概要	
	17:00～19:30	病院同行	-
3/30 (金)	9:00～14:00	待機	-
	14:00～16:00	振動基礎技術 ・振動の基礎	PET
3/31 (土)	-	休日	-
4/1 (日)	-	休日	-
4/2 (月)	9:00～16:00	振動基礎技術 ・ 振動計測 ・ 振動の保守管理 ・ 振動発生の原因 ・ バランシング	PET
4/3 (火)	9:00～16:00	振動基礎技術 ・ 振動計測 ・ 振動の保守管理 ・ 振動発生の原因 ・ バランシング	PET
4/4 (水)	9:00～16:00	非破壊検査技術 ・ 講義（UT, PT, MT, RT） ・ 実習（PT, MT, UT）	PET
4/5 (木)	9:00～12:00	非破壊検査技術 ・ 講義（UT, PT, MT, RT） ・ 実習（PT, MT, UT）	PET
	13:00～16:00	余寿命診断技術 ・ 必要性、金属の基礎 ・ 経年劣化メカニズム、損傷事例 ・ 余寿命診断技術、診断事例	
4/6 (金)	9:00～16:00	余寿命診断技術 ・ 必要性、金属の基礎 ・ 経年劣化メカニズム、損傷事例 ・ 余寿命診断技術、診断事例	PET
4/7 (土)	-	休日	-
4/8 (日)	-	休日	-
4/9 (月)	9:00～16:00	余寿命診断技術 ・ 耐力向上対策 ・ 実習（レプリカ採取、評価）	PET
4/10 (火)	9:00～10:30	安全（災害事例検討他）	PET
	10:30～12:00	アクションプランガイダンス（書き方指導）	

	13:00～16:00	環境保全への取組 ・ 環境法令、対策技術（大気、水質、廃棄他） ・ 脱硝装置	
4/11 (水)	9:00～12:00	環境保全への取組 ・ 環境法令、対策技術（大気、水質、廃棄他） ・ 脱硝装置	PET
	13:00～16:00	ボイラ水質管理	
4/12 (木)	-	移動（国際ホテル宇部→柳井発電所）	-
	13:00～16:00	ガスタービン・コンバインドサイクル発電技術 ・ 柳井発電所の概要 ・ コンバインドの基礎 ・ ガスタービン基礎	中国電力 柳井発電所
4/13 (金)	9:30～16:00	ガスタービン・コンバインドサイクル発電技術 ・ 柳井発電所の概要 ・ コンバインドの基礎 ・ ガスタービン基礎	中国電力 柳井発電所
4/14 (土)	-	休日	-
4/15 (日)	-	休日	-
4/16 (月)	9:30～16:00	ガスタービン・コンバインドサイクル発電技術 ・ 定期点検、燃焼器点検　・高温部品の基礎 ・ 排熱回収ボイラ　・蒸気タービン電気設備 ・ トラブル事例　・高温部品の管理方法 ・ ガスタービン制御　・意見交換	中国電力 柳井発電所
4/17 (火)	9:30～11:30	ガスタービン・コンバインドサイクル発電技術 ・ 定期点検、燃焼器点検　・高温部品の基礎 ・ 排熱回収ボイラ　・蒸気タービン電気設備 ・ トラブル事例　・高温部品の管理方法 ・ ガスタービン制御　・意見交換	中国電力 柳井発電所
	13:20～15:30	広島平和記念資料館見学	平和記念公園
4/18 (水)	10:00～16:00	三菱日立パワーシステムズ株式会社　工場見学	MHPS 呉工場
4/19 (木)	10:00～16:00	アクションプラン指導	JICA 中国
4/20 (金)	9:00～16:00	アクションプラン指導	JICA 中国
4/21 (土)	-	休日	-
4/22 (日)	-	移動（JICA 中国→日立）	-
4/23 (月)	10:00～16:00	三菱日立パワーシステムズ株式会社　工場見学	MHPS 日立工場
4/24 (火)	-	移動（日立→JICA 横浜）	-
4/25 (水)	10:00～13:00	アクションプラン発表	JICA 横浜
4/26 (木)	10:00～11:00	評価会	JICA 横浜
	11:00～12:00	閉講式	
	13:00～14:30	反省会	
4/27 (金)	-	離日	-

(2) テクニシャン研修（2018 年 3 月 4 日～3 月 24 日）

日程	時間	研修項目	研修場所
3/4 (日)	-	来日	-
3/5 (月)	9:30～10:15	ブリーフィング	JICA 関西
	10:15～11:00	プログラムオリエンテーション	
	11:00～12:00	コースオリエンテーション	
	14:00～17:00	ジョブレポート発表会	
3/6 (火)	9:00～12:00	関西電力概要／燃料	JICA 関西
	13:00～16:00	火力発電所（GTCC 概要／石炭概要）	
	16:30～17:30	日本語講習	
3/7 (水)	10:00～16:00	アクションプラン作成指導	JICA 関西
	16:30～17:30	日本語講習	
3/8 (木)	10:00～12:00	オリエンテーション（施設案内・作業服合わせ）	KP テクノセンター

	13:00～16:30	安全体感訓練	
3/9 (金)	9:00～12:00	溶接施工の基礎	KP テクノセンター
	13:00～16:30	事故災害未然防止	
3/10 (土)	-	休日	-
3/11 (日)	-	休日	-
3/12 (月)	9:00～12:00	金属材料取扱い	KP テクノセンター
	13:00～16:30	品質体感訓練	
3/13 (火)	9:00～16:30	弁分解点検	KP テクノセンター
3/14 (水)	9:00～12:00	高温高圧配管の保守	KP テクノセンター
	13:00～16:30	計器類の保守	
3/15 (木)	9:00～16:30	モータ分解点検	KP テクノセンター
3/16 (金)	10:00～12:00	設備見学：姫路第二発電所	姫路第二発電所
	14:00～17:00	石川島播磨重工業株式会社　工場見学	IHI 相生工場
3/17 (土)	-	休日	-
3/18 (日)	-	日本文化体験	姫路
3/19 (月)	9:00～12:00	アクションプラン作成	姫路キャッスルグランヴィリオホテル
	13:30～17:30	三菱日立パワーシステムズ株式会社　工場見学	MHPS 高砂工場
3/20 (火)	9:00～12:00	非破壊検査の種類と特徴	KP テクノセンター
	13:00～16:30	非破壊検査	
3/21 (水)	-	（宿舎移動）	-
3/22 (木)	9:00～17:30	アクションプラン作成	JICA 関西
3/23 (金)	9:30～12:30	アクションプラン発表	JICA 関西
	13:30～14:30	評価会	
	14:30～15:15	閉講式	
	15:15～16:00	意見交換会	
	16:00～17:00	反省会	
3/24 (土)	-	離日	-

(3) マネジメント研修（2018 年 3 月 14 日～3 月 24 日）

日程	時間	研修項目	研修場所
3/14 (水)	-	来日	-
3/15 (木)	10:00～10:30	ブリーフィング	JICA 関西
	11:00～11:30	プログラムオリエンテーション	
	13:00～14:00	コースオリエンテーション・関西電力概要	
	14:00～17:00	PCM による問題分析（Discussion 含む）	
3/16 (金)	10:00～12:00	設備見学：姫路第二発電所	姫路第二発電所
	14:00～17:00	石川島播磨重工業株式会社　工場見学	IHI 相生工場
3/17 (土)	-	休日	-
3/18 (日)	-	休日	-
3/19 (月)	9:00～12:00	PCM による目的分析	JICA 関西
	13:30～17:30	三菱日立パワーシステムズ株式会社　工場見学	MHPS 高砂工場
3/20 (火)	10:00～12:00	KP テクノセンター見学	KP テクノセンター
	13:00～16:30	非破壊検査	
3/21 (水)	-	祝日	-
3/22 (木)	10:00～12:00	人材育成	関西電力研修センター
	13:00～15:30	関西電力研修センター見学 O&M ソリューション紹介	
3/23 (金)	9:30～12:30	アクションプラン発表会	JICA 関西
	13:30～14:30	評価会	

	14:30～15:15	閉講式	
	15:15～16:00	意見交換会	
	16:00～17:00	反省会	
3/24 (土)	-	離日	-

(2)　第 2 回本邦研修

第 2 回本邦研修

(1) エンジニア研修（2019 年 1 月 6 日～2 月 9 日）

日程	時間	研修項目	研修場所
1/6 (日)	-	来日	-
1/7(月)	10:00～11:00	ブリーフィング	JICA 関西
	11:00～12:00	プログラムオリエンテーション	
	13:00～14:00	コースオリエンテーション	
	14:00～17:00	ジョブレポート発表会	
1/8(火)	9:00～12:00	問題分析	JICA 関西
	13:00～16:00	問題分析	
	18:00～19:30	日本語講習	
1/9(水)	9:00～12:00	問題分析	JICA 関西
	14:00～15:00	関西電力本店　RMC 見学	関西電力本店
	15:00～16:00	関西電力中央給電指令所見学	
	18:00～19:30	日本語講習	JICA 関西
1/10(木)	9:00～12:00	関西電力概要／燃料	JICA 関西
	13:00～16:00	火力発電所（GTCC 概要／石炭概要）	
1/11(金)	10:00～12:00	オリエンテーション	KP テクノセンター
	13:00～14:00	絶縁基準	
	14:00～16:00	電気設備の火災対応	
1/12(土)	-	休日	-
1/13(日)	-	休日	-
1/14(月)	10:20～20:00	ホームビジット	-
1/15(火)	9:00～12:00	発電機の予防保全	KP テクノセンター
	13:00～16:00	ケーブルの保全	
1/16(水)	9:00～12:00	主要電気設備の保護装置	KP テクノセンター
	13:00～15:30	母線保護装置、220/500kV 保護装置	
	15:30～17:00	教育施設見学	関西学院大学神戸三田キャンパス
1/17(木)	9:00～12:00	発電機、変圧器、6.6kV 電動機の保護装置	KP テクノセンター
	13:00～16:00	変圧器の予防保全	
1/18(金)	13:00～16:00	設備見学：舞鶴発電所	舞鶴発電所
1/19(土)	-	休日	-
1/20(日)	-	休日	-
1/21(月)	9:30～12:00	三菱電機株式会社　工場見学	三菱電機神戸製作所
	14:00～16:00	三菱電機株式会社　工場見学	三菱電機伊丹製作所
1/22(火)	9:00～12:00	オリエンテーション	関西電力研修センター
	13:00～14:30	品質管理	
	14:30～16:00	効率管理	
1/23(水)	9:00～16:00	非破壊検査	関西電力研修センター
1/24(木)	9:00～16:00	非破壊検査	関西電力研修センター
1/25(金)	9:00～12:00	設備見学：姫路第二発電所	姫路第二発電所
	14:00～17:00	日本電研工業株式会社　工場見学	日本電研工業
1/26(土)	-	休日	-
1/27(日)	-	休日	-
1/28(月)	9:00～12:00	設備見学：姫路第二発電所	姫路第二発電所
	13:30～17:00	三菱日立パワーシステムズ株式会社　工場見学	MHPS 高砂工場
1/29(火)	9:00～10:30	人材育成	

	10:30～12:00	過去教訓	関西電力研修センター
	13:00～16:00	遮断器の予防保全	
1/30(水)	9:00～16:00	振動基礎技術	関西電力研修センター
1/31(木)	9:00～16:00	振動基礎技術	関西電力研修センター
2/1(金)	9:00～16:00	振動基礎技術	関西電力研修センター
2/2(土)	-	日本文化体験	京都
2/3(日)	-	休日	-
2/4(月)	9:00～12:00	最適保守計画	関西電力研修センター
	13:00～16:00	励磁装置の予防保全	
2/5(火)	9:00～12:00	安全体感	関西電力研修センター
	13:00～16:00	6.6kV 電動機の予防保全	
2/6(水)	9:00～16:00	アクションプラン作成	JICA 関西
2/7(木)	9:00～12:00	アクションプラン作成	JICA 関西
	13:00～16:00	アクションプラン発表	
2/8(金)	9:00～10:00	評価会	JICA 関西
	11:00～12:00	閉講式	
	16:00～17:00	反省会	
2/9(土)	-	離日	-

(2) テクニシャン研修（2019 年 1 月 6 日～1 月 26 日）

日程	時間	研修項目	研修場所
1/6 (日)	-	来日	-
1/7(月)	10:00～11:00	ブリーフィング	JICA 関西
	11:00～12:00	プログラムオリエンテーション	
	13:00～14:00	コースオリエンテーション	
	14:00～17:00	ジョブレポート発表会	
1/8(火)	9:00～12:00	問題分析	JICA 関西
	13:00～16:00	問題分析	
	18:00～19:30	日本語講習	
1/9(水)	9:00～12:00	問題分析	JICA 関西
	14:00～15:00	関西電力本店　RMC 見学	関西電力本店
	15:00～16:00	関西電力中央給電指令所見学	
	18:00～19:30	日本語講習	JICA 関西
1/10(木)	9:00～12:00	関西電力概要／燃料	JICA 関西
	13:00～16:00	火力発電所（GTCC 概要／石炭概要）	
1/11(金)	10:00～12:00	オリエンテーション	KP テクノセンター
	13:00～16:00	変圧器の予防保全	
1/12(土)	-	休日	-
1/13(日)	-	休日	-
1/14(月)	-	日本文化体験	京都
1/15(火)	9:00～12:00	主要電気設備の保護装置	KP テクノセンター
	13:00～14:00	絶縁基準	
	14:00～16:00	電気設備の火災対応	
1/16(水)	9:00～12:00	発電機の予防保全	KP テクノセンター
	13:00～15:30	母線保護装置、220/500kV 保護装置	
	15:30～17:00	教育施設見学	関西学院大学神戸三田キャンパス
1/17(木)	9:00～12:00	6.6kV 電動機の予防保全	KP テクノセンター

	13:00～16:00	発電機、変圧器、6.6kV 電動機の保護装置	
1/18(金)	13:00～16:00	設備見学：舞鶴発電所	舞鶴発電所
1/19(土)	-	休日	-
1/20(日)	-	休日	-
1/21(月)	9:30～12:00	ケーブルの予防保全	KP テクノセンター
	14:00～16:00	品質体感訓練	
1/22(火)	9:00～12:00	事故災害未然防止	KP テクノセンター
	13:00～14:30	労働安全	
	14:30～16:00	安全体感訓練	
1/23(水)	9:00～16:00	モータ分解点検	KP テクノセンター
1/24(木)	9:00～16:00	アクションプラン作成	JICA 関西
1/25(金)	10:00～11:00	評価会	JICA 関西
	14:00～15:30	アクションプラン発表	
	15:30～16:15	閉講式	
	16:15～17:15	反省会	
1/26(土)	-	離日	-

(3) マネジメント研修（2019 年 2 月 3 日～2 月 9 日）

日程	時間	研修項目	研修場所
2/3 (日)	-	来日	-
2/4(月)	10:30～11:00	ブリーフィング	JICA 関西
	13:00～13:30	プログラムオリエンテーション	関西電力本店
	13:30～14:00	コースオリエンテーション	
	14:20～16:00	ジョブレポート発表会	
	16:00～17:00	関西電力本店　RMC 見学	
2/5(火)	9:00～12:15	関西電力研修センター見学	関西電力研修センター
	13:15～17:00	関係者分析／問題分析	
2/6(水)	10:00～11:30	設備見学：堺港発電所	堺港発電所
	13:00～14:15	設備見学：堺 LNG 基地	堺 LNG
	15:00～16:00	設備見学：南港発電所	南港発電所
2/7(木)	9:00～12:00	アクションプラン作成	JICA 関西
	13:00～15:00	アクションプラン発表会	
	15:00～17:00	人材育成	
2/8(金)	10:00～10:30	評価会	JICA 関西
	11:00～12:00	閉講式	
	14:30～15:40	反省会	
2/9(土)	-	離日	-

(3)　第 3 回本邦研修

第 3 回本邦研修

(1) エンジニア研修（2020 年 1 月 23 日～2 月 15 日）

日程	時間	研修項目	研修場所
1/23(木)	-	来日	-
1/24(金)	10:00～11:00	ブリーフィング	JICA 関西
	11:00～12:00	プログラムオリエンテーション	
	13:00～14:00	コースオリエンテーション	
	14:00～17:00	ジョブレポート発表会	
1/25(土)	-	休日	-
1/26(日)	09:00~12:00	問題分析	JICA 関西
	13:00~17:00	問題分析	
1/27(月)	09:00~10:00	オリエンテーション	関西電力研修センター
	10:00~11:00	作業前ミーティング(TBM)	関西電力研修センター
	11:00~14:00	タービン監視計器	
	14:00~17:00	タービン監視計器調整（実習）	
1/28(火)	09:00~17:00	タービン監視計器調整（実習）	関西電力研修センター
1/29(水)	09:00~17:00	タービン監視計器調整（実習）	関西電力研修センター
1/30(木)	09:30~12:00	GTCC 制御	姫路第二発電所
	13:00~14:00	GTCC 制御(シミュレータ)	
	14:00~16:00	設備見学：姫路第二発電所	
1/31(金)	09:00~10:30	品質管理	関西電力研修センター
	10:30~12:00	過去教訓	
	13:30~16:00	安全体感	
	16:00~17:00	週間レビュー	
2/1(土)	-	日本文化体験	京都
2/2(日)	-	休日	-
2/3(月)	09:00~10:00	オリエンテーション	KP テクノセンター
	10:00~12:00	プラント監視装置(圧力/温度/レベル/流量)	
	13:00~13:30	作業前ミーティング(TBM)	
	13:30~17:00	プラント監視装置校正(圧力/温度)	
2/4(火)	09:00~12:00	空気式制御弁(本体/アクチュエータ)	KP テクノセンター
	13:00~17:00	空気式制御弁(本体/アクチュエータ)（実習）	
2/5(水)	09:00~17:00	空気式制御弁(本体/アクチュエータ)（実習）	KP テクノセンター
2/6(木)	09:00~12:00	PID 制御理論	KP テクノセンター
	13:00~17:00	最適制御(ステップ応答/限界感度)（実習）	
2/7(金)	09:00~16:00	最適制御(ステップ応答/限界感度) （実習）	KP テクノセンター
	16:00~17:00	週間レビュー	
2/8(土)	-	休日	-
2/9(日)	-	休日	-
2/10(月)	10:30~15:00	島津製作所三条工場　工場見学 島津システムソリューションズ三条工場　工場見学	島津製作所 島津システムソリューションズ
2/11(火)	-	休日(祝日)	-
2/12(水)	09:00~10:00	質の高い電力インフラ	JICA 関西
	10:00~11:00	人材育成	
	11:00~12:00	最適保全	
	13:00~17:00	アクションプラン作成	
2/13(木)	09:00~16:00	アクションプラン作成	JICA 関西
	16:00~17:00	アクションプラン発表	

2/14(金)	09:00~10:00	評価会	JICA 関西
	10:00~11:00	反省会	
	11:00~12:00	閉講式	
	12:00~13:00	意見交換会	
2/15(土)	-	離日	-

(2) テクニシャン研修（2020 年 1 月 13 日～2 月 1 日）

日程	時間	研修項目	研修場所
1/13(月)	-	来日	-
1/14(火)	10:00~11:00	ブリーフィング	JICA 関西
	11:00~12:00	プログラムオリエンテーション	
	13:00~14:00	コースオリエンテーション	
	14:00~17:00	ジョブレポート発表会	
	18:00~19:30	日本語講座	
1/15(水)	09:00~17:00	問題分析	JICA 関西
	18:00~19:30	日本語講座	
1/16(木)	09:00~12:00	問題分析	JICA 関西
	14:00~15:00	関西電力中央給電指令所見学	関西電力本店
	15:00~16:00	関西電力概要	
	16:00~17:00	関西電力本店　RMC 見学	
	18:00~19:30	日本語講座	JICA 関西
1/17(金)	09:30~12:00	設備見学：姫路第二発電所	姫路第二発電所
	14:30~17:00	三菱電機株式会社　工場見学	三菱電機株式会社 神戸製作所
1/18(土)	-	休日	-
1/19(日)	-	ホームビジット	-
1/20(月)	10:00~12:00	オリエンテーション	KP テクノセンター
	13:00~14:00	作業前安全ミーティング(TBM)	
	14:00~17:00	プラント監視装置(圧力/温度/レベル/流量)	
1/21(火)	09:00~10:00	作業前安全ミーティング(TBM)	KP テクノセンター
	10:00~11:00	銅管加工	
	11:00~12:00	端末処理	
	13:00~17:00	プラント監視装置校正(圧力/温度)	
1/22(水)	09:00~12:00	空気式制御弁(本体/アクチュエータ)	KP テクノセンター
	13:00~17:00	空気式制御弁(本体/アクチュエータ)（実習）	
1/23(木)	09:00~17:00	空気式制御弁(本体/アクチュエータ)（実習）	KP テクノセンター
1/24(金)	09:00~16:00	空気式制御弁(本体/アクチュエータ)（実習）	KP テクノセンター
	16:00~17:00	週間レビュー	
1/25(土)	-	日本文化体験	奈良
1/26(日)	-	休日	-
1/27(月)	09:00~11:00	PID 制御理論	KP テクノセンター
	11:00~17:00	最適制御(ステップ応答/限界感度)（実習）	
1/28(火)	09:00~12:00	最適制御(ステップ応答/限界感度)（実習）	KP テクノセンター
	13:00~17:00	品質体感訓練	
1/29(水)	09:00~12:00	事故災害未然防止	KP テクノセンター
	13:00~14:00	労働安全	
	14:00~16:00	安全体感訓練	
	16:00~17:00	週間レビュー	
1/30(木)	09:00~17:00	アクションプラン作成	JICA 関西

1/31(金)	09:00~12:00	アクションプラン作成	JICA 関西
	13:00~14:00	反省会	
	14:00~15:00	アクションプラン発表	
	15:00~16:00	評価会	
	16:00~16:30	閉講式	
	16:30~17:00	意見交換会	
2/1(土)	-	離日	-

(4)　第 4 回オンライン研修

第 4 回オンライン研修

インストラクター研修（2021 年 11 月 10 日、11 月 29 日～12 月 8 日）

日程	時間 (JST)	研修項目	研修場所
11/10(水)	14:00~16:00	Kick-off meeting 接続確認	関西電力本店 新川電機大阪支社 新川電機千葉営業所 Muzaffargarh TC
11/29(月)	14:00~14:10	開講式	関西電力本店 新川電機千葉営業所 Muzaffargarh TC
	14:10~15:00	コースオリエンテーション	
	15:00~16:00	開梱／員数確認	
	16:00~18:00	設置／接続	
	18:00~20:00	起動確認（１）	
11/30(火)	14:00~15:00	起動確認（２）	関西電力本店 新川電機千葉営業所 Muzaffargarh TC
	15:00~16:20	機能確認（ベアリング傷／ベアリング交換）	
	17:00~18:00	機能確認（ロータ飛散）	
	18:00~20:00	機能確認（アンバランス）	
12/1(水)	14:00~16:15	機能確認（トラブルシューティング）	関西電力茨木研修センター 新川電機千葉営業所 Muzaffargarh TC
	17:00~18:15	振動基礎（１）	
	18:15~20:30	アンバランス計算（影響効果法）	
12/2(木)	14:00~16:15	振動基礎（２）	関西電力茨木研修センター 新川電機千葉営業所 Muzaffargarh TC
	17:00~19:15	アンバランス計算（３点法）	
	19:15~20:15	今週のまとめ／復習	
12/3(金)	-	休日	-
12/4(土)	-	休日	-
12/5(日)	-	休日	-
12/6(月)	14:00~16:00	開梱／員数確認	関西電力茨木研修センター Muzaffargarh TC
	17:00~19:00	非破壊検査概要／ＰＴ講義	
	19:00~20:15	ＰＴ実習	
12/7(火)	14:00~15:00	ＭＴ講義	関西電力茨木研修センター Muzaffargarh TC
	15:00~16:00	ＭＴ実習	
	17:00~18:00	ＵＴ講義	
	18:00~20:15	ＵＴ実習	
12/8(水)	14:00~16:30	アクションプラン指導・作成	関西電力本店 Muzaffargarh TC
	17:00~20:00	研修デモンストレーション（振動・非破壊）	
	20:00~20:30	講評／修了報告	

添付資料 6-1-5

研修員作成アクションプラン

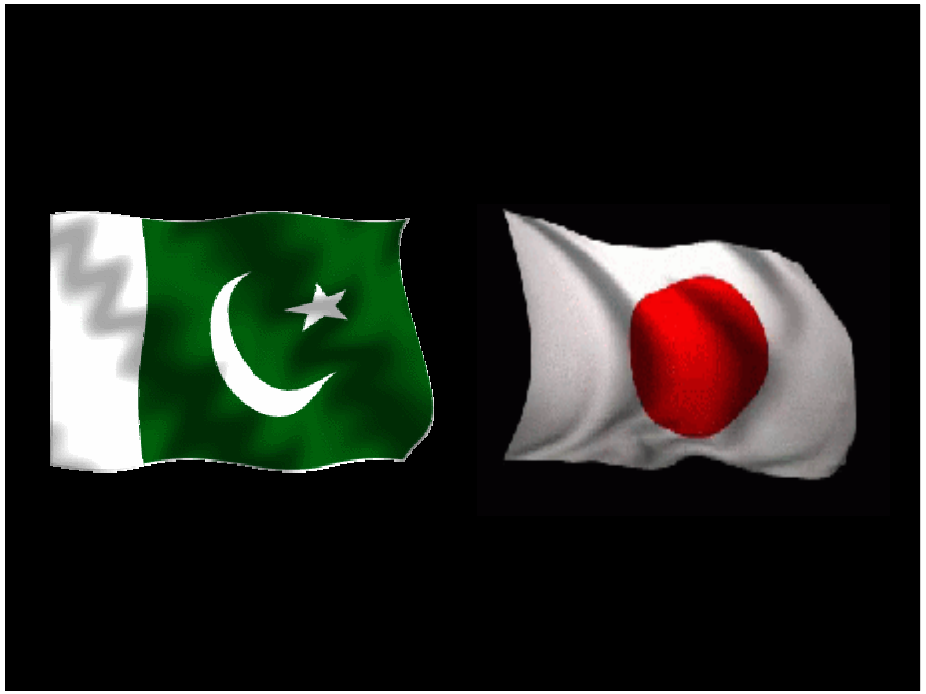
(1)　第 1 回本邦研修員作成のアクションプラン

IN THE NAME OF ALLAH, THE MOST BENEFICENT, THE MOST MERCIFUL

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



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.

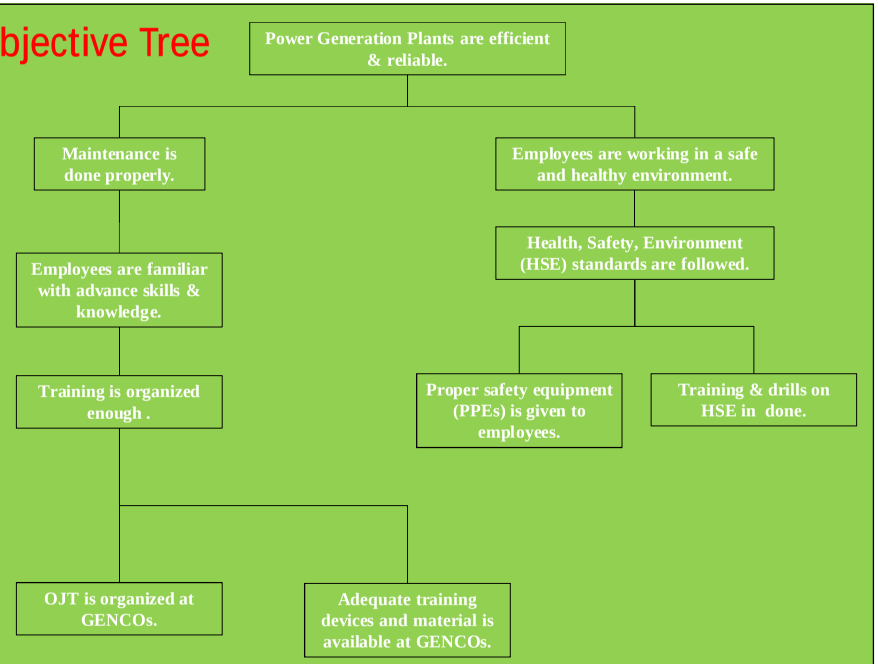
Problems Faced By Gencos

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)

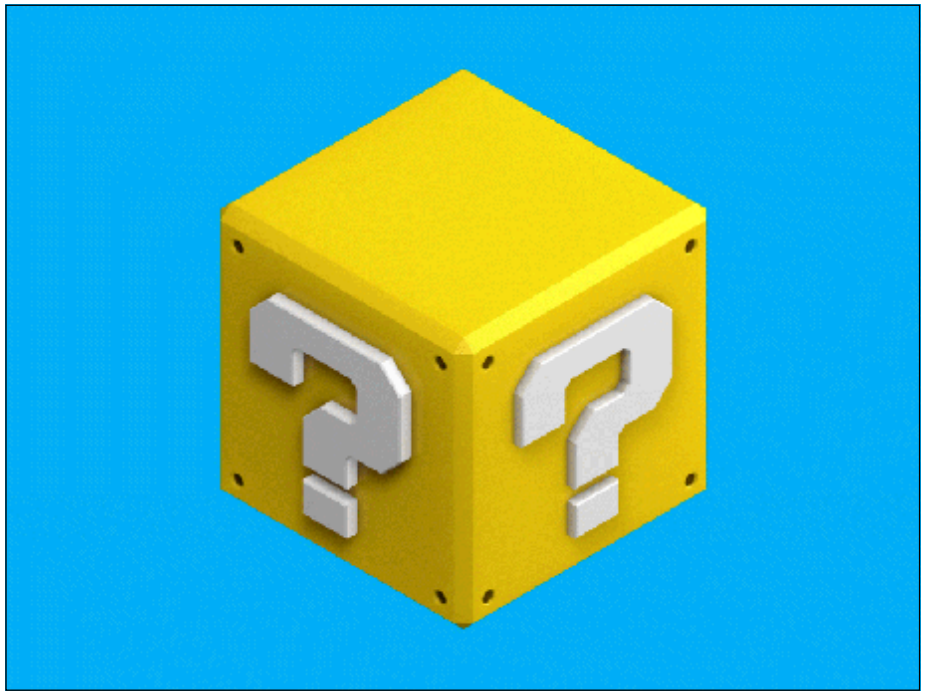
4. Laser Alignment of Rotary Equipment.

(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
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		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

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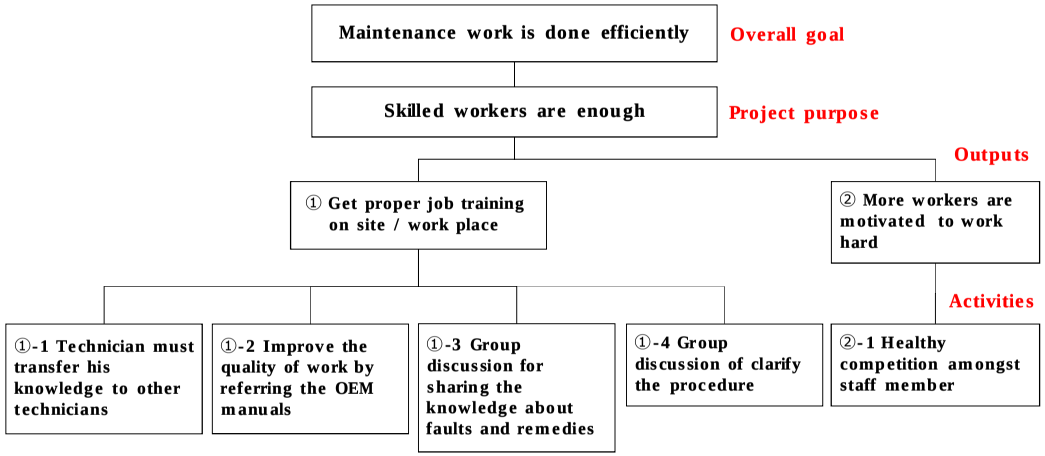

Detailed Plan of the Training

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
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9		Number of times																																					0
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		Number of trainees																																					0
15		Number of times																																					0
		Number of trainees																																					0

(2)　第 2 回本邦研修員作成のアクションプラン

Action Plan

Capacity Building & Strengthening of Thermal Power Generation Operation & Maintenance (Engineers) Pakistan

[Jan 06 – Feb 09, 2019]

独立行政法人 国際協力機構

Index

1. Framework of the Course
2. Issue Analysis
3. Making the Action Plan
4. Suggestions and Initiatives
5. Impressions Regarding JICA Training

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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.

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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

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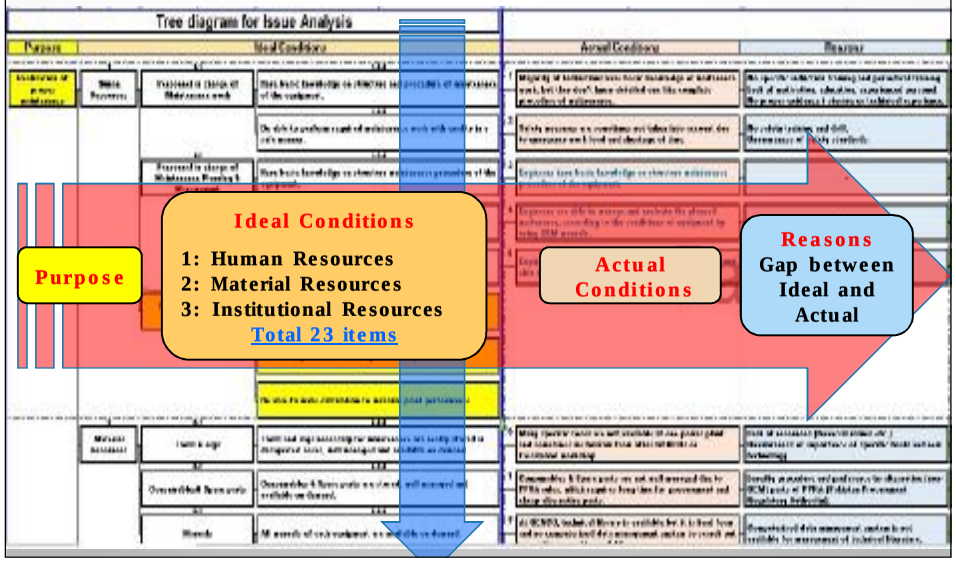
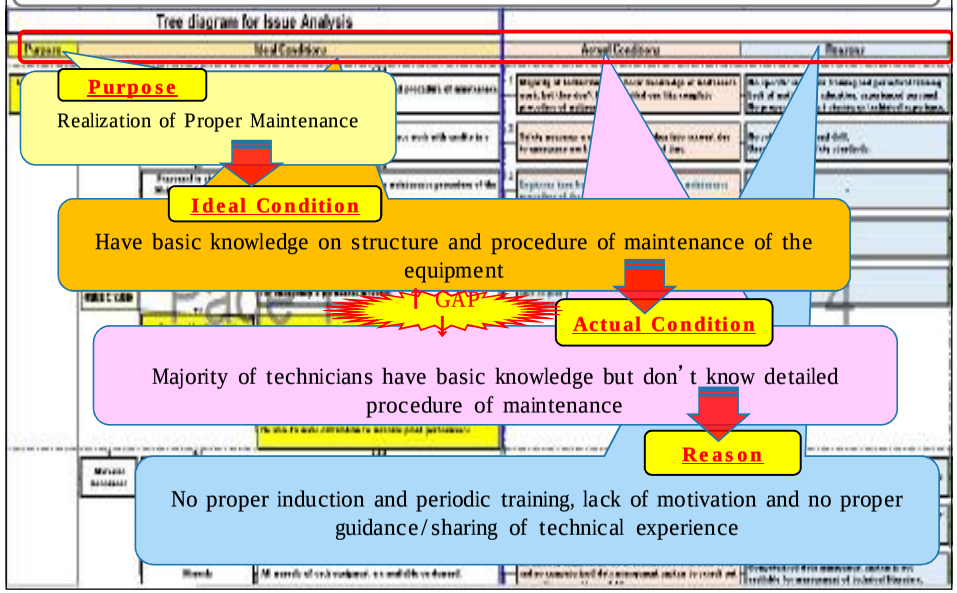
2. Issue Analysis (2/3)

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.

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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.

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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.

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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.

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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.

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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.

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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	Lectrure 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

2. Issue Analysis

3. Making the Action Plan

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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.

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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

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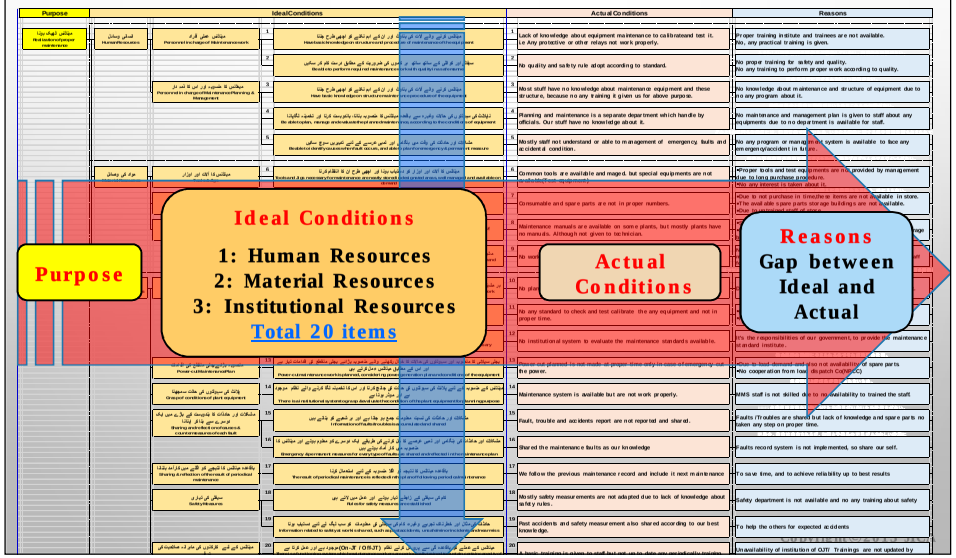
2. Issue Analysis (2/3)

We analyzed the Ideal Conditions, Actual Conditions and Reason of gap between ideal and actual condition.



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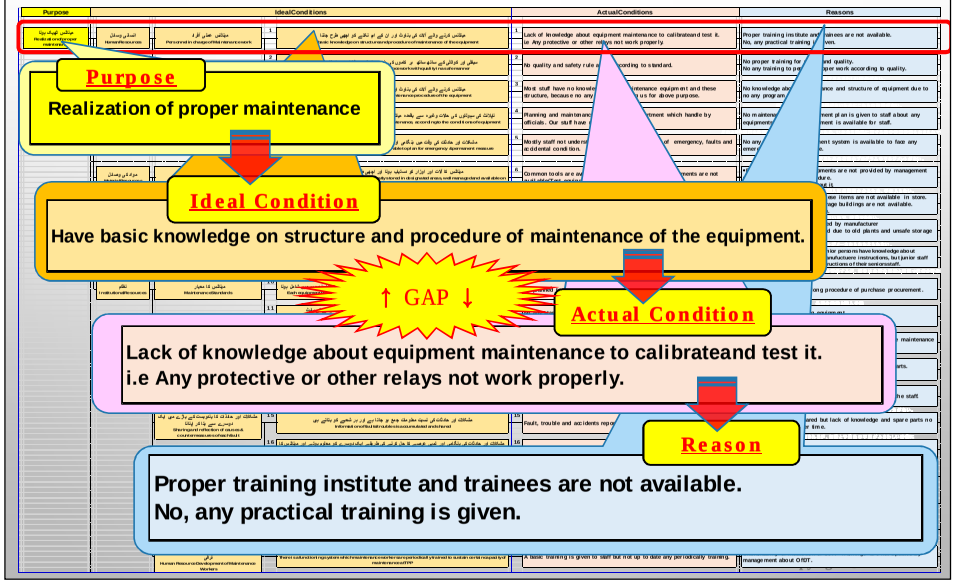

3. Making the Action Plan (1/3)

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

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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

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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

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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

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
																					Survey ▼													Survey ▼										
1	Basic & Advance study of Electrical Equipments	Strengthen & Builldup 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	Exprorential 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	Exprorential 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													
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										Result	No. of times																									
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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)　第 3 回本邦研修員作成のアクションプラン

Action Plan

Capacity Building & Strengthening
of Thermal Power Generation
Operation & Maintenance (Engineer)
Pakistan
[Jan.23 – Feb.15 2020]

独立行政法人 国際協力機構

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1. Framework of the Program

2. Issue Analysis

3. Making the Action Plan
   3-1. Training for technical staff on TPPs
   3-2. Activity on actual work
   3-3. Making the Action Plan Format

4. Suggestions and Initiatives

5. Impressions Regarding the JICA Training

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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.

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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.

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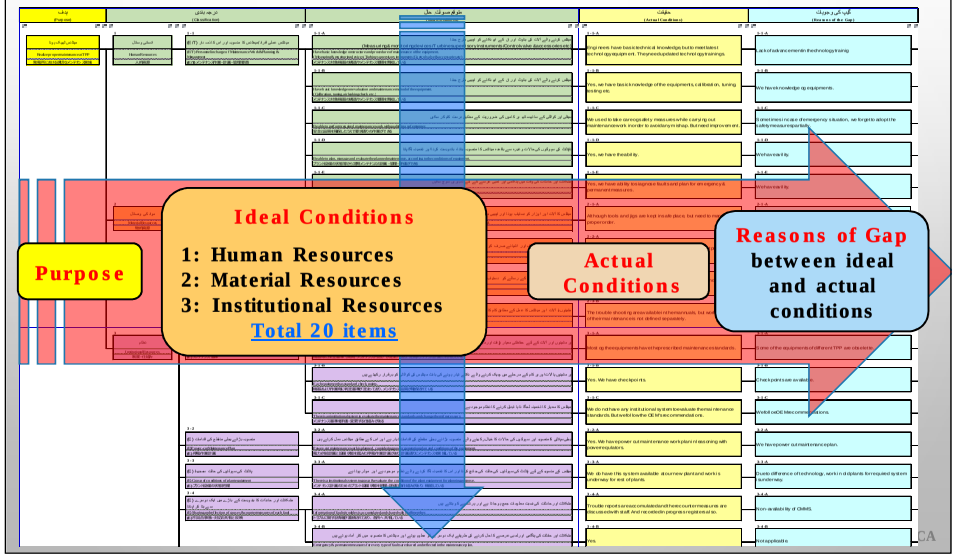
2. Issue Analysis (2/3)

We analyzed the Ideal Conditions, Actual Conditions and Reason of gap between ideal and actual condition.



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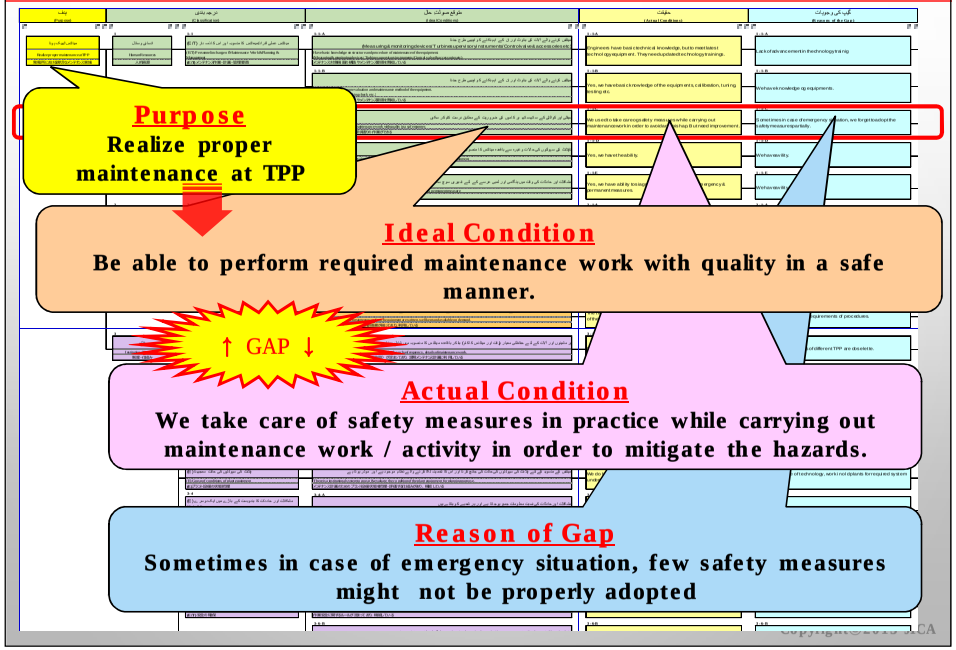

3. Making the Action Plan (/)

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

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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.

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3-1. Training for technical staff on TPPs (2/2)

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

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3-2. Activity on actual work

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.

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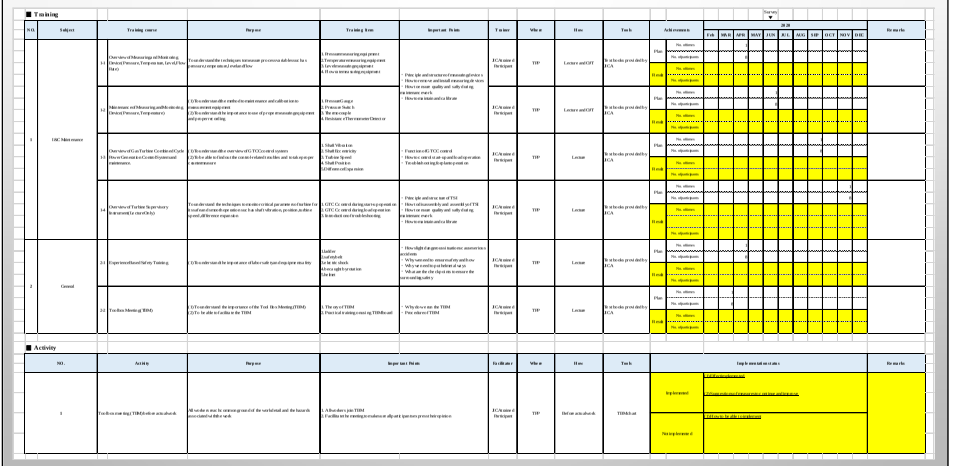
3-3. Making the Action Plan Format

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.



■ Training

NO.	Subject		Training course	Purpose	Training Item	Important Points	Trainer	Where	How	Tools	Achievement		Remarks
1	O&M Maintenance	1.1	Overview of Measuring and Monitoring (Vibration/Pressure/Temperature, Leak of flow Data etc)	To understand the techniques to measure process variables such as pressure, temperature and evaluate flow	1. Pressure measuring equipment 2. Temperature measuring equipment 3. Leak detection equipment 4. Flow rate measuring equipment	• Point, Spot and structure of measuring devices • How to remove and install measuring devices • How to ensure quality and safety during maintenance work • How to maintain and calibrate	JICA trainer & Participant	TPP	Lecture and OJT	Text books provided by JICA	Plan: No. attendees / No. objectives Do and Check: No. attendees / No. objectives	
		1.2	Measurement and Measuring and Monitoring (Vibration/Pressure/Temperature)	1. To understand the importance of proper measuring equipment and proper setting 2. To understand the importance of proper measuring equipment	1. Pressure Gauge 2. Pressure Switch 3. Thermocouple 4. Resistance Thermometer/Detector		JICA trainer & Participant	TPP	Lecture and OJT	Text books provided by JICA	Plan: No. attendees / No. objectives Do and Check: No. attendees / No. objectives	
		1.3	Overview of Gas Turbine Combustion Cycle and Overview of Generator Control system and maintenance	1. To understand overview of GT TCC control system 2. To be able to follow the control-related machine and work report in maintenance	1. Shaft Vibration 2. Shaft Eccentricity 3. Shaft Speed 4. Shaft Position 5. Differential Expansion	• Function of TCC control • How to start-up and shut-down • Overhaul and troubleshooting manual	JICA trainer & Participant	TPP	Lecture	Text books provided by JICA	Plan: No. attendees / No. objectives Do and Check: No. attendees / No. objectives	
		1.4	Overview of Turbine Supervisory Instrument (Overhaul)	To understand the techniques to monitor critical parameter of turbine for normal and abnormal operation such as shaft vibration, position, differential expansion etc.	1. GTC Control during start-up operation 2. GTC Control during load operation 3. Introduction of overhaul technology	• Point, Spot and structure of TSI • How to disassemble and assemble of TSI • How to ensure quality and safety during maintenance work • How to maintain and calibrate	JICA trainer & Participant	TPP	Lecture	Text books provided by JICA	Plan: No. attendees / No. objectives Do and Check: No. attendees / No. objectives	
2	General	2.1	Experience Based Safety Training	1. To be able to understand the importance of labor safety and design operation safety	1. Outline 2. Lead with safety 3. Job site check 4. Keep safety operation 5. Our task	• How to find out potential risks, measures to be taken and risks • Why be careful to ensure safety and flow • Why we need to put behavioral safety • What are the risks in our work and how to ensure the safe working safety	JICA trainer & Participant	TPP	Lecture	Text books provided by JICA	Plan: No. attendees / No. objectives Do and Check: No. attendees / No. objectives	
		2.2	Tool Box Meeting (TBM)	1. To understand the importance of the Tool Box Meeting (TBM) 2. To be able to facilitate the TBM	1. The style of TBM 2. Practical training on using TBM Board	• Why do we use the TBM • How to use TBM	JICA trainer & Participant	TPP	Lecture	Text books provided by JICA	Plan: No. attendees / No. objectives Do and Check: No. attendees / No. objectives	

■ Activity

NO.	Activity	Purpose	Important Points	Facilitator	Where	How	Tools	Implementation status	Remarks
1	Tool Box meeting (TBM) before actual work	1. To make it more by common ground of the work behind and the hazards associated with work 2. To understand the risks and	1. A Boss does join TBM 2. Facilitator let the meeting in a relaxed atmosphere and ask questions prior to beginning	JICA trainer & Participant	TPP	Define actual work	TBM checkset	Implemented: 1. Start of work (Implemented) 2. Meeting with Contractor (Contractor, site Engineer and Operator) Not implemented: 1. Will be ready for after installation	

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4. Suggestions and Initiatives

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.

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5. Impressions Regarding the JICA Training (1/2)

- **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.

- **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.

- **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.

- **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.

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5. Impressions Regarding the JICA Training (2/2)

- **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.

- **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.

- **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.

- **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.

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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 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		Feb	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Remarks
													2020											
(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					
												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 trainingi
> 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 R&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]

独立行政法人 国際協力機構

Index

1. Framework of the Program
2. Issue Analysis
3. Making the Action Plan
   3-1. Training for technical staff on TPPs
   3-2. Activity on actual work
   3-3. Making the Action Plan Format
4. Suggestions and Initiatives
5. Impressions Regarding the JICA Training

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1. Framework of the Course

Confirmation of the project framework

- Bilateral co-operation between the government of Pakistan & the government of Japan.
- Target Type of Power Generation: Conventional Type (Gas, Coal and Oil) and Gas Turbine Combined Cycle (GTCC)
- 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.

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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

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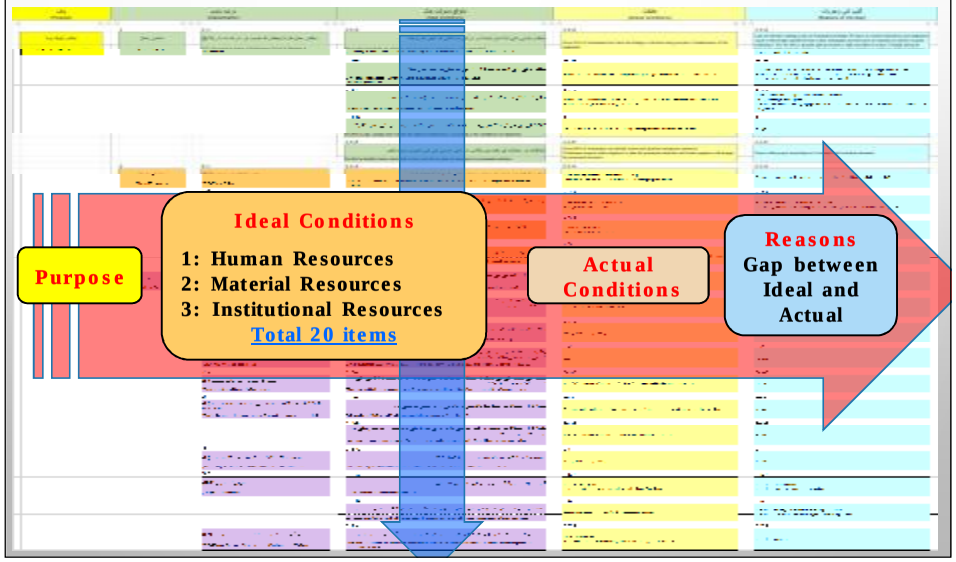
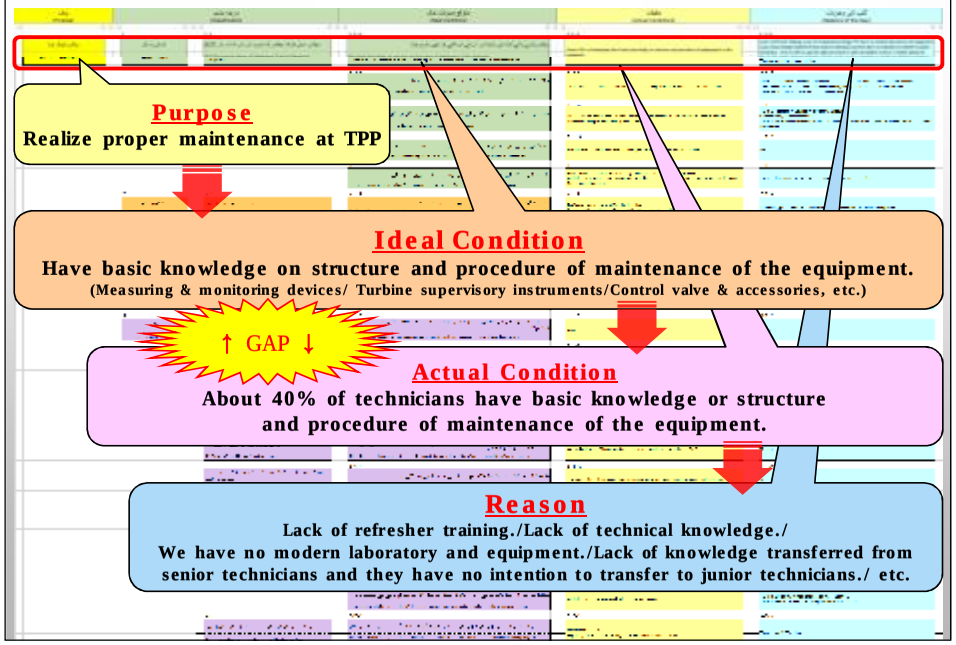
2. Issue Analysis (2/3)

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

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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.

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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.

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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.

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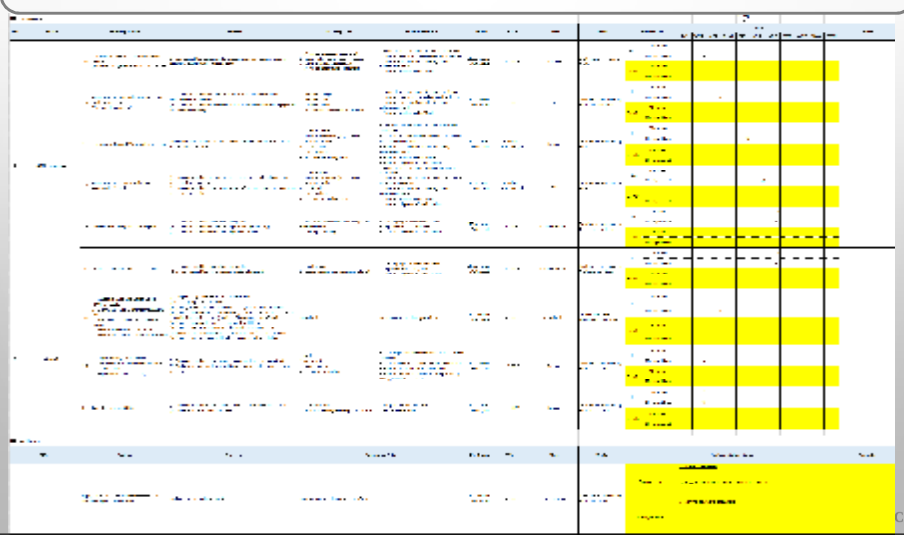
3-3. Making the Action Plan Format

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.



CA

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

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5. Impressions Regarding the JICA Training

- **Mr. Muhammad Zahid Akhtar**
  All of you gave me on unforgettable memories about your country and about your Japanese. Thanks JICA.
- **Mr. Muhammad Usman Khan**
  I have never experienced this kind of training before.
- **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.
- **Mr. Abdul Toheed**
  A tribute to JICA Management to complete so many programs on time.

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5. Impressions Regarding the JICA Training

- **Mr. Shahid Masood**
  JICA training is very useful for me. Thankful JICA.
- **Mr. Muhammad Ijaz**
  Thanks JICA to provide me a great opportunity to learn and see the great country Japan.
- **Mr. Asad Ullah**
  The JICA staff is punctual, devoted and committed with his duties.
- **Mr. Noor Hussain**
  Thank you JICA for arrange this kind of program for us and also all training teacher and kindly Mr. Kameyama thankful.

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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		Feb	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Remarks
													2020											
(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				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	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 Participant	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 Participant	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 Participant	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 Participant	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 Participant	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 meter, 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 B&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)　第 4 回オンライン研修員作成のアクションプラン

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	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	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	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	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															

添付資料 6-1-6

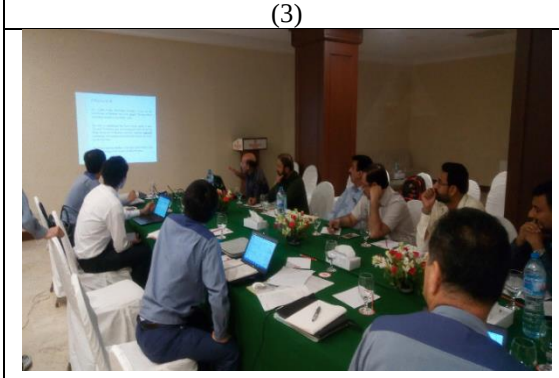
活動実績資料

(1)　活動状況写真

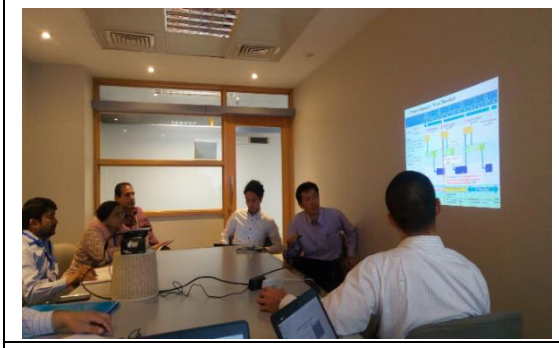
第 1 次現地業務（2017 年 11 月 12 日～11 月 25 日）	
キックオフミーティング(1)	キックオフミーティング(2)
WEA 訪問(1)	WEA 訪問(2)
Muzaffargarh 発電所訪問(1)	Muzaffargarh 発電所訪問(2)
Kot Addu 発電所訪問(1)	Kot Addu 発電所訪問(2)

第 1 次現地業務（2017 年 11 月 12 日～11 月 25 日）	
Jamshoro 発電所訪問(1)	Jamshoro 発電所訪問(2)
Lakhra 発電所訪問(1)	Lakhra 発電所訪問(2)
ラップアップミーティング(1)	ラップアップミーティング(2)
第 1 回 JCC(1)	第 1 回 JCC(2)

第 2 次現地業務（2018 年 9 月 2 日～9 月 15 日）	
キックオフミーティング	Nandipur 発電所訪問(1)
Nandipur 発電所訪問(2)	Nandipur 発電所訪問(3)
WEA 訪問(1)	WEA 訪問(2)
Faisalabad 発電所訪問(1)	Faisalabad 発電所訪問(2)

第 2 次現地業務（2018 年 9 月 2 日～9 月 15 日）	
Faisalabad 発電所訪問(3)	Faisalabad 発電所訪問(4)
Central Gas Turbine Maintenance Workshop 訪問(1)	Central Gas Turbine Maintenance Workshop 訪問(2)
Central Gas Turbine Maintenance Workshop 訪問(3)	Central Gas Turbine Maintenance Workshop 訪問(4)
	
Guddu 研修所とのミーティング	Muzaffargarh 発電所訪問(1)

第 2 次現地業務（2018 年 9 月 2 日～9 月 15 日）	
Muzaffargarh 発電所訪問(2)	Jamshoro 発電所訪問
Kotri 発電所訪問(1)	Kotri 発電所訪問(2)
Kotri 発電所訪問(3)	Kotri 発電所訪問(4)
WAPDA Staff College 訪問(1)	WAPDA Staff College 訪問(2)

第 2 次現地業務（2018 年 9 月 2 日～9 月 15 日）	
	
ラップアップミーティング	第 2 回 JCC(1)
第 2 回 JCC(2)	

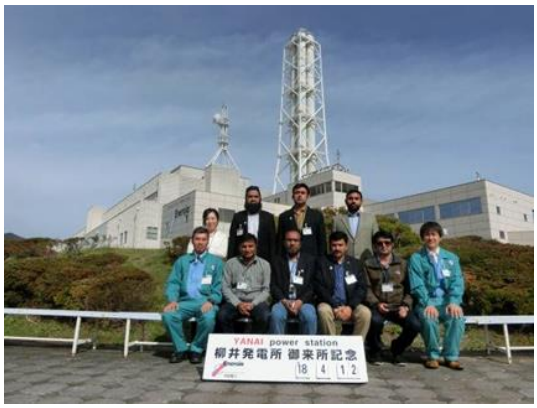
第 3 次現地業務（2019 年 9 月 30 日～10 月 12 日）	
キックオフミーティング	Muzaffargarh 発電所訪問(1)
Muzaffargarh 発電所訪問(2)	Muzaffargarh 発電所訪問(3)
Muzaffargarh 発電所訪問(4)	Muzaffargarh 発電所訪問(5)
Muzaffargarh 研修所訪問	

第 3 次現地業務（2019 年 9 月 30 日～10 月 12 日）	
Guddu 発電所訪問(1)	Guddu 発電所訪問(2)
Guddu 発電所訪問(3)	Guddu 発電所訪問(4)
Guddu 発電所訪問(5)	Guddu 発電所訪問(6)
Guddu 発電所訪問(7)	Guddu 研修所訪問(1)

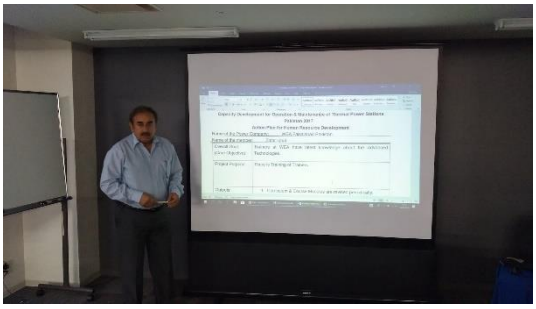
第 3 次現地業務（2019 年 9 月 30 日～10 月 12 日）	
Guddu 研修所訪問(2)	Guddu 研修所訪問(3)
Guddu 研修所訪問(4)	Guddu 研修所訪問(5)
Guddu 研修所訪問(6)	Guddu 研修所訪問(7)
Jamshoro 発電所訪問(1)	Jamshoro 発電所訪問(2)

第 3 次現地業務（2019 年 9 月 30 日～10 月 12 日）	
Jamshoro 発電所訪問(3)	Jamshoro 発電所訪問(4)
Jamshoro 発電所訪問(5)	ラップアップミーティング
第 3 回 JCC(1)	第 3 回 JCC(2)

第 1 回本邦研修（エンジニア：2018 年 3 月 21 日～4 月 27 日）	
開講式	コースオリエンテーション
アクションプラン研修（PCM）	TQM 研修
人材育成研修(1)	人材育成研修(2)
振動基礎研修(1)	振動基礎研修(2)

第 1 回本邦研修（エンジニア：2018 年 3 月 21 日～4 月 27 日）	
非破壊検査研修(1)	非破壊検査研修(2)
	
余寿命診断研修	発電所見学（柳井発電所）
工場見学（MHPS）	アクションプラン作成
アクションプラン発表	閉講式

第 1 回本邦研修（テクニシャン：2018 年 3 月 4 日～3 月 24 日）	
アクションプラン研修（PCM）(1)	アクションプラン研修（PCM）(2)
非破壊検査	モータ分解点検
品質体感訓練	発電所見学（姫路第二発電所）
工場見学（MHPS）	閉講式

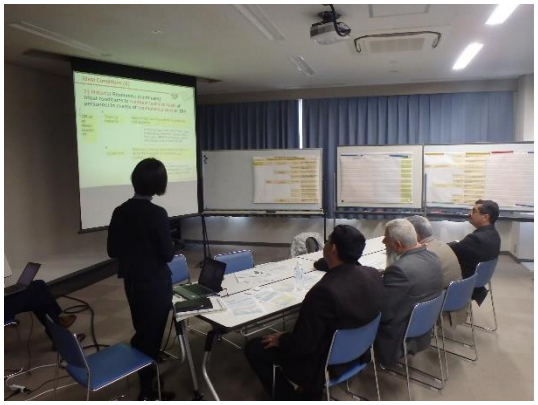
第 1 回本邦研修（マネジメント：2018 年 3 月 14 日～3 月 24 日）	
アクションプラン研修（PCM）(1)	アクションプラン研修（PCM）(2)
本邦研修見学（テクニシャン）	工場見学（MHPS）
	
アクションプラン作成	アクションプラン発表
閉講式	

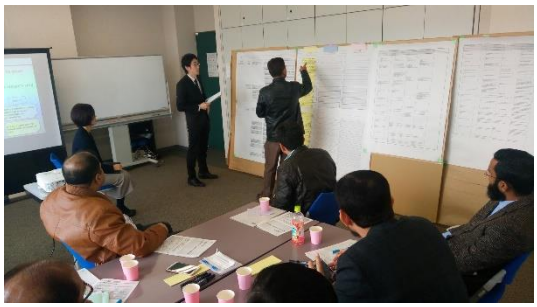
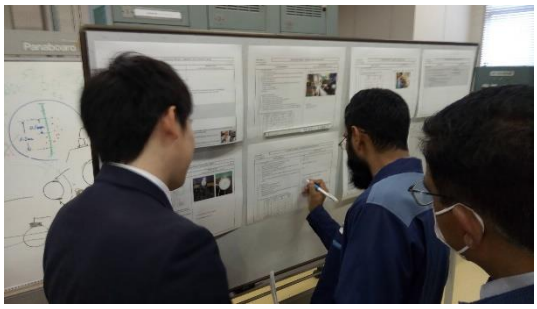
第 2 回本邦研修（エンジニア：2019 年 1 月 6 日～2 月 9 日）	
アクションプラン研修（Issue Analysis）	電気リレー研修
発電機研修	非破壊検査研修
振動基礎研修	発電所見学（姫路第二発電所）
発電所見学（舞鶴発電所）	工場見学（三菱電機）

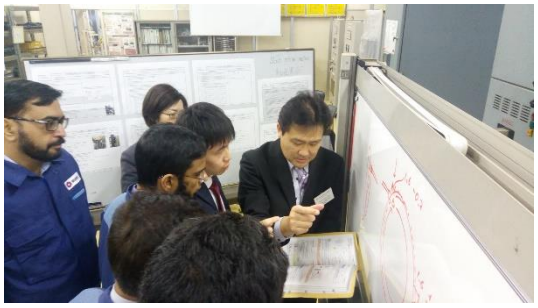
第 2 回本邦研修（エンジニア：2019 年 1 月 6 日～2 月 9 日）	
工場見学（日本電研）	工場見学（MHPS）
安全体感訓練(1)	安全体感訓練(2)
アクションプラン発表	閉講式

第 2 回本邦研修（テクニシャン：2019 年 1 月 6 日～1 月 26 日）	
アクションプラン研修（Issue Analysis）	RMC 見学
電気リレー研修	発電所見学（舞鶴発電所）
Action Plan 作成	Action Plan 発表
閉講式	

第 2 回本邦研修（マネジメント：2019 年 2 月 3 日～2 月 9 日）	
アクションプラン研修（Issue Analysis）	研修資機材見学（NDI）
研修資機材見学（振動モデルロータ）	研修資機材見学（運転シミュレータ）
本邦研修見学（安全体感訓練）	発電所見学（南港発電所）
発電所見学（堺港発電所）	発電所見学（堺 LNG 基地）

第 2 回本邦研修（マネジメント：2019 年 2 月 3 日～2 月 9 日）	
	
アクションプラン作成(1)	アクションプラン作成(2)
アクションプラン発表	閉講式

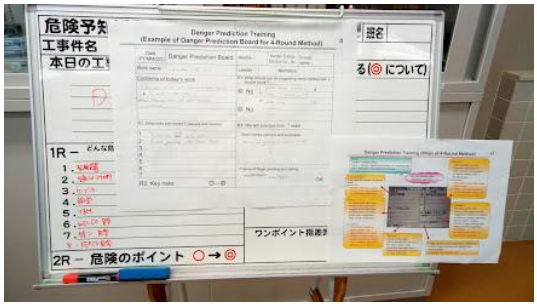
第 3 回本邦研修（エンジニア：2020 年 1 月 23 日～2 月 15 日）	
コースオリエンテーション	Job Report 発表
	
アクションプラン研修（Issue Analysis）(1)	アクションプラン研修（Issue Analysis）(2)
TSI 研修(1)	TSI 研修(2)
	
TSI 研修(3)	TSI 研修(4)

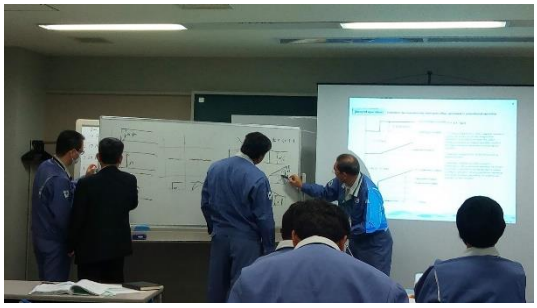
第 3 回本邦研修（エンジニア：2020 年 1 月 23 日～2 月 15 日）	
	
TSI 研修(5)	TBM 研修(1)
TBM 研修(2)	安全体感訓練(1)
安全体感訓練(2)	プラント監視計器研修(1)
プラント視計器研修(2)	制御弁研修(1)

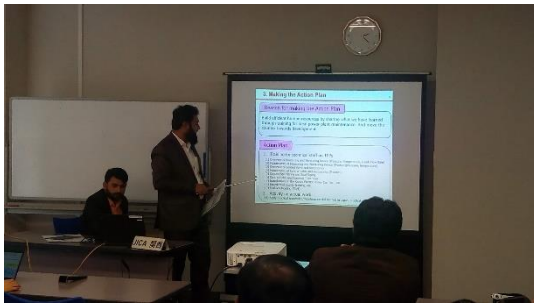
第 3 回本邦研修（エンジニア：2020 年 1 月 23 日～2 月 15 日）	
制御弁研修(2)	PID 制御研修(1)
PID 制御研修(2)	異常探索研修(1)
異常探索研修(2)	研修所見学（KP テクノセンター）
発電所見学（姫路第二発電所）(1)	発電所見学（姫路第二発電所）(2)

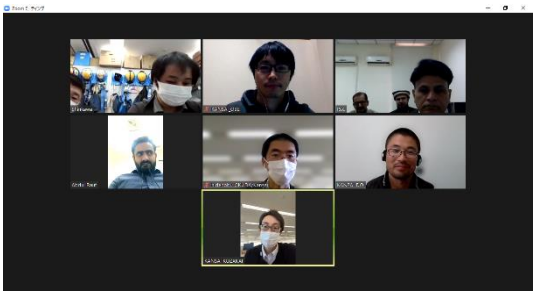
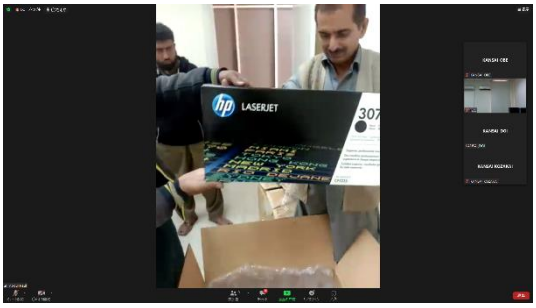
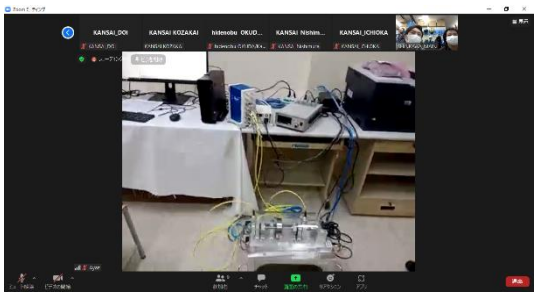
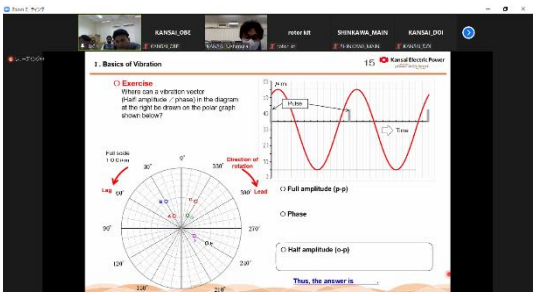
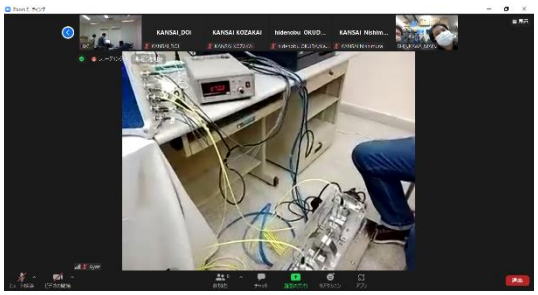
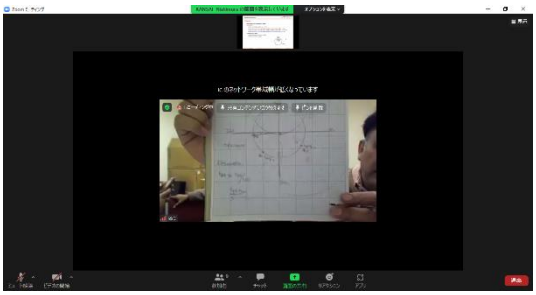
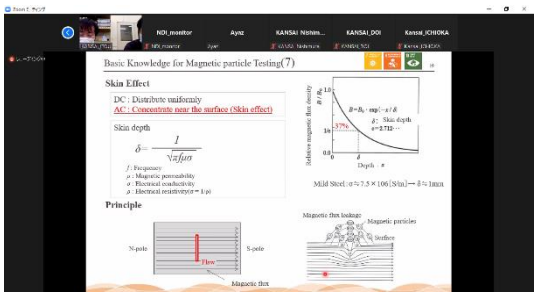
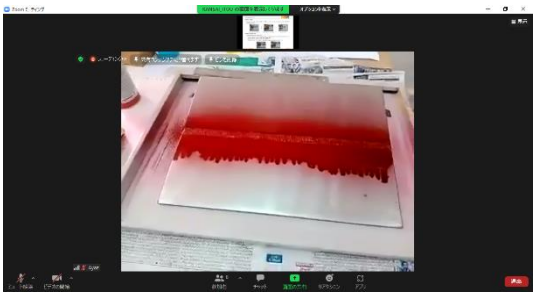
第 3 回本邦研修（エンジニア：2020 年 1 月 23 日～2 月 15 日）	
発電所見学（姫路第二発電所）(3)	発電所見学（姫路第二発電所）(4)
工場見学（島津製作所）	週間レビュー
アクションプラン作成(1)	アクションプラン作成(2)
アクションプラン発表	閉講式

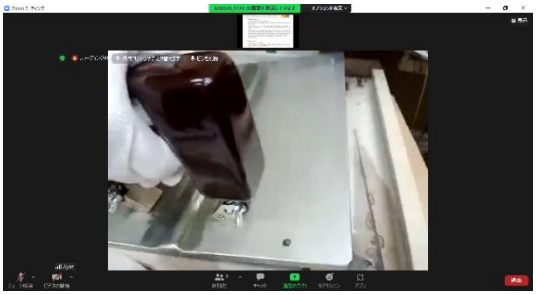
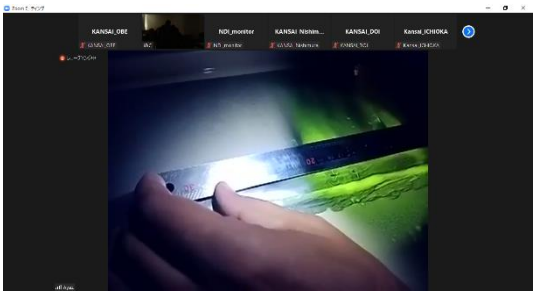
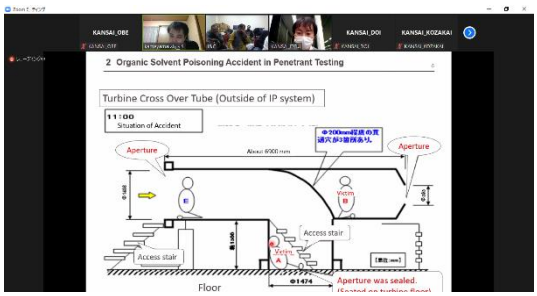
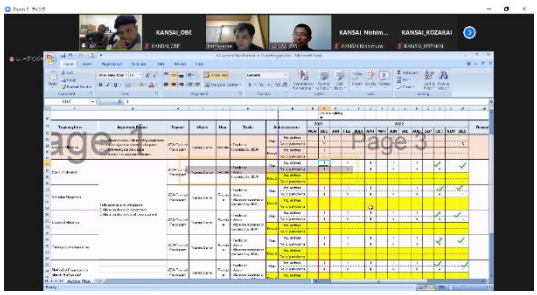
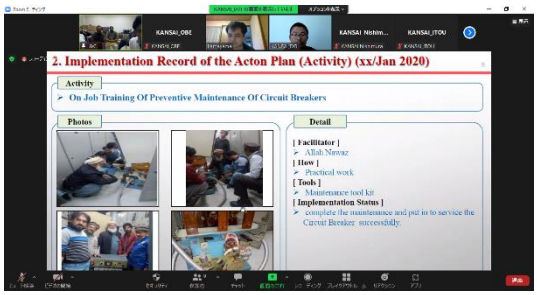
第 3 回本邦研修（テクニシャン：2020 年 1 月 13 日～2 月 1 日）	
コースオリエンテーション	Job Report 発表
アクションプラン研修（Issue Analysis）(1)	アクションプラン研修（Issue Analysis）(2)
プラント監視計器研修(1)	プラント監視計器研修(2)
ケーブル端末処理研修	電磁弁研修

第 3 回本邦研修（テクニシャン：2020 年 1 月 13 日～2 月 1 日）	
	
TBM 研修(1)	TBM 研修(2)
制御弁研修(1)	制御弁研修(2)
PID 制御研修(1)	PID 制御研修(2)
PID 制御研修(3)	品質体感訓練

第 3 回本邦研修（テクニシャン：2020 年 1 月 13 日～2 月 1 日）	
	
理解度確認テスト(1)	理解度確認テスト(2)
発電所見学（姫路第二発電所）(1)	発電所見学（姫路第二発電所）(2)
RMC 見学	工場見学（三菱電機）
アクションプラン作成(1)	アクションプラン作成(2)

第 3 回本邦研修（テクニシャン：2020 年 1 月 13 日～2 月 1 日）	
	
アクションプラン発表(1)	アクションプラン発表(2)
閉講式	

第 4 回オンライン研修（インストラクター：2021 年 11 月 29 日～12 月 8 日）	
	
開講式・関係者挨拶	研修資機材開梱
	
研修資機材設置	振動研修（理論）
	
振動研修（実習）(1)	振動研修（実習）(2)
	
非破壊検査研修（理論）	非破壊検査研修（実習）(1)

第 4 回オンライン研修（インストラクター：2021 年 11 月 29 日～12 月 8 日）	
	
非破壊検査研修（実習）(2)	非破壊検査研修（実習）(3)
	
非破壊検査研修（実習）(4)	非破壊検査における人身災害研修
	
アクションプラン作成	アクションプラン報告レポート紹介
研修員による AP デモンストレーション	閉講式

(2)　現地活動記録

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).

Sqn.

Capacity Building and Strengthening of Thermal Power Generation
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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 Khan	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 MMS	NPGCL M/Garh	
SHAHBAZ-ULLAH	Addl: Sys Engineer	NPGCL M/Garh	
Muhammad Muddassir	Assistant Manager Maintenance	NPGCL M/G	
Ali Asghar	CEO	NPGCL	
Ali Jafar Jafa	DD (Technical)	NPGCL	

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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	NPGCL	

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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)

Capacity Building and Strengthening of Thermal Power Generation
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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	[illegible]
Abdul Wajid	Performance Engineer	KAPCO	[illegible]
M. Arshad saqib	PE Performance	KAPCO	[illegible]

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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
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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. Qadri	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)	
Haruaki Furukawa	Electric Engineer	JICA (kansai)	古川晴章
Yuki OBE	I&C Engineer	ditto	Y. OBE

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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.

Capacity Building and Strengthening of Thermal Power Generation
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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	森 淳希
Hiroki Hirahata	General Manager	JICA (Kansai)	平畑 弘樹
Toru Kanai	Manager.	JICA (Kansai)	河合 徹

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meeting title: Lakhra 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)	大部祐貴

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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	
Naveed Afnan	Nandipur.	Plant Manager	
Umair Ahmed	NPGCL	Asst. Manager	
Yuki Obe	Kansai	C&I Eng.	大部祐貴
Shigeru Yoshitake	Kansai	Mech. eng	吉竹茂
Haruaki Furukawa	Kansai	Electric Engineer	古川晴彦
Yoshihiro Doi	Kansai	Mech Mgr	
Hiroki Hirahata	Kansai	General Manager	平畑弘樹
Junki Mori	JICA	Assistant Deputy Director	森淳希

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: 4 th / 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. Mahboob Farid	WAPDA	Deputy Director	
Abdur Rauf	WAPDA	Principal.	
Zafar Iqbal	LCCA.	Addl DG	
RIFFAT Qureshi	WAPDA	GM Training	
Junki Mori	JICA	Assistant Deputy Director	
Hiroki Nishita	Kansai	General Manager	
Yoshihiro Doi	Kansai	Mech. Mtg.	Yoshi Doi
Haruaki Furukawa	Kansai	Electric Engineer	古川晴亮
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
Amjad Nisar	GTPS Genco-III	Addl. Plant Manager	
Munir Bhatti	Central Maintenance Workshop Fsd	Addl. Director	
Rizwan Bhatti	GTPS GENCO-III	Asst: ENGR. (T&C)	
Muhammad Arshad	SPS Genco-III	AREC(M)	
Muhammad Jafar	GHCL	Addl. Director	
Ab: Kareem Memon	AREO 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	森淳希
Hiroki Hirahata	Kansai	General Manager	平畑弘樹
Yoshihiro Doi	Kansai	Mech. Mgr	
Haruaki Furukawa	Kansai	Electrical Engineer	古川晴彦
Shigeru Yoshizaki	Kansai	Mech eng	吉竹茂
Yuki Obe	Kansai	C&I Eng	大部祐貴

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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 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
SOHAIB AZIZ	GENCO II	Deputy Manager	
Asif Hasan Khan	GENCO II	Assistant Manager	
Muhammad Jafar	GHCL	Addl. Director	
Maf Saad Ahmad	CPGCL	Ad. Director	
Fakhar ud din	CPGCL	Asst. Director	
Muhammad Moosa	CPGCL	Foreman Mech:	
Hiroki Hirahata	Kansai	General Manager	平畑 弘樹
Jinki Mori	JICA	Deputy Assistant Director	森 仁希
Yoshihiro Doi	Kansai	Mech. Mgr	Yoshi Doi
Yuki Obe	Kansai	C&I Eng	大部 祐貴
Harunaki Furukawa	Kansai	Electric Engineer	古川 晴亮
Shigeru Yoshitake	Kansai	Mech. eng	吉竹 茂

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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 Ahmad	NPGCL-GENCO-III	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
Shigeru 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 Dou	Kansai	Mech. Mgr	Yoshi Dou
Junki Mori	JICA	Deputy Assistant Director	森 淳貴

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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 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	Nadeem.
NAZEER AHMED	JPCL, GTPS, Kotri	Senior Engineer (Mechanical)	
Abdullah	CPGCL, Gaddu	Senior Engineer (Mechanical)	
MUHIB-ALI-RAISER.	JPCL-GENCO-I	Add. Senior Mechanical	
Syed Munee	JPCL, Genco-I	Deputy Director (MIS)	
M. Asjam Memon	JPCL, Genco-1	Plant Manager GTPS Kotri	
Muhammad Jafar	GHCL	Addl. Director	
G. 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.	大部祐貴
Shigeru Yoshitake	Kansai	Mech. eng	吉竹茂
Harunaki Furukawa	Kansai	Electric Engineer	古川晴亮
Yoshihiro Doi	Kansai	Mech Mgr	Yoshi Doi
Hiroki Hirakata	Kansai	General Manager	平田弘樹

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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	Saboosh uz Zaman	CEO	GENCO-III	
3	Hioki 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	Yoshi Doi
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 Trang	GENCO-II	
2	Muhammad Jafer	Addl. Div	GHCL	
3	IMRAN AHMAD	SR. PROGRAMME MANAGER	JICA	
4	Ahmed Ali Burio	Co ordinator JICA + AM Mgr (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-ILCHI	Dy: Manager	GENCO II	
9	Asif Hasan Khan.	Addl Dy Manager.	GENCO-II	
10	Muhammad Moosa	Mech: Fom	GENCO: II Guddu	

FP @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	Muhammad Saleem	IT Expert	CPGCL	
21	Hiroki Hirahata	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	大部祐貴

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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 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 (JPCL)	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	

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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	Hirahata Hiroki	General Manager	Kansai Electric	平田弘樹
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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添付資料 6-1-7

成果品一覧

成果品一覧

(1) 報告書

No.	報　告　書　名	提出時期
1	ワークプラン	2018 年 6 月
2	ベースライン調査報告書	2018 年 8 月
3	業務進捗報告書（第 1 回）	2018 年 9 月
4	業務進捗報告書（第 2 回）	2019 年 10 月
5	業務進捗報告書（第 3 回）	2021 年 3 月
6	事業モニタリングシート Ver.1	2018 年 9 月
7	事業モニタリングシート Ver.2	2019 年 3 月
8	事業モニタリングシート Ver.3	2019 年 10 月
9	事業モニタリングシート Ver.4	2020 年 4 月
10	事業モニタリングシート Ver.5	2020 年 12 月
11	事業モニタリングシート Ver.6	2022 年 2 月
12	業務完了報告書	2022 年 2 月

(2) その他成果品

No.	成　果　品　名	提出時期
1	第 1 回本邦研修（エンジニア・テクニシャン・マネジメント）のカリキュラム、研修テキスト	2018 年 3 月
2	第 2 回本邦研修（エンジニア・テクニシャン・マネジメント）のシラバス、カリキュラム、研修テキスト	2019 年 2 月
3	第 3 回本邦研修（エンジニア・テクニシャン）のシラバス、カリキュラム、研修テキスト	2020 年 1 月
4	第 4 回オンライン研修（インストラクター）のシラバス、カリキュラム、研修テキスト	2021 年 11 月

添付資料 6-1-8

供与機材リスト

供与機材リスト

(1) 非破壊検査キット(Muzaffargarh/Guddu Training Center 向け)

Item No.	名　称	メーカ・型式	員　数	
			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) 振動モデルロータキット(Muzaffargarh Training Center 向け)

Item No.	名　称	メーカ・型式	員　数
			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.	名　称	メーカ・型式	員　数
			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: Munib Ahmad

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

This is to confirm and certify that we have received the Product as below in satisfactory quality.

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15	Ordinary black magnetic particle liquid for magnetic particle inspection	18 Sets
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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

添付資料 6-1-9

事業モニタリングシート Ver.6 更新版

・**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)

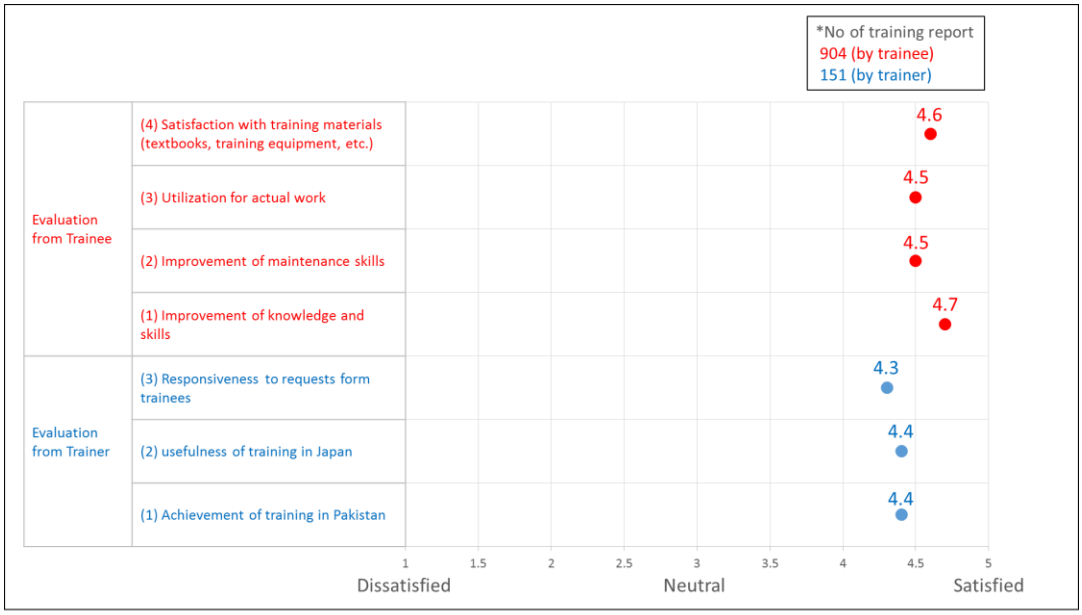

Chart 1-1: Evaluation of Training provided by JICA trained participants (based on report surveys)

- [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.

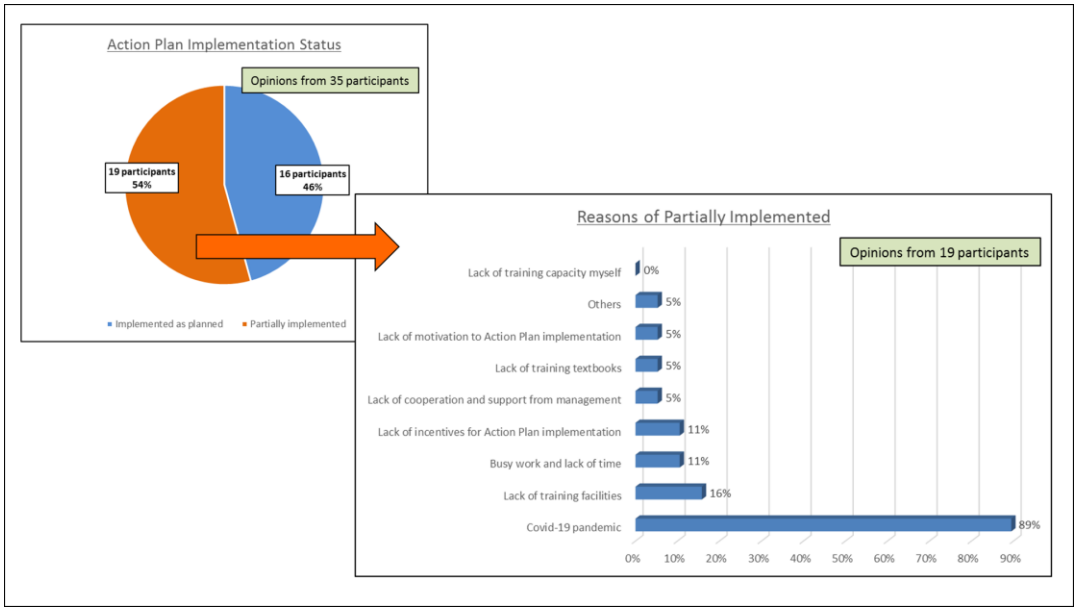

Chart 1-2: Action Plan Implementation Status (based on report surveys)

- ✓ 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

Period of Project: October, 2017 - March, 2022

Project Site: ~~WEA and~~ GENCOs' thermal power stations

Version No. 6

Dated: 17th February, 2022

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	# # #	1 2 3	4 5 6	7 8 9	# # #	1 2 3	4 5 6	7 8 9	# # #	1 2 3	4 5 6	7 8 9	# # #	1 2 3	4 5 6	7 8 9	# # #	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	Plan	2017		2018				2019				2020				2021				2022		Responsible Organization		Achievements	Issue & Countermeasures
Sub-Activities	Actual	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				
	Plan			
	Actual			

Monitoring Plan		2017		2018				2019				2020				2021				2022		Remarks	Issue	Solution
		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																					Due to the extension of the project period, Project Completion Report was submitted in February 2022.		
	Actual																							
Public Relations																								
	Plan																							
	Actual																							
	Plan																							
	Actual																							

バングラデシュ国 添付資料

添付 6-2-1　　討議議事録(R/D)及び会議議事録

(1) 討議議事録(R/D)

(2) R/D 修正に係る議事録

添付 6-2-2　　短期専門家派遣実績

添付 6-2-3 JCC 議事録

(1) 第 1 回 JCC

(2) 合同 TV 会議

(3) 第 2 回 JCC

(4) 第 3 回 JCC

(5) 第 4 回 JCC

添付 6-2-4　　研修実績

(1) 第 1 回本邦研修

(2) 第 2 回本邦研修

(3) 第 3 回本邦研修

(4) 第 4 回オンライン研修

添付 6-2-5　　研修員作成アクションプラン

(1) 第 1 回本邦研修員作成のアクションプラン

(2) 第 2 回本邦研修員作成のアクションプラン

(3) 第 3 回本邦研修員作成のアクションプラン

(4) 第 4 回オンライン研修員作成のアクションプラン

添付 6-2-6　　活動実績資料

(1) 活動状況写真

(2) 現地活動記録

添付 6-2-7　　成果品リスト

添付 6-2-8　　事業モニタリングシート Ver.7 更新版

添付資料 6-2-1

討議議事録（R/D）及び会議議事録

(1)　討議議事録（R/D）

RECORD OF DISCUSSIONS

FOR

THE PROJECT FOR CAPACITY DEVELOPMENT FOR OPERATION AND MAINTENANCE OF THERMAL POWER STATIONS

AGREED UPON BETWEEN

MINISTRY OF POWER, ENERGY AND MINERAL RESOURCES

OF

THE PEOPLE'S REPUBLIC OF BANGLADESH

AND

JAPAN INTERNATIONAL COOPERATION AGENCY

Dated October 11th, 2017

For

JAPAN INTERNATIONAL COOPERATION AGENCY

Mr. Taku Yamabe
Senior Representative
JICA Bangladesh Office

For

GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH

Mr. Rahmat Ullah Mohd. Dastagir, ndc
Additional Secretary
(Planning and Renewable Energy)
Power Division
Ministry of Power, Energy, and Mineral Resources

Based on the discussion under the Detailed Planning Mission for the the Project for Capacity Development for Operation and Maintenance of Thermal Power Stations (hereinafter referred to as "the Project") between Power Division, Ministry of Power, Energy and Mineral Resources of Bangladesh (hereinafter referred to as "the Counterpart") and the Japan International Cooperation Agency (hereinafter referred to as "JICA"), JICA held a series of discussions with the Counterpart and relevant organizations to develop a detailed plan of the Project.

The purpose of this record of discussions (hereinafter referred to as "the R/D") is to establish a mutual agreement for its implementation by both parties and to agree on the detailed plan of the Project as described in the followings and the Annexes, which will be implemented within the framework of the Agreement on Technical Cooperation signed on December 8th, 2002 (hereinafter referred to as "the Agreement") and the Note Verbales exchanged on June 27th, 2016 between the Government of Japan and the Government of Bangladesh.

The Counterpart 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 Bangladesh.

Both parties also agreed that the Project will be implemented in accordance with the "Basic Principles for Technical Cooperation" published in December 2016 (hereinafter referred to as "the BP"), unless other arrangements are agreed in the R/D.

The R/D is delivered at Dhaka as of the day and year above written. The R/D may be amended by a minutes of meetings between both parties, except the plan of operation to be modified in monitoring sheets. The minutes of meetings will be signed by authorized persons of each side who may be different from the signers of the R/D.

Annex 1 Main Points Discussed
Annex 2 Project Design Matrix (PDM)
Annex 3 Plan of Operation (PO)
Annex 4 List of Proposed Members of Joint Coordinating Committee

Annex 1

MAIN POINTS DISCUSSED

1. Purpose of the Project

The purpose of the Project is to improve the capacity of operation and maintenance of thermal power plants through strengthening the training capacity of operation and maintenance engineers in charge of thermal power stations.

2. SCOPE OF THE PROJECT

2-1 Main subject of the Project is capacity development of operation and maintenance (hereinafter referred to as "O&M") of thermal power generation especially on Gas Turbine and Combined Cycle (hereinafter referred to as "GTCC") and Reciprocating Engine (hereinafter referred to as "RE") power generation. Lecture on general introduction regarding coal-fired power generation including advanced environmental practices in Japan will be also considered.

2-2 The training course in Japan is the main component of the Project. 20 to 30 trainees per year and 60 to 80 trainees in 3 years are tentatively planned to be invited.

2-3 The target group of the Project is O&M engineers who will be the core instructors to conduct trainings in each thermal power station and/or Training Centers under public utilities. The Counterpart will nominate appropriate candidates for instructors to be trained in Japan based on the criteria to be prepared by the JICA experts.

2-4 JICA experts will conduct preparation study and follow up activities for implementing action plan for knowledge dissemination in Bangladesh.

3. IMPLEMENTING AGENCY OF THE PROJECT

3-1 The following organizations are the implementing agencies of the Project. Power Division, Ministry of Power, Energy and Mineral Resources will supervise the whole activities of the Project and will coordinate among the agencies towards the achievement of the project purpose..

- Power Division, Ministry of Power, Energy and Mineral Resources
- Bangladesh Power Development Board (BPDB)
- Electricity Generation Company of Bangladesh (EGCB)
- North West Power Generation Company Limited (NWPGCL)
- Ashganji Power Station Company Limited (APSCL)
- Coal Power Generation Company of Bangladesh Limited (CPGCBL).

3-2 The Project Director, Project Managers will be assigned from the implementing agencies as listed in the members of Joint Coordinating Committee as shown in Annex 4.

3-3 Project Managers will jointly manage and coordinate the project activities in collaboration with JICA expert. The Project director will supervise the whole activities of the Project.

4. COOPERATION PERIOD OF THE PROJECT

The duration of the Project will be Three (3) years from the first dispatch of

JICA experts.

5. **PROJECT DESIGN MATRIX (PDM) AND PLAN OF OPERATION(PO)**
The Project Design Matrix (hereinafter to as "PDM") and the Plan of Operation (hereinafter referred to as "PO") as shown in the Annex will be the tool for project management including monitoring and evaluation of the Project. The PDM, PO and the activities of the Project are subject to change within the scope of the R/D with mutual consultations when necessity arises in the course of implementation of the Project.

6. **JOINT COORDINATION COMMITTEE**
For effective implementation of the Project, both sides agreed to establish a Joint Coordination Committee (hereinafter referred to as "JCC"). The expected responsibilities and the membership of the JCC are described in Annex 4. JCC will be held whenever necessary in the course of the Project implementation.

7. **ENVIRONMENTAL AND SOCIAL CONSIDERATIONS**
With regard to the Section 10.1 of the BP, the Project is likely to have minimal adverse impact on the environment and society under the 'JICA Guidelines for Environmental and Social Considerations (April 2010)'.

8. **SECURITY**
Both sides agreed that the Power Division will make all the necessary security arrangements for JICA mission team and JICA Experts of the Project including. providing police escort and/or deploying General Ansar and/or Battalion Ansar to the Project to secure the safety of consultants and contractors, if required by JICA.

9. **OTHER POINTS DISCUSSED**
Both sides agreed that operational costs such as daily allowance, accommodation and travel cost etc. in Bangladesh will be provided by the Power Division and Power Utilities for their own personnel.

Project Design Matrix

Project Title: Project for Capacity Development for Operation and Maintenance of Thermal Power Stations

Implementing Agency:Power Division, Ministry of Power, Energy and Mineral Resources, BPDB,NWPGCL, EGCB, CPGCBL and APSCL

Target Group: O&M engineers of implementing Agencies

Period of Project: Oct 2017 - Sep 2020

Project Site: Thermal power stations under public utilities

Version No. 0

Dated on October 11, 2017

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	Achievement	Remarks
Overall Goal					
Capacity of Operation and Maintenance of Thermal Power Plants (TPP) is strengthened.	-O&M action plans are prepared and regularly updated -Improve the knowledge of the stakeholders regarding O&M -Improved the skills of developing O&M action plans	- Post Monitoring report - training records at each PP - organization records of PP			
Project Purpose					
Training Capacity on Operation and Maintenance (O&M) of Thermal Power Stations is strengthened.	- No. of improved and/or new training cources regularly operated for TPP O&M at targeted TPP - No. of assigned trainers who were trained and conduct trainings (in total)	- Project Monitoring Sheet - Interview	- Trained instructors will not resign and transfer from BPDB and targeted PP.		
Outputs					
1.Current situation of O&M of thermal power stations and rules and regulations 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 BPDB, BPMI and targeted PP during the project period.		
2. Instructors of thermal PP are trained and secured.	- Training program is prepared based on the training needs. - Total number of trained instructors - Total number of training (OJTs) conducted at power stations	- Project Monitoring Sheet			
3. Training curricula and materials of O&M are improved.	- Traing curricula and matrials of O&M PP - Result of monitoring	Traing curricula and matrials Questionnares, performance test			
4 O&M Training at thermal PP is improved.	- Achievement level of Action Plans prepared by trained instructors. - Training Materials to check the achievement is prepared.	- Project Monitoring Sheet - Action Plans - Training Materials			

Activities	Inputs		Important Assumption
	The Japanese Side	The Bangladesh Side	
1-1 To analyze the current situation including legal system/ rules & regulations of O&M at thermal PP, and grasp the need of trainings. 1-2 To review the training system of thermal PP staff, and analyze the current situation and issues of each technical level of O&M staff. 1-3 To confirm and propose the training needs of each technical level.	a. Expert - Chief Advisor/ Thermal Power Maintenance - Thermal Power Operation - Training Planning / Coordinator - Legal system/ Rules and Regulations b. Training in Japan c. Training equipment if necessary	a. Assignment of Counterpart personnel - Project Representatives - Counterpart members b. Office space and necessary facilities for Japanese experts c. Other operational cost	
2-1 To prepare the program of Training in Japan for instructors and O&M staff by identifyng issues and training needs 2-2 To conduct trainings in Japan and develop capacity of instructors and O&M staff of thermal PP. 2-3 To prepare Action Plans of trainings for O&M of thermal PP.			**Pre-Conditions**
3-1 To propose of human resource development plan and staff deployment plan, and accreditation system in the targeted PP 3-2 To improve curricula and training materials for O&M training at PP (OJTs) and Training Centers			
4-1 To conduct trainings at each PP by instructors. 4-2 To modify the training contents and curricula and materials as necessary based on feedback of trainings in Bangladesh.			**<Issues and countermeasures>**

Plan of Operation

Dated on Octlber 11th 2017

Project Title:Project for Capacity Development for Operation and Maintenance of Thermal Power Stations *Calender Year

Inputs	Plan / Actual	2017 I–IV	2018 I–IV	2019 I–IV	2020 I–IV	2021 I–IV	Remarks	Monitoring: Issue	Monitoring: Solution
Expert									
Chief Advisor/ Thermal Power Maintenance	Plan / Actual	To be assigned by JICA							
Thermal Power Operation	Plan / Actual								
Training Planning / Coordinator	Plan / Actual								
Legal system/ Rules and Regulations	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								

Activities / Sub-Activities	Plan / Actual	2017 I–IV	2018 I–IV	2019 I–IV	2020 I–IV	2021 I–IV	Responsible Organization: Japan	Responsible Organization: GOB	Achievements	Issue & Countermeasures
Output 1: Current situation of O&M of thermal power stations and rules and regulations is analyzed and training needs are identified.										
1.1 To analyze the current situation including legal system/ rules & regulations of O&M at thermal PP, and grasp the need of trainings.	Plan / Actual									
1.1.1	Plan / Actual									
1.1.2	Plan / Actual									
1.2 To review the training system of thermal PP staff, and analyze the current situation and issues of each technical level of O&M staff.	Plan / Actual									
1.2.1	Plan / Actual									
1.2.2	Plan / Actual									
1.3 To confirm and propose the training needs of each technical level.	Plan / Actual									
1.3.1	Plan / Actual									
1.3.2	Plan / Actual									
Output 2: Instructors of thermal PP are trained and secured.										
2.1 To prepare the program of Training in Japan for instructors and O&M staff by identifyng issues and training needs.	Plan / Actual									
2.1.1	Plan / Actual									
2.1.2	Plan / Actual									
2.2 To conduct trainings in Japan and develop capacity of instructors and O&M staff of thermal PP.	Plan / Actual									
2.2.1	Plan / Actual									
2.2.2	Plan / Actual									
2.3 To prepare Action Plans of trainings for O&M of thermal PP.	Plan / Actual									
2.3.1	Plan / Actual									
2.3.2	Plan / Actual									
Output 3: Instructors of thermal PP are trained and secured.										
3.1 To propose of human resource development plan and staff deployment plan, and accreditation system in the targeted PP.	Plan / Actual									
3.1.1	Plan / Actual									
3.1.2	Plan / Actual									
3.2 To improve curricula and training materials for O&M training at PP (OJTs) and Training Centers.	Plan / Actual									
3.2.1	Plan / Actual									
3.2.2	Plan / Actual									
Output 4: O&M Training at thermal PP is improved.										
4.1 To conduct trainings at each PP by instructors.	Plan / Actual									
4.1.1	Plan / Actual									
4.1.2	Plan / Actual									
4.2 To modify the training contents and curricula and materials as necessary based on feedback of trainings in Bangladesh.	Plan / Actual									
4.2.1	Plan / Actual									
4.2.2	Plan									
Duration / Phasing	Plan / Actual									

Monitoring Plan	Plan / Actual	2017 I–IV	2018 I–IV	2019 I–IV	2020 I–IV	2021 I–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 4

List of Proposed Members of Joint Coordination Committee for the Project

1. Composition

(1) Project Team

1) Chairman of JCC/Project Director

Additional secretary of Power Division, Ministry of Power, Energy and Mineral Resources

2) Project Managers,

Representatives from following utilities;

- Bangladesh Power Development Board (BPDB)
- Electricity Generation Company of Bangladesh (EGCB)
- North West Power Generation Company Limited (NWPGCL)
- Ashganji Power Station Company Limited (APSCL)
- Coal Power Generation Company of Bangladesh Limited (CPGCBL)

3) JICA Experts
4) Other Personnel from the Counterparts
5) Others whom are to be agreed by the Counterparts and JICA

(2) Other members from Bangladeshi side

1) Cooperation partners,
2) Other persons that Bangladeshi side might consider necessary

(3) Other members from Japanese side:

1) JICA
2) Other persons that Japanese side might consider necessary

(2)　R/D 修正に係る議事録

MINUTES OF MEETINGS
BETWEEN
THE JAPAN INTERNATIONAL COOPERATION AGENCY
AND
THE MINISTRY OF POWER, ENERGY AND MINERAL RESOURCES
OF
THE PEOPLE'S REPUBLIC OF BANGLADESH
FOR AMENDMENT OF THE RECORD OF DISCUSSIONS
ON
THE PROJECT FOR CAPACITY DEVELOPMENT FOR OPERATION AND MAINTENANCE OF THERMAL POWER STATIONS

The Japan International Cooperation Agency (hereinafter referred to as "JICA") and the Ministry of Power, Energy and Mineral Resources of Bangladesh (hereinafter referred to as "MPEMR"), which is the main counterpart of the Project hereby agreed that the Record of Discussions on the Project for Capacity Development for Operation and Maintenance of Thermal Power Stations (hereinafter referred to as "the Project") signed on 11th October, 2017 will be amended as follows;

1. Duration of the Project

Before	Amended Version
Annex 1.4 COOPERATION PERIOD OF THE PROJECT The duration of the Project will be Three (3) years from the first dispatch of JICA experts.	Annex 1.4 COOPERATION PERIOD OF THE PROJECT The duration of the Project will be Four and a half years from the first dispatch of JICA experts.
Reason: Because of the global spread of the coronavirus (COVID-19), there were some delays in the project activities. In order to achieve the project purpose by implementing additional training, the Project duration needs to be extended by above period.	

The parties acknowledge and agree that this 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., via pdf) of an original signature.

This amendment will become effective as of the signature date.

Annex 1 : Record of Discussions (signed on 11th October, 2017)

Dhaka, (29 / 12 / 2020)

For

THE JAPAN INTERNATIONAL COOPERATION AGENCY

Mr. HAYAKAWA Yuho
Chief Representative
JICA Bangladesh Office

For

GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH

Mr. Rahamat Ullah Mohd. Dastagir
Additional Secretary
Power Division
Ministry of Power, Energy, and Mineral Resources

添付資料 6-2-2

短期専門家派遣実績

短期専門家派遣実績

本プロジェクトに従事した短期専門家、その派遣期間及び業務従事 M/M は以下のとおりである。

担　当	氏　名	現地業務従事期間 （移動期間を含む）	現地業務 従事 M/M
チーフアドバイザ／ 火力発電（運転・保守）	平畑　弘樹	2017 年 10 月 13 日～10 月 27 日（15 日間） 2018 年 7 月 28 日～8 月 6 日（10 日間） 2019 年 7 月 24 日～8 月 7 日（15 日間）	1.33
副チーフアドバイザ／ 火力発電（運転・保守）	河合　徹	2017 年 10 月 13 日～10 月 27 日（15 日間）	0.50
	小堺　瑛	2019 年 7 月 24 日～8 月 7 日（15 日間）	0.50
火力発電（保守・機械）	吉竹　茂	2017 年 10 月 13 日～10 月 27 日（15 日間） 2018 年 7 月 28 日～8 月 6 日（10 日間）	0.83
	土井　祥宏	2018 年 7 月 28 日～8 月 6 日（10 日間） 2019 年 7 月 24 日～8 月 7 日（15 日間）	0.83
火力発電（保守・電気）	一岡　栄喜	2017 年 10 月 13 日～10 月 27 日（15 日間） 2018 年 7 月 28 日～8 月 6 日（10 日間） 2019 年 7 月 24 日～8 月 7 日（15 日間）	1.33
火力発電（保守・制御）	藤井　健雄	2017 年 10 月 13 日～10 月 27 日（15 日間）	0.50
	大部　祐貴	2018 年 7 月 28 日～8 月 6 日（10 日間） 2019 年 7 月 24 日～8 月 7 日（15 日間）	0.83
		（合計）	**6.65**

添付資料 6-2-3

JCC 議事録

(1)　第 1 回 JCC

MINUTES OF MEETING
FOR
THE FIRST JOINT COORDINATION COMMITTEE (JCC)
ON
THE PROJECT FOR CAPACITY DEVELOPMENT FOR OPERATION AND MAINTENANCE OF THERMAL POWER STATIONS
BETWEEN
THE JAPAN INTERNATIONAL COOPERATION AGENCY
AND
THE GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH

Japan International Cooperation Agency (hereinafter referred to as "JICA") and the Government of the People's Republic of Bangladesh (hereinafter referred to as "GoB") established a Joint Coordination Committee (hereinafter referred to as "JCC") for the effective and successful implementation of the Project for Capacity Development for Operation and Maintenance of Thermal Power Stations (hereinafter referred to as "the Project").

The first JCC on the Project was held on 25 October 2017, at Ministry of Power, Energy, and Mineral Resources (hereinafter referred to as "MoPEMR"), Dhaka, chaired by Mr. Rahmat Ullah Mohd. Dastagir, MoPEMR. As a result of discussions in the 1st JCC Meeting, the Japanese side and Bangladeshi side have confirmed the main items described in the Annex.

Dhaka, October 25, 2017

平畑 弘樹

Mr. Hiroki Hirahata
JICA Expert / Chief Advisor

Mr. Rahmat Ullah Mohd. Dastagir, ndc
Additional Secretary
Power Division
Ministry of Power, Energy, and Mineral Resources

ANNEX

1. Project Organization

(1) Formation of JCC

Based on the Record of Discussion dated 11th October, 2017(hereinafter referred to as "RD"), Joint Coordination Committee (hereinafter referred to as "JCC") has been formulated with the following structure by the notification dated 23th October, 2017, to supervise proper implementation of technical assistance project under implementation.

(a) Additional Secretary (Planning), Power Division, Chair Person
(b) Joint Chief, Power Division, Alternate Chair Person
(c) Focal point/Representative, Bangladesh Power Development Board (BPDB), Member
(d) Focal point/Representative, Electricity Generation Company of Bangladesh Limited (EGCB), Member
(e) Focal point/Representative, North West Power Generation Company Limited (NWPGCL), Member
(f) Focal point/Representative, Ashuganj Power Station Company Limited (APSCL), Member
(g) Focal point/Representative, Coal Power Generation Company of Bangladesh Limited (CPGCBL), Member
(h) JICA Expert Team, Member
(i) Focal point/Representative, Power Division, Member Secretary

(2) Notified Scope of Work of JCC

(a) Supervision of implementation of technical cooperation project
(b) Nomination of Engineer/Officers under this project, for training to be organized by JICA
(c) Necessary recommendation for proper implementation of technical cooperation project
(d) If necessary, the committee can co-opt one or more members

2. Project Outline

(1) Confirmation of Project Outline

The JICA Expert Team has explained the scope of works, overall schedule and the activities to be conducted in the project based on Attachment 2. The JICA Expert Team requested close collaboration from the Bangladesh side for the implementation of project activities as well as for organizing the JCC Meeting, which is to be held once a year at minimum during the project period.

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

(2) Result of the 1st Mission

The JICA Expert Team implemented its 1st mission on Bangladesh from 15th October, 2017, to 25th October, 2017, to collect data and information on current situation of O&M. The JICA Expert Team made a brief explanation of analysis on current situation based on Attachment 2. 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.

(3) Necessity of Amendment of PDM

The both sides exchanged the opinion on the necessity of amendment of PDM agreed on RD. The both sides confirmed to discuss on this issue further, taking the result of the 1st counterpart training in Japan and the baseline survey into consideration.

3. First Counterpart Training in Japan

(1) Schedule

Counterpart Training in Japan is tentatively planned from 14 January to 17 February for Engineers, and from 14 January to 10 February for Technical workers.

(2) Goal

The goal of the first training in Japan is to develop capacity of the leading O&M staff to improve capacity development at each thermal power plant.

(3) Overall Contents

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

Expected Output	Training Subjects/Agendas	Training Methods	For Engineers	For Technicians
Develop capacity of instructors of TPP	Introduction of 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
Conduct trainings at each TPP by the instructors	Methodology to formulate action plan	Lecture	O	O
	Presentation about action plan	Discussion	O	O

The both sides agreed on the purpose of the training subjects/agendas. The Bangladesh side confirmed that the capacity development on these aspects get into alignment with policy of the Bangladesh side on human resource development of O&M staff of TPP.

(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)
Current Duties	Be a Leading engineer working on GTCC thermal power plants, and has expertise related to mechanical engineering*, who are capable to be instructors to train other engineers. *Program related to electrical engineering would be held on 2nd year.	Be a Leading technician working on GTCC thermal power plants, and has expertise related to mechanical work*, who are capable to be instructors to train other technicians. *Program related to electrical work would be held on 2nd 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. *Pregnant applicants are not recommended to apply due to the potential risk of health and life issues of mother and fetus.	

*1: Lecture will be made in Japanese and translated to English or Bengalis (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 plan to share their experience and knowledge attained in the training in Japan and improve capacity development for O&M of TPPs. The members of JCC shall closely coordinate to follow up the implementation of these action plans. Each participant is requested to provide reports to the JICA Expert Team on the result of the implementation of the action plan.

Attachment 1 Participant List
Attachment 2 Presentation Materials

Meeting: A Meeting of the Joint Coordination Committee(JCC) on "Project for Capacity Development for Operation and Maintenance of Thermal Power Stations"

Venue: Conference Room of Power Division
(Room # 1116, Level # 11, Bidyut Bhaban, Ramna, Dhaka)

Date: 25 October, 2017

Time: 03.00 pm.

Participant List

Sl No.	Name of the Participant	Designation & Organization	Mobile/Phone E-mail	Signature
1	Taku Yanoke	Senior Rep, JICA	[redacted]	
2	Koichi Hirata	Representative, JICA	[redacted]	
3	Ahmed Mukammeluddin	Senior Program Manager JICA, Bangladesh Office	[redacted]	
4	Junki Mori	Program Officer. JICA	[redacted]	
5	Shigeru Yoshizake	Kansai	[redacted]	
6	Toru Kawai.	Kansai.	[redacted]	
7	Hiroki Hirahata	Kansai	[redacted]	
8	Hidenobu Ichioka	Kansai	[redacted]	
9	Engr. M. Mahmuduz Rahman Mahmud	Dy Director (KEN) BPDB	[redacted]	
10	Muhammad Chishty Ashequ	Assistant Chief Power Division	[redacted]	
11	Md. Anamul Haque	DGM (HR) NWPGCL	[redacted]	
12	Md. Shah Alam Khan	Chief Engineer (M. & M)	[redacted]	
13	SK Md Abdul Ahad Deputy Chief	Power Division	[redacted]	
14	Ibrahim Ahmed Safi Al Mahtab	SE, EGCB	[redacted]	

THE PROJECT FOR CAPACITY DEVELOPMENT FOR OPERATION AND MAINTENANCE OF THERMAL POWER STATIONS IN PEOPLE'S REPUBLIC OF BANGLADESH

1

Survey Report and Next Action

October 2017

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

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2

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

Project Summary

3

<Project Purpose>

Overall Goal	Capacity of O&M of Thermal Power Plants (TPP) is strengthened.
Project Goal	**Training capacity on O&M** of thermal power stations is strengthened

<Project Output>

Output 1	**Current situation of O&M** of thermal power stations is analyzed and **training needs** are identified.
Output 2	**Instructors of TPP** are trained and secured.
Output 3	**Training curricula and materials of O&M** are improved
Output 4	**O&M training at TPP** is improved.

<Others>

Power generation	Gas Turbine Combined Cycle (GTCC) ※Lecture on general introduction regarding coal fired power generation including advanced environmental practices in Japan
Project Sites	BPDB, EGCB, NWPGCL, APSCL & CPGCBL' TPP in Dhaka
Counterpart	Power Division, Ministry of Power, Energy and Mineral Resources (MoPEMR), BPDB EGCB, NWPGCL, SPSCL, CPGCBL
Target group	O&M engineer who will be the core instructors to conduct training
Duration	October 2017 – September 2020 (3 years)

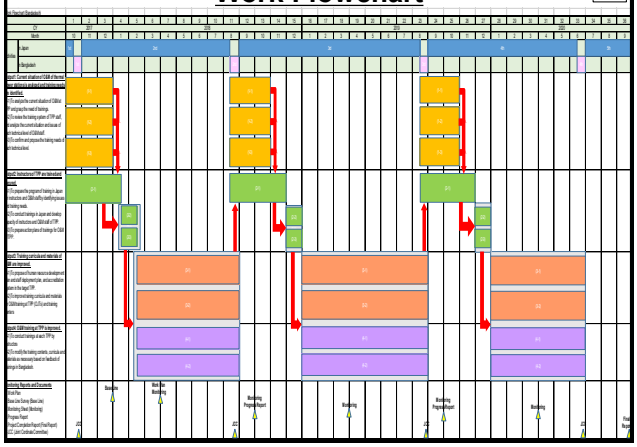
Project Activity toward Output

4

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 TPP and grasp the need of trainings.
Activities (1-2)	To review the training system of TPP staff, and analyze the current situation and issues of each technical level of O&M staff.
Activities (1-3)	To confirm and propose the training needs of each technical level.
Output 2	**Instructors of TPP are trained and secured.**
Activities (2-1)	To prepare the program of training in Japan for instructors and O&M staff by identifying issues and training needs.
Activities (2-2)	To conduct trainings in Japan and develop capacity of instructors and O&M staff of TPP.
Activities (2-3)	To prepare action plans of trainings for O&M of TPP.
Output 3	**Training curricula and materials of O&M are improved.**
Activities (3-1)	To propose human resource development plan, staff deployment plan, and accreditation system in the target TPP.
Activities (3-2)	To improve training curricula and materials for O&M training at TPP (OJTs) and training centers
Output 4	**O&M training at TPP is improved.**
Activities (4-1)	To conduct trainings at each TPP by instructors
Activities (4-2)	To modify the training contents, curricula and materials as necessary based on feedback of trainings in Bangladesh.

Work Flowchart

5



Implementation Structure (JCC)

6

<Project Team>

Chair Person
Additional Secretary (Planning), Power Division

Alternate Chair Person
Joint Chief, Power Division

Members

- Focal Point/Representative, Bangladesh Power Development Board (BPDB)
- Focal Point/Representative, Electricity Generation Company of Bangladesh (EGCB)
- Focal Point/Representative, North West Power Generation Company Limited (NWPGCL)
- Focal Point/Representative, Ashganj Power Station Company Limited (APSCL)
- Focal Point/Representative, Coal Power Generation Company of Bangladesh Limited (CPGCBL)
- JICA Expert Team
- Focal Point, Power Division, Member Secretary

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Actual Itinerary on this Survey

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Date	Activity	Focal Point
15th Oct.	Kick-off Meeting with MoPEMR & other counterparts	-
16th Oct.	Meeting with BPDB at WAPDA Bhaban	M. Mahmudur Rahman Mahmud
	Meeting with Power Division at Biddyut Bhaban	Dr. Shah Md. Helal Uddin
17th Oct.	Meeting with EGCB at Unique Heights, Eskaton	Iblahim Ahmad Shafi Al Mohtad
	Meeting with NWPGCL at UTC Building, Panthapath	Md. Anamul Haque
	Meeting with APSCL at JICA Office	Md. Shah Alam Khan
18th Oct.	Site Visit to Ghorasal Power Plant & Training Center	M. Mahmudur Rahman Mahmud
19th Oct.	Site Visit to Bheramara Power Plant	Mohammad Mosharraf Hossain
22nd Oct.	Site Visit to Haripur Power Plant	A.K.M. Mostafizur Rahaman (Md. Kamruzzaman)
	Site Visit to Pendekar Energy Limited's at Haripur	-
23rd Oct.	Site Visit to Ashganj Power Plant	Md. Shah Alam Khan
24th Oct.	Wrap-up Meeting with Power Division & other counterparts (Focal Points)	-
25th Oct.	Wrap-up Meeting at JCC (Joint Coordination Committee)	-

Important Assumptions for Training Program

9

<Finding of this Mission>

- ✓ New GTCC power plants are generally well operated and maintained **under LTSA or warranty period of EPC contracts.**
- ✓ Officers and staff of new power plants are capable for implementing **daily O&M work based on OEM manuals.**
- ✓ No obstacle on concluding of LTSA was observed.

<Suggestion from the Mission Team>

- ✓ Even under LTSA with manufacturers, it is important for power plant officers and staff to **deepen the general understanding for O&M for overall human resources development** in power sectors.

O&M Training Needs through this Survey

10

<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

<Request from Bangladeshi Side>

- ✓ **Knowledge** about the Latest Technology of Thermal Power Plant such as GTCC and USC (Ultra Super Critical coal-firing)
- ✓ **Human Resource** including Development Plan and OJT
- ✓ **Training Equipment** such as Non-Destructive Inspection and Remaining Life Assessment

O&M Training Program in Japan

11

Expected Output	Training Subjects/Agendas	Training Methods	For Engineers	For Technicians
Develop capacity of instructors of TPP	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
Conduct trainings at each TPP by the instructors	Methodology to formulate action plan	Lecture	O	O
	Presentation about action plan	Discussion	O	O

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Important Assumptions for Selection Criteria

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<Finding of this Mission>

- ✓ **Each generation companies implement training program.**
- ✓ Sometimes EGCB and NWPGCL utilize the training centers of BPDB. APSCL has its own training center.
- ✓ **There is no officers dedicated only for trainers.** Leading officers of each power plants sometimes implement training course as trainers.

< Suggestion from the Mission Team >

- ✓ Target should be **the leading engineers and technicians** who are capable for **expanding their knowledge attained on the training program in Japan to other members** of the power plant.

Selection Criteria for the Training in Japan

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Items	Qualification (Engineers)	Qualification (Technicians)
Current Duties	Be a Leading engineer working on GTCC thermal power plants, and has expertise related to **mechanical engineering***, who are capable to be instructors to train other engineers. *Program related to **electrical engineering** would be held on 2nd year.	Be a Leading technician working on GTCC thermal power plants, and has expertise related to **mechanical work***, who are capable to be instructors to train other technicians. *Program related to **electrical work** would be held on 2nd 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. *Pregnant applicants are not recommended to apply due to the potential risk of health and life issues of mother and fetus.	

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

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Monitoring Indicators for Overall Goal

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Items	Monitoring Indicators	Means of Verification
Overall Goal Capacity of O&M of Thermal Power Plants (TPP) is strengthened.	✓ **O&M action plans are prepared and regularly updated** in order to improve O&M through action plans.	✓ Project monitoring sheet, including **regular training reports at each TPP provided by trained instructors.**
Project Goal Training capacity on O&M of Thermal power stations is strengthened.	✓ **Number of improved and/or new training courses** regularly operated for O&M at targeted TPP. ✓ **Number of assigned trainers** who were trained and conduct training (in total) ※Assumption Trained instructors will not resign and transfer from BPDB and targeted TPP.	✓ Project monitoring sheet, including **regular training reports at each TPP provided by trained instructors.**

Monitoring Indicators for Project Output

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Items	Monitoring Indicators	Means of Verification
Output 1 Current situation of O&M of TPP is analyzed, and training needs are identified.	✓ **Training needs are compiled** based on the current situation.	✓ Project monitoring sheet
Output 2 Instructors of TPP are trained and secured.	✓ **Training program** is prepared based on the training needs. ✓ **Number of trained instructors.** ※Assumption Trained instructors continue to work for BPDB and target TPP during the duration.	✓ Project monitoring sheet
Output 3 Training curricula and materials of O&M are improved	✓ **Training curricula and materials** of O&M are proposed and modified if necessary	✓ Project monitoring sheet, including **regular training reports at each TPP provided by trained instructors.**
Output 4 O&M training at TPP is improved.	✓ **Number of training (OJTs)** conducted at TPP. ✓ **Achievement level of action plans** prepared by trained instructors. ※Assumption Trained instructors continue to work for	✓ Project monitoring sheet, including **regular training reports at each TPP provided by trained instructors.**

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Main Points Discussed for Next Step

- ✓ **Request for Next Step (By November 8, 2017)**
  Comments for Minutes of Meeting (MoM), especially
  -O&M training program in Japan.
  -Selection criteria for the training in Japan.
  -Monitoring indicators.
- ✓ **Undertaking by Bangladeshi side;**
  -Selecting Instructors based on the selection criteria.
  (By November 15, 2017)
  -Other operational cost.
  -Regular training reports at each TPP provided by instructors.
- ✓ **Undertaking by Japanese side;**
  -Training in Japan for each 10 engineers/technicians per year.
  -Monitoring the improvement of O&M at TPP and modifying the training contents such as training curricula and materials.

(2)　合同 TV 会議

MINUTES OF MEETING
ON
THE PROJECT FOR CAPACITY DEVELOPMENT FOR OPERATION AND MAINTENANCE OF THERMAL POWER STATIONS
BETWEEN
THE JAPAN INTERNATIONAL COOPERATION AGENCY
AND
THE GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH

Japan International Cooperation Agency (hereinafter referred to as "JICA"), JICA Expert Team, and the representative from the relevant authorities of the Government of the People's Republic of Bangladesh held TV conference on 14th November, 2018, on the Project for Capacity Development for Operation and Maintenance of Thermal Power Stations (hereinafter referred to as "the Project").

As a result of the discussion, the Japanese side and the Bangladeshi side confirmed the main items described in Annex.

Signed this (DD/MM/YYYY) : / /

平畑 弘樹	
Hiroki Hirahata JICA Expert / Chief Advisor	Shah Md. Helal Uddin, PhD Deputy Chief Power Division Ministry of Power, Energy, and Mineral Resources

ANNEX

1. Progress of the Project

The JICA Expert Team has explained the Work Flowchart, the progress made after the first JCC meeting including the first training courses in Japan implemented from January to February 2018, and the upcoming activities based on Attachment 1. The JICA Expert Team requested close collaboration from the Bangladesh 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 Bangladesh side acknowledged the contents of the explanation and agreed to meet the request from the JICA Expert Team.

2. Action Plan

(1) Purpose of Action Plan

The both sides confirmed that the Action Plans for improving Human Resource Development (hereinafter referred to as “HRD”) for O&M of thermal power plant (hereinafter referred to as “TPP”) 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 the Project, Action Plans are expected to be formulated for the purpose of improvement of HRD activities conducted on each TPP.

(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

3. Result of the Second Mission

(1) Outline of the Mission

The JICA Expert Team implemented its second mission on Bangladesh from July 29 to August 6, 2018, to achieve the below purposes;

- Reviewing O&M training activities at each TPP implemented by JICA-trained engineers and technicians,
- Grasping current situation of O&M, and identifying training needs,

- ü Mutual agreement on O&M training program in Japan scheduled in FEB/MAR 2019,
- ü Mutual agreement on selection criteria for next participants (engineers and technicians),
- ü Grasping current Human Resource Development system in Bangladesh through Kansai's case introduction.

The JICA Expert Team made a brief explanation of current situation of each topics based on Attachment 1.

(2) Result of the interview of the Head Office and the review of Action Plan Implementation

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

(Result of the interview of the Head Office)

- ü Brand-new GTCCs are generally well operated and maintained under LTSA or warranty period of EPC contracts.
- ü In some aging TPPs, there are some GTCC repowering projects which combine existing ST with additional GT/HRSG.
- ü In O&M work including technical HRD, TPPs utilize mainly OEM manuals.
- ü For avoidance of excessive dependence on OEM, some head offices require the latest maintenance technology against major technical troubles, in case of Japanese GTCC as well as USC (Ultra-Super Critical coal-firing).

(Result of the review of Action Plan Implementation)

- ü JICA-trained engineers and technicians are utilizing their knowledge and skills obtained in Japan for dissemination to other colleagues, through On the Job Training.

(3) Analysis of current situation of O&M and suggestion of Training target

The JICA Expert Team explained more suitable O&M condition learned through the 2nd survey as follows. Toward this condition, TPPs should ask manufacturers' support positively especially regarding products, on the other hand, TPPs should manage autonomously regarding operating themselves.

The JICA Expert Team also concluded that training program for Bangladesh should be focused on maintenance knowledge and skill, especially mechanical field in GTCC. Bangladesh side confirmed the contents.

(More O&M Suitable Condition)

a. Operation field:
   - ü Collective training for operators in shift team.
   - ü Using actual facilities or simulator which has same specification as current workplace.
   - ü Learning operation knowledge and skill including normal/urgent operation.

b. Maintenance field:

- ü Collective training for engineers/technicians with equal abilities.
- ü Using main equipment which has same type of power generation as current workplace.
- ü Learning maintenance knowledge and skill including trouble-shooting.
- ü Training on mechanical is more prioritized than electrical/C&I, considering aging impact on O&M quality and cost in the near future.

4. HRD framework in Bangladesh

JICA Expert Team explained Kansai's Human Resource Development framework briefly and discussion points. Based on the result of the mission, JICA Expert Team recognized to need the further survey of current situation and discussion with Bangladesh side to recommend the measures for enhancing HRD for O&M of TPP. The Bangladesh side took note of it, and JICA Expert Team would do in the next survey.

5. Second Counterpart Training in Japan

(1) Schedule

The second Counterpart Training in Japan is tentatively planned from 24th February to 30th March 2019 for Engineers, and from 24th February to 15th March 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	✓ Introduction of the latest technology in TPP
✓ Experience-based Safety Training	✓ Experiential Safety Training
✓ Human Resource Development	✓ Welding Procedure Management
✓ Quality Management	✓ Experiential Quality Training
✓ Thermal Efficiency Management	✓ Metal Material
✓ Basic Training of Vibration (Balancing)	✓ Overhauling Rotary Pumps
✓ Non-Destructive Inspection	✓ Basics of Non-Destructive Inspection Skills
✓ GT & High Temperature Parts / Maintenance of GTCC (inc. HRSG/Generator, Shaft Alignment)	✓ Maintenance of High Temperature and High Pressure Piping
✓ Remaining Life Assessment (advanced)	✓ Occupational HSE (especially Safety)
✓ Feed Water Treatment	✓ General System and Outline of GTCC
✓ Site Visit on TPP and Manufacture's factory	✓ Site Visit on TPP and Manufacture's factory
✓ Lessons Learned from Accidents	✓ Prevention of Accidents and Disasters
✓ Participation in GTCC Overhaul (Video)	✓ Participation in GTCC Overhaul (Video)
✓ Human Error Prevention	✓ Methodology to Formulate Action Plan
✓ Welding Quality Management in Japan (inc. Welding Defect)	
✓ Effective Maintenance for Quality Electric Power Infrastructure	
✓ Methodology to Formulate Action Plan	

The both sides agreed on the purpose of the training subjects/agendas. The Bangladesh side confirmed that the capacity development on these aspects get into alignment with policy of the Bangladesh side on HRD of O&M staff of TPP.

(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	10 persons	10 persons
Training Term	About 1 month	About 3 weeks
Current Duties	Be a leading engineer working on thermal power plants, and has expertise related to mechanical engineering in GTCC, who are capable to be instructors to train other engineers.	Be a leading technician working on thermal power plants, and has expertise related to mechanical work in GTCC, who are capable to be instructors to train other technicians.
Experience in the relevant field	Middle-class* engineers and technicians in the O&M field of GTCC *Ideally, they have from 5 to 10 years' experience in GTCC including GT, ST, HRSG.	
Educational Background	Be a graduate of university	Be a diploma of technical high school or college preferably
Language	Have a competent command of spoken and written English.	See footnote*
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 Bangladesh	
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	

* Lecture will be made in Japanese and translated to Bengali. 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 TPP. In this regard, Japanese side requested the Bangladesh side to nominate participants who are capable of drafting Action Plans and also disseminating their knowledge and skills to other colleagues in each TPP.

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 31st December 2018, assuming that GI from JICA Expert Team shall be issued by 29th November 2018. After the nomination from the Bangladesh side, the Japanese side will confirm the participants for the second training within 1 week.

6. Project Monitoring Sheet

The both sides confirmed the contents of the Project Monitoring Sheet Ver. 1 as Attachment 2.

7. Monitoring Indicator

Regarding Project Design Matrix (PDM) agreed on the Record of Discussion, 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 May 2019.

8. Request from JICA Expert Team

(1) Regular submission of training report from some of JICA-trained engineers and technicians in BPDB is requested.

Attachment 1 Presentation Materials
Attachment 2 Project Monitoring Sheet Ver. 1

THE PROJECT FOR CAPACITY DEVELOPMENT FOR OPERATION AND MAINTENANCE OF THERMAL POWER STATIONS IN PEOPLE'S REPUBLIC OF BANGLADESH

1

SURVEY REPORT and NEXT ACTION

November 2018

Japan International Cooperation Agency (JICA)

The Kansai Electric Power Co., Inc.

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1. Project Summary

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

Project Purpose

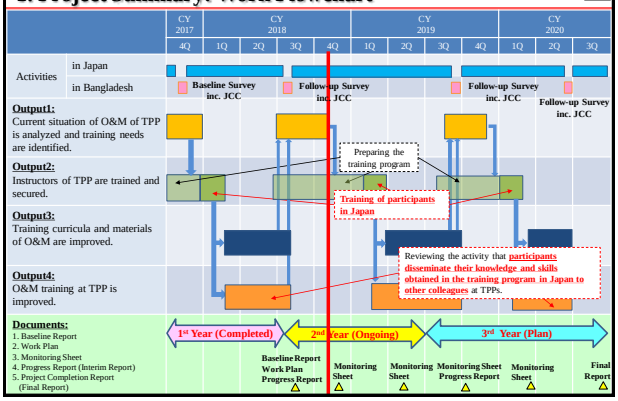
Overall Goal	Capacity of O&M of TPPs is strengthened.
Project Goal	Training capacity on O&M of TPPs is strengthened.

Project Output

Output 1	Current situation of O&M of thermal power stations is analyzed and training needs are identified.
Output 2	Instructors of TPP are trained and secured.
Output 3	Training curricula and materials of O&M are improved.
Output 4	O&M training at TPP is improved.

1. Project Summary: Work Flowchart

4



1. Project Summary: Monitoring Indicator

5

Items	Monitoring Indicators	Achievement
Overall Goal : Capacity of O&M of Thermal Power Plants (TPP) is strengthened.	✓ O&M action plans are prepared and regularly updated in order to improve O&M through action plans.	✓ While almost all of JICA-trained engineers & technicians implemented action plans, **it's necessary to review action plan implementation.** ☞ 7 ~ 10
Project Goal : Training capacity on O&M of Thermal power stations is strengthened.	✓ Number of improved and/or new training courses regularly operated for O&M at targeted TPP.	✓ They conducted **13 improved/new training courses at TPPs** as of June, 2018 (NDI, vibration analysis & safety).
	✓ Number of assigned trainers who were trained and conduct training (in total)	✓ **10 engineers & 10 technicians** trained in Japan for dissemination to other colleagues at TPPs.
Output 1 : Current situation of O&M of TPP is analyzed, and training needs are identified.	✓ Training needs are compiled based on the current situation.	✓ JICA Expert Team has compiled training needs through **baseline survey in 2017** and **1st follow-up survey in 2018** ☞ 11 ~ 18
Output 2 : Instructors of TPP are trained and secured.	✓ Training program is prepared based on the training needs.	✓ For 1st training in Japan, JICA Expert Team prepared **training program based on training needs.**
	✓ Number of trained instructors.	✓ **10 engineers & 10 technicians** trained in Japan for dissemination to other colleagues at TPPs.
Output 3 : Training curricula and materials of O&M are improved	✓ Training curricula and materials of O&M are proposed and modified if necessary	✓ **They revised existing materials** based on 1st training in Japan (NDI & vibration analysis etc.) ✓ JICA Expert Team has made **fruitful discussion on HRD framework by Kansai's case.** ☞ 19 ~ 24
Output 4 : O&M training at TPP is improved.	✓ Number of training (OJTs) conducted at TPP.	✓ While they conducted 13 training for 82 engineers & 90 technicians at TPPs, JICA Expert Team expects them to **enhance training activities at TPPs.** ☞ 6
	✓ Achievement level of action plans prepared by trained instructors.	✓ While they're progressing their action plans, **it's necessary to review action plan implementation**

1. Project Summary: Training Activity at TPPs

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

		Number of Participants in Japan	Number of Training Activity at each TPPs	Number of Trainees at each TPPs	Reference
BPDB	Engineers	2	0	0	No response (1 of 2 engineers)
	Technicians	4	2	40	No response (2 of 4 technicians)
NWPGCL	Engineers	2	2	35	Adding new course trained in Japan to NWPGCL's curriculums. (NDI)
	Technicians	2	1	8	
APSCL	Engineers	2	1	9	Revising existing materials based on 1st training in Japan
	Technicians	2	1	19	
CPGCBL	Engineers	2	1	7	Using training materials provided in Japan
EGCB	Engineers	1	1	23	Requesting training equipment like NDI kit, vibration analyzer & balancing machine.
	Technicians	1	2	16	
RPCL	Engineers	1	1	8	
	Technicians	1	1	7	
Total	Engineers	10	6	82	Reported by 9 engineers.
	Technicians	10	7	90	Reported by 8 technicians

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2. **Action Plan Implementation**

3. O&M Training in Japan: FEB/MAR, 2019

4. HRD Framework in Bangladesh

5. Summary on the Mission for Next Step

2. Action Plan: Overview of Action Plan

Through these 1st and 2nd surveys, JICA Expert Team recognizes the importance of Action Plan as follows;

What is Action Plan?

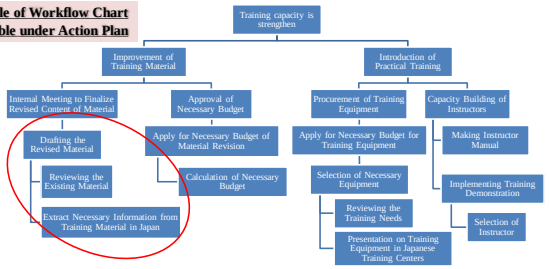
- ✓ Plan of actions to achieve the Project Purpose
  ≒ Strengthen HRD capacity of TPPs
- ✓ Contains following information;
  - Analysis on current issues and causes
  - Concrete activities to be implemented in different stages
  - Timeframe
  - Persons in charge
  - Possible Obstacles/Conditions etc.

How will Action Plans be formulated and implemented?

- ✓ Drafted by participants of training in Japan
- ✓ Endorsed and implemented by their organizations

2. 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

2. Action Plan: Monitoring Structure

Actor	Task
Training Participants	➢ Draft Monitoring Report to be submitted to JICA Expert Team
Counterpart Organizations	➢ **Endorse** the Monitoring Report and Submitting it to JICA Expert Team through its focal point ➢ **Evaluate contribution** of the training participants on implementing the action plan and sharing the information to JICA Expert Team ➢ **Arrange teleconference** with JICA Expert Team 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

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3. O&M Training in Japan: Participant's Comments

	Main Suggestion	Especially Useful Subjects	Required Additional Subjects
Engineers	➢ We expect **more technical and skilled training** about new technology. ➢ The training should include some course for **effective O&M at TPPs** ➢ We should be given time for **open discussion of previous accidents and trouble-shooting** etc.	➢ Basic Training of Vibration (Balancing) ➢ Non-Destructive Inspection ➢ GT & High Temperature Parts / Maintenance of GTCC ➢ Experience-based Safety Training ➢ Human Resource Development ➢ Site Visit on TPP and Manufacture's factory	➢ **Welding Defects** ➢ **Shaft Alignment for Rotary Equipment (turbine/pump)**
Technicians	➢ Any training is fruitful, but it would be great if each subject have some more time.	➢ Methodology to Formulate Action Plan ➢ Experiential Safety Training ➢ Welding Procedure Management/ Metal Material ➢ Basics of Non-Destructive Inspection Skills ➢ Valve Maintenance skills and Overhauling Pumps	➢ **Practical Skill at Rotary Equipment (Alignment and Balancing)** ➢ **Instruction of GTCC**

3. O&M Training in Japan: Important Assumption

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Finding of this Mission: Head Office and TPPs

- ✓ Brand-new GTCCs are generally well operated and maintained **under LTSA or warranty period of EPC contracts**.
- ✓ In some aging TPPs, there are some **GTCC repowering projects** which combine existing ST with additional GT/HRSG.
- ✓ In O&M work including technical HRD, TPPs utilize mainly **OEM manuals**.
- ✓ For avoidance of excessive dependence on OEM, some head offices require **the latest maintenance technology against major technical trouble,** in case of Japanese GTCC as well as USC (Ultra-Super Critical coal-firing).

Finding of this Mission: JICA-trained Engineers/Technicians

- ✓ JICA-trained engineers & technicians are utilizing their knowledge and skills obtained in Japan **for dissemination to other colleagues, through OJT**.

3. O&M Training in Japan: Targeted Scope

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Training in Japan will focus on **maintenance knowledge and skill,** especially **mechanical field in GTCC**.

Operation Training: More Suitable Condition (especially advanced course)

- ✓ Collective training for **operators in shift team.**
- ✓ Using actual facilities or simulator which has **same specification** as current workplace.
- ✓ Learning operation knowledge and skill including **normal/urgent operation**.

➡ ***Manufacturer's support in the workplace seems more effective.***

Maintenance Training: More Suitable Condition

- ✓ Collective training for **engineers/technicians with equal abilities**.
- ✓ Using main equipment which has **same type of power generation** as current workplace.
- ✓ Learning maintenance knowledge and skill including **trouble-shooting from utility's viewpoint**
- ✓ **Mechanical** is preferable to electrical/C&I, considering aging impact on O&M quality & cost in the near future.

➡ ***It's possible for utility company to contribute to Bangladesh more effectively.***

3. O&M Training in Japan: Advanced Mechanical

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

Practical Skill

Workshop

Action Plan

* New training subjects as shown in blue underlined & boldfaced type

3. Selection Criteria: Important Assumption

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Finding of this Mission: Head Office and TPPs

- ✓ Each generation company implements training program, and usually utilize mainly **OEM service & training center for especially O&M.**
- ✓ With regard to HRD, the current contents are basically general, and **have not been categorized according to various ability of engineers & technicians.**
- ✓ **Mechanical participants are preferable** to electrical and C&I, considering foreseeable aging impact on O&M quality and cost in the near future.
- ✓ **There is no officer dedicated only for instructors.** At the request of training centers, leading officer of TPPs usually implements training course as instructor.

Suggestion from JICA Expert

- ✓ Target should be **leading engineers and technicians who are capable of disseminating their knowledge and skills obtained in O&M training in Japan to other colleagues** at TPPs.

3. O&M Training in Japan: Selection Criteria

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Items	Qualification (Engineers)	Qualification (Technicians)
Number	10 persons	10 persons
Training Term	About 1 month	About 3 weeks
Current Duties	Be a leading engineer working on thermal power plants, and has expertise related to **mechanical engineering in GTCC**, who are capable to be instructors to train other engineers.	Be a leading technician working on thermal power plants, and has expertise related to **mechanical work in GTCC**, who are capable to be instructors to train other technicians.
Experience in the relevant field	**Middle-class* engineers and technicians in the O&M field of GTCC** *Ideally, they have from 5 to 10 years' experience in GTCC including GT, ST, HRSG.	
Educational Background	Be a graduate of university	Be a diploma of technical high school or college preferably
Language	Have a competent command of spoken and written English.	See footnote*
Health	Must be in good health, both physically and mentally, to participate in the program in Japan.	

*:Lecture will be made in Japanese and translated to Bengali. 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. O&M Training in Japan: Selection Criteria

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Items	Qualification (Engineers)	Qualification (Technicians)
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 Bangladesh	
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	

Notice:

- For efficient dissemination of the knowledge, instructors in Training Centers with mechanical expertise, or candidates for these posts are most welcomed.

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4. HRD Framework in Bangladesh

JICA Expert Team would **grasp current situation of Bangladeshi HRD Framework in detail in the 2nd follow-up survey** and suggest some relevant improvements hereafter.

- ✓ JICA Expert Team explained **Kansai's HRD Framework** and discussed with Head office members.
  - ● Kansai forms optimal HRD framework with Job rotation(OJT) and lectures(OFF-JT)
    - All new employees in Kansai would be assigned the operation section aiming to understand basic and overall thermal power system for one year.(OJT)
    - During stepping up their skill and knowledge, Kansai classifies them into 5 levels and each level has the evaluation check system. All of them have to pass each level.(OFF-JT)
- ✓ JICA Expert Team has found out the difference between Bangladeshi and Kansai's HRD Framework. JICA Expert Team will learn it more and suggest the measures to improve Bangladeshi Framework with referring their own Framework.
- ✓ Moreover, JICA Expert Team will grasp **roles & responsibilities of each organization** (Head Offices, TPPs & Training Centers etc.).

4. HRD Framework: Kansai's Case (Initial Job Rotation)

Initial job rotation (from operation to maintenance) enables every newcomer to **grasp general operation & maintenance workflow (On-JT).**

Level		Low	Middle		High
Employee's Stage		Novice	Advanced Beginner	Competent	Proficient
Engineer	Operation section	1st stage: Shift Team [1.5 years]			
	Maintenance section	2nd stage: Maintenance [1.5 years]			
	Construction / Headquarters	mandatory program = general & basic skill	Construction / Headquarters /Power plant Up to each [3 years-]		

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4. HRD Framework: Kansai's Case (e.g. Mech. Maintenance)

Kansai provides every staff with technical lectures and practical exercise **according to its own knowledge/skill (Off-JT).**

Level	Low	Middle		High
Employee's Stage	Novice	Advanced Beginner	Competent	Proficient
Expertise (Mechanical)	Beginners' Course	Boiler & Steam Turbine Fan/Valve/Pump Gas Turbine	Boiler & Steam Turbine Technical Regulation Metallic Material GT Combustion Welding quality management Expert course	Residual Life Assessment GT (advanced) Boiler(advanced)

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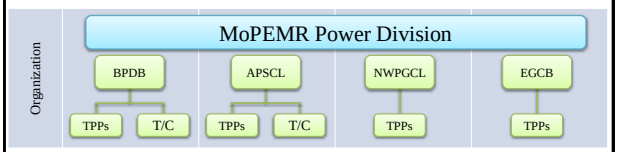
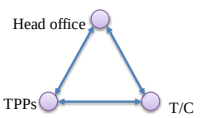
4. HRD Framework in Bangladesh: Roles & Responsibilities

Regarding HRD, JICA Expert Team need to clarify more detailed status such as **roles & responsibilities of each organization (Head offices, TPPs and T/C)** in 2nd follow-up survey.



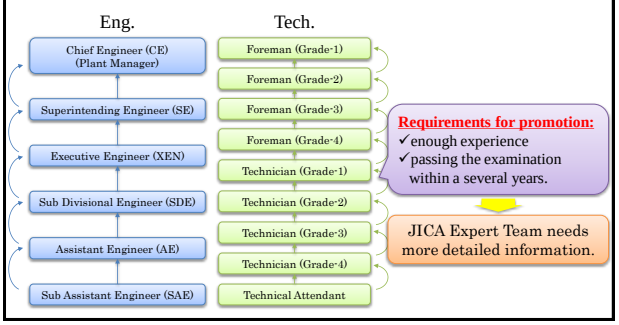
T/C: Training Center



Which organization forms the HRD framework?
Which organization plans the annual curriculums?
Which organization approve the annual plan?
Which organization implements the annual plan etc.

4. HRD Framework in Bangladesh: Evaluation System

For the purpose of enhancing O&M knowledge/skills, JICA Expert Team need to clarify **Bangladeshi evaluation system for promotion** in 2nd follow-up survey.



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5. **Summary on the Mission for Next Step**

5. Summary on the Mission for Next Step

✓ **Request for Next Step:**

Giving us any comments from Bangladeshi side for MoM & monitoring sheet **by Nov. 21, 2018**, especially,

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

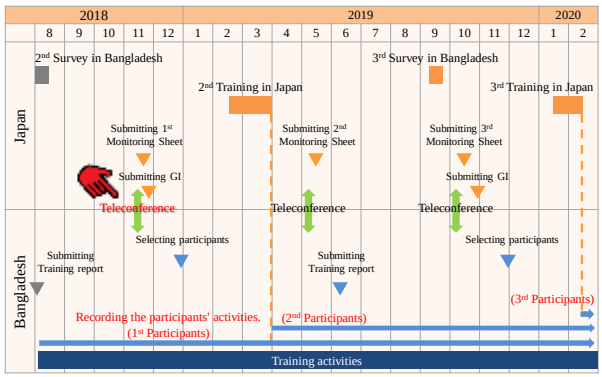
✓ **Undertaking by Bangladeshi Side:**

- Selecting participants based on the selection criteria **by Dec. 31, 2018.**
- **Supervising** and reporting O&M training activity at each TPP implemented by JICA-trained engineers & technicians (by TPP manager).

✓ **Undertaking by Japanese Side:**

- Submitting GI about the O&M training in Japan **by Nov. 29, 2018.**
- Conducting the O&M training in Japan for each 10 engineers/technicians as participants **(Feb./Mar. , 2019).**
- Reviewing training activities by JICA-trained engineers & technicians.

5. Summary on the Mission for Next Step



(3)　第 2 回 JCC

MINUTES OF MEETING
FOR
THE SECOND JOINT COORDINATION COMMITTEE (JCC)
ON
THE PROJECT FOR CAPACITY DEVELOPMENT FOR OPERATION AND MAINTENANCE OF THERMAL POWER STATIONS
BETWEEN
THE JAPAN INTERNATIONAL COOPERATION AGENCY
AND
THE GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH

Japan International Cooperation Agency (hereinafter referred to as "JICA") and the Government of the People's Republic of Bangladesh (hereinafter referred to as "GoB") established a Joint Coordination Committee (hereinafter referred to as "JCC") for the effective and successful implementation of the Project for Capacity Development for Operation and Maintenance of Thermal Power Stations (hereinafter referred to as "the Project").

The second JCC on the Project was held on 6th August 2019, at Power Division, Ministry of Power, Energy, and Mineral Resources (hereinafter referred to as "MoPEMR"), Dhaka, chaired by Mr. Mohammad Alauddin, Joint Secretary (Renewable Energy), Power Division. As a result of discussions in the 2nd JCC Meeting, the Japan side and Bangladesh side have confirmed the main items described in the Annex.

Dhaka, 6th August 2019

Hiroki Hirahata
JICA Expert / Chief Advisor

Mohammad Alauddin
Joint Secretary (Renewable Energy)
Power Division
Ministry of Power, Energy, and Mineral Resources

ANNEX

1. Progress of the Project

The JICA Expert Team has explained the Work Flowchart, the progress made after the first follow up survey (hereinafter referred to as “the Mission”) including the second training courses in Japan implemented from February to May 2019, and the upcoming activities based on Attachment 2.

The JICA Expert Team requested close collaboration from the Bangladesh 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 Bangladesh side acknowledged the contents of the explanation and agreed to meet the request from the JICA Expert Team.

2. Result of the Mission

(1) Outline of the Mission

The JICA Expert Team implemented its third mission on Bangladesh from 25th July to 6th August 2019, to achieve the below purposes;

- ü Reviewing O&M training activity at TPPs implemented by JICA-trained engineers & technicians.
- ü Grasping the current situation of O&M at TPPs and identifying the O&M training needs, through discussion on the issue analysis,
- ü Suggesting 3rd O&M training program in Japan scheduled in November to December 2019 and the selection criteria for engineers & technicians, and achieving mutual agreement on them,
- ü Suggesting brand-new HRD (Human Resource Development) training in Japan scheduled in December 2019 and the selection criteria for managements achieving mutual agreement on them.

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

(2) Result of the interview of the Head Office and the review of Action Plan Implementation

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

(Result of the review of Action Plan Implementation)

- ü JICA-trained engineers & technicians implemented their Action Plan as previously arranged with active support from management, and a series of their dissemination activities can help to improve the O&M capacity at TPPs.
- ü Safety culture is now being improved through implementation of Action Plan such as 4S activity (Sort, Set in order, Shine and Standardize) activities and TBM (Tool Box Meeting).
- ü JICA-trained engineers & technicians told that they fully utilize training materials provided by JICA Expert Team, and that the practical subject like “pump alignment” was especially useful among the

training course in Japan because they can utilize the knowledge and skills directly to their work.

- ü Engineers started to keep the record of accidents and incidents, and technicians make tools, jigs and consumables lists when repairing. These lists can help to save the time in the next same repairing. And now they are storing these lists.

(Result of the review of current situation)

- ü There is probably room for improving HRD more effectively & more systematically while having some induction course and evaluation system for their promotion such as examination & interview.
- ü Although each power generation company implements its annual HRD plan with existing training centers in BPDB & APSCL, it seems to be limited to lecture style without practical training.

- ü In some TPPs, it seems to be substantially depending on only OJT because no educational system enable them to enhance their knowledge & skills.

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

JICA Expert Team conducted Issue Analysis as main topic at 2nd batch O&M training in Japan.

For the purpose of realizing proper maintenance of TPPs, considering each difference between ideal & actual conditions item by item, every participant tried to clarify the countermeasures through internal discussion while being supported by JICA Expert Team.

In the Mission JICA Expert team reconfirmed Issue Analysis and discussed current situation.

As conclusion, there are no formalized information sharing system for trouble, measures and safety information. They only share such kind of information personally, but certain company is now installing the computerized sharing system to comprehensively manage the necessary information. And training program is focusing on mainly theoretical subject and not practical one.

JICA Expert Team would like to request Bangladesh side for the further understanding and continuous support for Action Plan implemented by JICA-trained engineers & technicians.

- ü Coordinating Engineers/Technicians work to implement their Action Plan as planned.
- ü Preparing training equipment required for Action Plan implementation.

(4) Suggestion of Training target

The JICA Expert Team explained more suitable O&M condition through the Mission as follows.

- ü Training on mechanical is more prioritized than electrical and I&C, considering aging impact on O&M quality and cost in the near future.

- ü For realizing more effective capacity building for O&M at TPPs, management in charge of HRD is strongly expected to participate in brand-new 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 8th to 14th December 2019 for Management, from 17th November to 21st December 2019 for Engineer, and from 17th November to 14th December 2019 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 Bangladesh.	Utilizing **actual condition** in Bangladesh on HRD issue analysis.
Visit on KANSAI's Headquarters	To grasp KANSAI's HRD basic concept and the latest TPPs technology.	Suggesting **an example of ideal condition** (HRD basic concept) on HRD issue analysis.
Site Visit on KANSAI's GTC TPP	To grasp the latest condition and how to manage the latest GTCC directly.	Suggesting **an example of ideal condition** (TPPs) on HRD issue analysis.
Site Visit on Training Center (For Technician)	To grasp roles & responsibilities of T/C directly and encourage technicians during next O&M training in Japan.	Suggesting **an example of ideal condition** (T/C for technicians) on HRD issue analysis.
Site Visit on Training Center (For Engineer)	To grasp roles & responsibilities of T/C directly and encourage engineers during next O&M training in Japan.	Suggesting **an example of ideal condition** (T/C for engineers) on HRD issue analysis.
HRD Issue Analysis	To analyze current issues & causes related to HRD in Bangladesh	Considering **each difference between actual/ideal conditions** item by item, and identifying **the countermeasure.**
Action Plan Presentation	To make effective action plan to improve HRD situation in Bangladesh	Implementing action plan as scheduled.

(For Engineer and Technician)

	Engineer	Technician
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	
Mechanical Maintenance	Maintenance of GTCC	General System and Outline of GTCC
	Remaining Life Assessment (advanced)	Maintenance of High Temperature and High Pressure Piping
	Feed Water Treatment	Overhauling Rotary Pumps (modifying **more practical**)
	Basic Training of Vibration (Balancing)	**Vibration and Balancing**
	Non-Destructive Inspection	Metal Material
	Welding Quality Management in Japan (inc. Welding Defect)	Basics of Non-Destructive Inspection Skills
		Welding Procedure Management
Site Visit	Site Visit on TPP (inc. observing actual overhaul work)	Site Visit on TPP (inc. observing actual overhaul work)
	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 both sides agreed on the purpose of the training subjects/agendas. The Bangladesh side confirmed that the capacity development on these aspects get into alignment with policy of the Bangladesh side on HRD of O&M staff of TPP.

(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	**Max 7 persons** who are dispatched from these counterparts: **Power Division (MoPEMR), BPDB, EGCB, NWPGCL, APSCL, CPGCBL and RPCL respectively**
Training Term	**About 1 week**
Current Duties	Be a management level officer who are closely related to **the above-mentioned HRD training program.**
Required Condition	Be a management level officer who has **sufficient technical background**, can formulate **the effective Action Plan** and willing to / have an authority to make a substantial contribution to **improving HRD at TPPs from a technical viewpoint.**
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)

Items	Qualification (Engineer)	Qualification (Technician)
Number	**8 persons*1**	**8 persons*1**
Training Term	About 5 weeks	**About 4 weeks**
Current Duties	Be a leading engineer working on thermal power plants, and has expertise related to **mechanical 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 **mechanical 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.	

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 Bangladesh
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 mechanical expertise, or candidates for these posts are most welcomed.

*1: Each power generation company is expected to apply at least one engineer and one technician as next participants.
*2: Lecture will be made in Japanese and translated to English or Bengal. 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 of engineers and technicians are expected to make Action Plans described above to improve capacity of O&M of TPP. In this regard, Japan side requested the Bangladesh side to nominate participants who are capable of drafting Action Plans and also disseminating their knowledge and skills to other colleagues in each TPP.
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 TPP. In this regard, Japan side requested the Bangladesh side to nominate participants who are in charge of HRD and also restructuring their HRD structure in each company.

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 10th September 2019, assuming that GI from JICA Expert Team shall be issued by 22nd August 2019. After the nomination from the Bangladesh side, the Japan side will confirm the participants for the second training within 1 week.

6. Project Monitoring Sheet

The both sides confirmed the contents of the Project Monitoring Sheet Ver. 3 as Attachment 3.

7. Monitoring Indicator

Regarding Project Design Matrix (PDM) agreed on the Record of Discussion, 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. 3, which is planned on September 2019.

Owing to not only positive training activities by JICA-trained participants but also effective support from management, the both sides recognized that the Project could make steady progress as scheduled.

Attachment 1 Attendance list in the 2nd JCC
Attachment 2 Presentation Materials
Attachment 3 Project Monitoring Sheet Ver. 3(drafted)
Attachment 4 Minutes of Meetings during the Mission.

বিদ্যুৎ, জ্বালানি ও খনিজ সম্পদ মন্ত্রণালয়
বিদ্যুৎ বিভাগ, পরিকল্পনা-২ শাখা

A meeting of the Joint Coordination Committee (JCC) on "Project for Capacity Development for Operation and Maintenance of Theramal Power Stations"

Venue: Conference Room of Power Division (Room # 1116, Level # 11) Bidyut Bhaban, Ramna, Dhaka)

Date: 06/04/2019
Time: 10.00 am.

Participant List

Sl No.	Name of the Participant	Designation & Organization	Mobile/Phone E-mail	Signature
1	Shah Md. Helal Uddin Deputy Chief Power Div.	[redacted]	[redacted]	
2			[redacted]	
3			[redacted]	
4	Hiroki Hirahata	JICA Expert Team Kansai Electric	[redacted]	平畑 弘樹
5	Akira Kozakai	JICA Expert Team Kansai Electric	[redacted]	小堺 瑛
6	Yoshihiro Doi	JICA Expert Team Kansai Electric	[redacted]	Yoshi Doi
7	Hidenobu Ichioka	JICA Expert team Kansai Electric	[redacted]	一岡栄喜
8	Kamal Hossain	Manager-HR RPCL	[redacted]	Kamal
9	MUHAMMAD MATIUR RAHMAN	MANAGER (HRM) CPGCBL	[redacted]	MRahman
10	Md. Abdur Rouf	Executive Director (Project) CPGCBL	[redacted]	

Participant List

Sl No.	Name of the Participant	Designation & Organization	Mobile/Phone E-mail	Signature
11	MD. MAHBUB KABIR	CE B-R Powergen Ltd.	[redacted]	
12	M. Mahmudur Rahman Mahid	Dy Director (XEN) BPDB		
13	KSHITISH CHANDRA BISWAS	APSCL		06/08/19.
14	Ahmad Mukammelul Haq	Principal Program Manager, JICA		
15	Ibrahim Ahmad Shafi Al Mohtad	SE (P&D) EGCB Ltd.		
16	Md. Anamul Haque	DGM(HR)		
17				
18				
19				
20				

SURVEY REPORT and NEXT ACTION

August 2019

Japan International Cooperation Agency (JICA)

The Kansai Electric Power Co., Inc.

Contents

1. **Project Summary**
2. Action Plan Implementation based on O&M Issue Analysis at TPPs
3. O&M Training in Japan for Engineer & Technician
4. HRD Training in Japan for Management
5. Summary on the Mission for Next Step

1. Project Summary: Capacity Building for O&M at TPPs

This JICA project aims to implement capacity building for O&M (Operation and Maintenance) at TPPs (Thermal Power Plants), in order to make continuous technical support for Bangladesh side.

Project Purpose

Overall Goal	Capacity of O&M of TPPs is strengthened.
Project Goal	Training capacity on O&M of TPPs is strengthened.

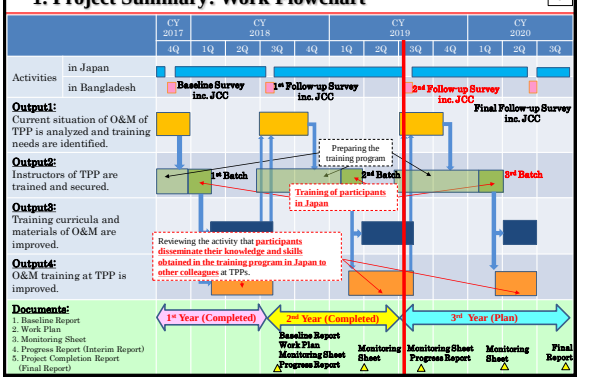
Project Output

Output 1	Current situation of O&M of thermal power stations is analyzed and training needs are identified.
Output 2	Instructors of TPP are trained and secured.
Output 3	Training curricula and materials of O&M are improved.
Output 4	O&M training at TPP is improved.

1. Project Summary: Capacity Building for O&M at TPPs

Targeted Type of Power Generation	Gas Turbine Combined Cycle (GTCC) ※Lecture on general introduction regarding coal fired power generation including advanced environmental practices in Japan
Project Sites	BPDB, EGCB, NWPGCL, APSCL, CPGCBL and RPCL's Thermal Power Plants (TPPs) in Dhaka and its suburbs
Counterpart	Power Division, Ministry of Power, Energy and Mineral Resources (MoPEMR) Bangladesh Power Development Board (BPDB) Electricity Generation Company of Bangladesh Limited (EGCB) North West Power Generation Company Limited (NWPGCL) Ashuganj Power Station Company Limited (APSCL) Coal Power Generation Company of Bangladesh Limited (CPGCBL) Rural Power Company Limited (RPCL)
Beneficiaries	O&M engineers and technicians who will be the core instructors to conduct trainings in each TPPs and/or Training Centers under public utilities
Duration	October 2017 – September 2020 (3 years)

1. Project Summary: Work Flowchart



1. Project Summary: Objective of 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 identifying **the O&M training needs,** through discussion on the issue analysis.
- ✓ Suggesting **next O&M training in Japan** and the selection criteria **for engineers & technicians**: 3rd Batch, NOV/DEC in 2019.
- ✓ Suggesting **brand-new HRD (Human Resource Development) training in Japan** and the selection criteria **for management**: DEC in 2019.

1. Project Summary: 2nd Follow-up Survey

Date		Events		
25-July	Thu.	Dhaka	Kick off Meeting	All members
28-July	Sun.	Sirajganj CCPP	Meeting with management and JICA-trained participants (engineers & technicians)	NWPGCL
29-July	Mon.	BPDB HQ		BPDB
30-July	Tue.	Ashuganj Site		APSCL
31-July	Wed.	NWPGCL HQ		NWPGCL
1-August	Thu.	EGCB HQ		EGCB
		CPGCBL HQ		CPGCBL
4-August	Sun.	RPCL HQ		RPCL
6-August	Tue.	Dhaka	JCC	All members

Counterpart	Agenda
Management	➢ Presentation (especially next O&M/HRD training in Japan and the selection criteria). ➢ General discussion on further technical contribution from JICA Expert Team (if any).
JICA-trained engineers JICA-trained technicians	➢ Reviewing the training activity at TPPs implemented by JICA-trained participants. ➢ 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 : Capacity of O&M of Thermal Power Plants (TPP) is strengthened.	✓ O&M action plans are prepared and regularly updated in order to improve O&M through action plans.	✓ JICA Expert Team (JET) has **reviewed action plan implementation by JICA-trained participants.**
Project Goal : Training capacity on O&M of Thermal power stations is strengthened.	✓ Number of improved and/or new training courses regularly operated for O&M at targeted TPP.	✓ **125 improved/new training courses at TPPs** as of July, 2019 (NDI, vibration analysis, safety, pump alignment & tool box meeting).
	✓ Number of assigned trainers who were trained and conduct training (in total).	✓ **20 engineers & 20 technicians** trained in Japan for dissemination to other colleagues at TPPs.
Output 1 : Current situation of O&M of TPP is analyzed, and training needs are identified.	✓ Training needs are compiled based on the current situation.	✓ JET coordinated the training curricula based on current situation of TPPs and the training needs through Baseline, 1st and 2nd follow-up survey.
Output 2 : Instructors of TPP are trained and secured.	✓ Training program is prepared based on the training needs.	✓ Based on the training needs shown in Output1, JET prepared 1st & 2nd O&M training program in Japan.
	✓ Number of trained instructors.	✓ **20 engineers & 20 technicians** trained in Japan for dissemination to other colleagues at TPPs.
Output 3 : Training curricula and materials of O&M are improved	✓ Training curricula and materials of O&M are proposed and modified if necessary.	✓ They revised existing materials based on 1st & 2nd training in Japan and added new courses to their company's training curricula.
Output 4 : O&M training at TPP is improved.	✓ Number of training (OJTs) conducted at TPP.	✓ While they conducted **125 trainings for 562 engineers & 698 technicians at TPPs**, JICA Expert Team expects them to enhance training activities at TPPs.
	✓ Achievement level of action plans prepared by trained instructors.	✓ JET has **reviewed action plan implementation by JICA-trained participants.**

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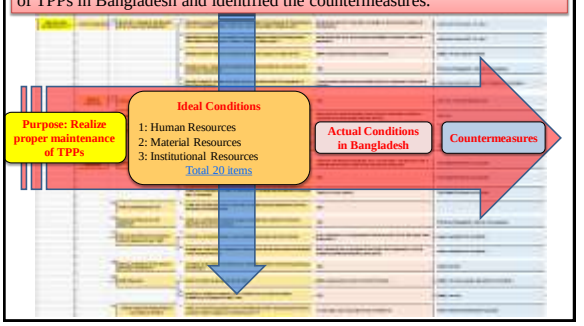
2. O&M Issue Analysis at TPPs: Basic Concept

Participants and JICA Expert Team comprehensively analyzed O&M issues of TPPs in Bangladesh and identified the countermeasures.



2. 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	NOV	DEC	2019 JAN	FEB	MARCH	APRIL	MAY	JUN	JUL	AUG	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	EMD	Why Service Life Evaluation is important	JIC As trained participant	TPP	Lecture	Textbook (provided by JICA) O&M Manual (provided by manufacturer)	Plan	No. of times													
												No. of participants													
											Result	No. of times													
												No. of participants													
			1-2	Main Deterioration Events and Their Mechanism of Deterioration	EB	What are the main damage factors How each damage factor causes what kind of damage on where	JIC As trained participant	TPP	Lecture	Textbook (provided by JICA) O&M Manual (provided by manufacturer)	Plan	No. of times													
												No. of participants													
											Result	No. of times													
												No. of participants													
			1-3	Service Life Diagnosis Methods	EB,EN	When & how to check the damage, according to the kinds of damage	JIC As trained participant	TPP	Lecture	Textbook (provided by JICA) Manual (provided by manufacturer)	Plan	No. of times													
												No. of participants													
											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	EB	How vibrations occur.	JIC As trained participant	TPP	Lecture	Textbook (provided by JICA)	Plan	No. of times													
												No. of participants													
											Result	No. of times													
												No. of participants													
			2-2	Analysis of Vibration	EMD	How to read and follow up the vibration trend and take actions	JIC As trained participant	TPP	Practical training	Textbook (provided by JICA)	Plan	No. of times													
												No. of participants													
											Result	No. of times													
												No. of participants													

2. Action Plan Implementation: Findings of the Mission

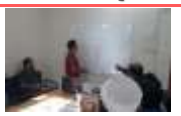
(Actual Conditions)

✓ JICA-trained engineers & technicians implemented their Action Plan **as previously arranged with active support from management**, and a series of their dissemination activities can help to **improve the O&M capacity at TPPs.**

✓ Safety culture is now being improved through implementation of Action Plan such as 4S (Sort, Set in order, Shine and Standardize) activities and TBM (Tool Box Meeting).

2. Action Plan Implementation: Findings of the Mission

13


Lecture Training at BPDB

Tool Box Meeting at APSCL

Lecture Training at EGCB

Meeting before repair work at NWPGCL

Training for maintenance personnel at RPCL

Lecture Training at CPGCBL

2. Action Plan Implementation: Findings of the Mission

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(Actual Conditions)

- ✓ JICA-trained engineers & technicians told that they fully utilize **training materials provided by JICA Expert Team**, and that **the practical subject like "pump alignment" was especially useful** among the training course in Japan because they can utilize the knowledge and skills directly to their work.
- ✓ **Engineers started to keep the record of accidents and incidents**, and **technicians make tools, jigs and consumables lists when repairing.** These lists can help to save the time in the next same repairing. And now they are storing these lists.

Recording format of accidents/incidents

Incident/accident	Emergency measure
When	Result of accident/ incident:
What	Countermeasure
Why	Signature

2. Action Plan Implementation: Findings of the Mission

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(Actual Conditions)

- ✓ There are **no formalized information sharing system** for trouble, measures and safety information. They only share such kind of information personally, but certain company is now installing the computerized sharing system to comprehensively manage the necessary information.
- ✓ Training program is **focusing on mainly theoretical subject and not practical one.**

(Suggestion from JICA Expert Team)

- ✓ JICA Expert Team would like to request Bangladesh side for **the further understanding and continuous support for Action Plan implemented by JICA-trained engineers & technicians**.
  - ➢ Coordinating Engineers/Technicians work to implement their Action Plan as planned.
  - ➢ Preparing training equipment required for Action Plan implementation.

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3. O&M Training in Japan: Important Assumption

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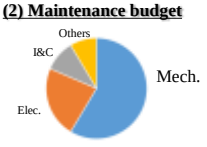
We suggest to focus on general contents, especially **Mechanical Maintenance** as next O&M training in Japan.

(1) Failure impact

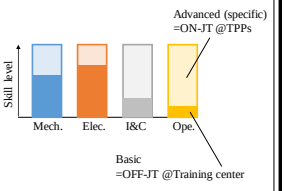
Mechanical ≒ Electrical > I&C

(except for the causes of miss operation)

(2) Maintenance budget



(3) ON-JT and OFF-JT



3. O&M Training in Japan: Training Program

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	Engineer	Technician
General	✓ Introduction of the latest technology in TPP (inc. USC) ✓ Experience-based Safety Training ✓ Human Resource Development ✓ Quality Management ✓ Thermal Efficiency Management ✓ Tool Box Meeting (for Safety) ✓ Lessons Learned from Accidents ✓ Human Error Prevention ✓ Effective Maintenance for Quality Electric Power Infrastructure	✓ Introduction of the latest technology in TPP (inc. USC) ✓ Experiential Safety Training ✓ Experiential Quality Training ✓ Prevention of Accidents and Disasters ✓ Occupational HSE (especially Safety) ✓ Tool Box Meeting (for Safety)
Mechanical Maintenance	✓ Maintenance of GTCC ✓ Remaining Life Assessment (advanced) ✓ Feed Water Treatment ✓ Basic Training of Vibration (Balancing) ✓ Non-Destructive Inspection ✓ Welding Quality Management in Japan (inc. Welding Defect)	✓ General System and Outline of GTCC ✓ Maintenance of High Temperature and High Pressure Piping ✓ Overhauling Rotary Pumps (modifying more practical) ✓ Vibration and Balancing ✓ Metal Material ✓ Basics of Non-Destructive Inspection Skills ✓ Welding Procedure Management
Site Visit	✓ Site Visit on TPP (inc. observing actual overhaul work) ✓ Site Visit on Manufacturer's factory	✓ Site Visit on TPP (inc. observing actual overhaul work) ✓ Site Visit on Manufacturer's factory
JICA Original	✓ Issue Analysis ✓ Methodology to Formulate Action Plan	✓ Issue Analysis ✓ Methodology to Formulate Action Plan

3. O&M Training in Japan: Selection Criteria

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Items	Qualification (Engineer)	Qualification (Technician)
Number	8 persons*1	8 persons*1
Training Term	About 5 weeks (NOV 17 to DEC 21)	About 4 weeks (NOV 17 to DEC 14)
Current Duties	Be a leading engineer working on thermal power plants, and has expertise related to mechanical 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 mechanical 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: Each power generation company is expected to apply at least one engineer and one technician as next participants.

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

3. O&M Training in Japan: Selection Criteria

20

Items	Qualification (Engineer)	Qualification (Technician)
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 Bangladesh	
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	

Notice:

- For efficient dissemination of the knowledge, instructors in Training Centers with mechanical expertise, or candidates for these posts are most welcomed.

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4. HRD Training in Japan: Findings of the Mission

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Our understanding about current HRD in Bangladesh

(For Engineers)

✓ **There is probably room for improving HRD more effectively & more systematically** while having some induction course and evaluation system for their promotion such as examination & interview.

✓ Although each power generation company implements its annual HRD plan with existing training centers in BPDB & APSCL, **it seems to be limited to lecture style without practical training.**

(For Technicians)

✓ In some TPPs, it seems to be **substantially depending on only OJT** because no educational system enable them to enhance their knowledge & skills.

Suggestion from JICA Expert Team

✓ For realizing more effective capacity building for O&M at TPPs, **management in charge of HRD** is strongly expected to participate in brand-new **HRD training in Japan** and recognize the issue to be solved.

4. HRD Training in Japan: Training Program

23

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 Bangladesh.	Utilizing actual condition in Bangladesh on HRD issue analysis.
Visit on KANSAI's Headquarters	To grasp KANSAI's HRD basic concept and the latest TPPs technology.	Suggesting an example of ideal condition (HRD basic concept) on HRD issue analysis.
Site Visit on KANSAI's GTCC Power Station	To grasp the latest condition and how to manage the latest GTCC directly.	Suggesting an example of ideal condition (TPPs) on HRD issue analysis.
Site Visit on Training Center (For Technician)	To grasp roles & responsibilities of T/C directly and encourage technicians during next O&M training in Japan.	Suggesting an example of ideal condition (T/C for technicians) on HRD issue analysis.
Site Visit on Training Center (For Engineer)	To grasp roles & responsibilities of T/C directly and encourage engineers during next O&M training in Japan.	Suggesting an example of ideal condition (T/C for engineers) on HRD issue analysis.
HRD Issue Analysis	To analyze current issues & causes related to HRD in Bangladesh.	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 Bangladesh.	Implementing action plan as scheduled.

4. HRD Training in Japan: Selection Criteria

24

Items	Qualification (Management)
Number	Max 7 persons who are dispatched from these counterparts: Power Division (MoPEMR), BPDB, EGCB, NWPGCL, APSCL, CPGCBL and RPCL respectively
Training Term	About 1 week (DEC 8 to DEC 14)
Current Duties	Be a management level officer who are closely related to the above-mentioned HRD training program.
Required Condition	Be a management level officer who has sufficient technical background, can formulate the effective Action Plan and willing to / have an authority to make a substantial contribution to improving HRD at TPPs from a technical viewpoint.
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.

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5. Summary on the Mission for Next Step

✓ **Request for Next Step:**

Giving any comments from Bangladesh side for MoM **by AUG 15, 2019** especially,

- O&M and HRD training program in Japan.
- Each selection criteria for next participants.

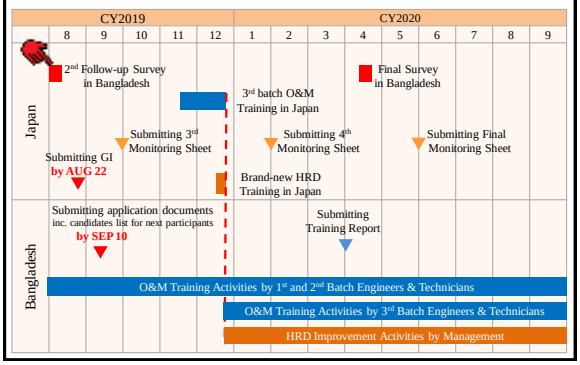
✓ **Undertaking by Bangladesh Side:**

- Submitting application documents inc. candidates list for next participants **by SEP 10, 2019.**
- Supervising and reporting O&M training activities at TPPs implemented by JICA-trained engineers & technicians (by TPP manager).
- Implementing HRD improvement activities at TPPs.

✓ **Undertaking by Japan Side:**

- Submitting GI about O&M and HRD training in Japan **by AUG 22, 2019.**
- Conducting O&M and HRD training in Japan **(NOV/DEC, 2019).**
- Reviewing action plan implemented by JICA-trained participants.

5. Summary on the Mission for Next Step



(4)　第 3 回 JCC

MINUTES OF MEETING
FOR
THE THIRD JOINT COORDINATION COMMITTEE (JCC)
ON
THE PROJECT FOR CAPACITY DEVELOPMENT FOR OPERATION AND MAINTENANCE OF THERMAL POWER STATIONS
BETWEEN
THE JAPAN INTERNATIONAL COOPERATION AGENCY
AND
THE GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH

The Japan International Cooperation Agency (hereinafter referred to as "JICA") and the Government of the People's Republic of Bangladesh (hereinafter referred to as "GoB") established a Joint Coordination Committee (hereinafter referred to as "JCC") for the effective and successful implementation of the Project for Capacity Development for Operation and Maintenance of Thermal Power Stations (hereinafter referred to as "the Project").

The third JCC on the Project was held on 22nd October 2020, through video conference, chaired by Mr. Rahamat Ullah Mohd. Dastagir, Additional Secretary (Planning), Power Division, Ministry of Power, Energy, and Mineral Resources (hereinafter referred to as "MoPEMR"). As a result of discussion in the third JCC Meeting, the Japanese side and the Bangladesh side have confirmed the main items described in the Annex.

Signed this (DD/MM/YYYY) : 26 / 11 / 2020

Mr. Habara Hidefumi
JICA Expert / Chief Advisor

Mr. Rahamat Ullah Mohd. Dastagir
Additional Secretary
Power Division
Ministry of Power, Energy, and Mineral Resources

Mr. YUZURIO Susumu
Senior Director
Energy and Mining Group
Infrastructure Management Division
Japan International Cooperation Agency

ANNEX

1. Achievement of the Project

The JICA Expert Team explained the achievement of the Project using presentation report as attachment 2. Both sides agreed that the project purpose have almost achieved considering evaluation indicators such as number of improved new training courses and number of trainers. However, the output 4, the improved operation and maintenance (hereinafter referred to as "O&M") training courses at thermal power stations, 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 56% 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 however, there found to be some delays.

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 Bangladesh sides, made utmost efforts to continue their activities remotely after this March, some of them found it difficult to conduct as planned.

Both sides confirmed that it is necessary for the management of thermal power plants (hereinafter referred to as "TPP") to create enabling environment, in terms of staffs, finance, and equipment and facilities, for properly implement the Action Plan as planned in a systematic manner in order to further strengthen the training capacity on O&M of TPPs.

For this purpose, the participants of the 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. Bangladesh side confirmed the contents.

(1) Actual Conditions

- ✓ Before the pandemic of Covid-19, JICA-trained engineers & technicians implemented their Action Plan as previously arranged with active support from management, and a series of their dissemination activities can help to improve the O&M capacity at TPPs.
- ✓ Safety and Quality culture is being improved through implementation of Action Plan such as 4S (Sort, Set in order, Shine and Standardize) activities and TBM (Tool Box Meeting).
- ✓ JICA-trained engineers & technicians told that they fully utilized

training materials provided by JICA Expert Team, and that the practical subject like "pump alignment" was especially useful among the training course in Japan because they can utilize the knowledge and skills directly to their work.

- ✓ Recently, due to the response to the Covid-19, it became difficult for JICA-trained engineers & technicians to implement their Action Plan. However, one JICA-trained engineer conducted online class on GTCC O&M, safety and 5S methodology for his colleagues.

(2) Request from the Project Team (JICA-trained participants and JCC members)

- ✓ The JICA Expert Team requested the chair of the JCC, Additional Secretary (Planning) of MoPEMR Power Division, for the further understanding and continuous support for Action Plan implemented by JICA-trained engineers & technicians.
  - ➢ Coordinating the engineers/technicians' works to implement their Action Plan as planned.
  - ➢ Preparing training equipment required for Action Plan implementation.
- ✓ The Project Team from the Bangladesh side suggested that additional training to complement the action plan implementation in Bangladesh affected by the Covid-19 as follows:
  - ➢ Training course of other subject (e.g. electrical maintenance)
  - ➢ Training Course of more practical skills (Root Cause Analysis, Maintenance Scheduling Method, etc.) focusing on specific power generation type, fuel type, etc.
- ✓ JICA-trained participants explained the effects and usefulness of the Project and expressed the need for further training courses to further strengthen the capacity on O&M of TPPs.

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 TPPs as follows. Bangladesh confirmed the contents.

(1) The JICA Expert Team comprehensively analyzed the O&M issues of TPPs in Bangladesh 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 with O&M training course in Japan and their Action Plan.

(3) On the other hand, JICA Expert Team recognize that, through reviewing the Project achievement, the following points need to be improved.

- ✓ Since trainings in Japan were mainly focused on general contents of thermal power generation and its mechanical maintenance subjects, there is still room for improvement in;
  - ➢ Basic skills & knowledge of electrical and Control and Instrumentation (hereinafter referred to as "C&I") maintenance
  - ➢ 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 TPPs in Bangladesh. Bangladesh confirmed the contents.

   (1) Technical Training in Japan
   - ✓ Training Course of electrical and C&I maintenance
   - ✓ 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.

   The JICA Expert Team proposed conducting additional training course based on the further training needs from Bangladesh side, and explained that the training could also complement the Action Plan implementation in Bangladesh affected by the Covid-19. Both sides agreed to amend the Record of Discussion to conduct the additional training accordingly.

5. Conclusion

   Based on the implementation of the capacity development project for O&M at TPPs for around 3 years, the JICA Project Team concluded that the Project is practical and effective to improve O&M capacity. They suggested that the Bangladesh side implement the Action Plan for further improvement of O&M at TPPs with strong support from their management.

   The Project Team and the Chairperson of the JCC also confirmed the necessity of additional training components mentioned above for complementing delays and deficit of output originally planned due to the Covid-19.

Attachment 1	Attendance list in the third JCC
Attachment 2	Presentation Materials (including Project Evaluation and Additional Training Proposal)
Attachment 3	Project Monitoring Sheet Ver. 5 (drafted)

Attendance List

A meeting of the Joint Coordination Committee (JCC) on "Project for Capacity Development for Operation & Maintenance of Thermal Power Stations"

Date: 22nd October, 2020

Time: 3:00 pm (BST)

Method: Microsoft Teams Web Conference

No.	Name	Position	Company
1	Rahamat Ullah Mohd. Dastagir	Additional Secretary (Planning), Chair person of JCC	MoPEMR Power Division
2	Dr. Shah Md. Helal Uddin	Joint Secretary (Planning-1), Focal Point	MoPEMR Power Division
3	Tania Khan	Joint Secretary (Planning-2), Participant of HRD training	MoPEMR Power Division
4	Muhammad Chishty Asheque	Assistant Chief	MoPEMR Power Division
5	Ibrahim Ahmad Shafi	Chief Engineer (P&D), Focal Point	EGCB
6	Atiqur Rahman	Manager (HR), Participant of HRD training	EGCB
7	Al Obyed Bin Ahmed	SDE, Siddhirganj 335MW CCPP, Participant of 1st training	EGCB
8	Kamal Hossain	Deputy General Manager (HR&Admin), Focal Point	RPCL
9	Mohammad Ashikur Rahman	Manager (Training), Participant of HRD training	RPCL
10	Md. Anamul Haque	Deputy General Manager (HR), Focal Point, Participant of HRD training	NWPGCL
11	Md. Abu Zafar Siddique	Executive Engineer (XEN), Khulna 225 MW CCPP, Participant of 1st training	NWPGCL
12	Md. Mahmudul Hasan	XEN, Khulna 225 MW CCPP, Participant of 2nd training	NWPGCL

Attendance List

No.	Name	Position	Company
13	Shamsur Rahman	XEN, Sirajganj 225 MW CCPP, Participant of 1st training	NWPGCL
14	Md. Habibur Rahman	XEN, Sirajganj 225 MW CCPP, Participant of 2nd training	NWPGCL
15	Pijush Bhattacharjee	XEN, Bheramara 410 MW CCPP, Participant of 3rd training	NWPGCL
16	Abul Kalam Azad	Executive Director (Project), Focal Point	CPGCBL
17	Muhammad Matiur Rahman	Deputy General Manager (HR&Admin), Participant of HRD training	CPGCBL
18	Md. Abdus Satter Miah	Director Training (Superintending Engineer)	BPDB
19	Md. Zahurul Islam	Manager, Ghorashal CCPP, Participants of HRD training	BPDB
20	MAHMUD Mohammad Mahmudur Rahman	Deputy Director (XEN), Focal Point, Participant of 1st training	BPDB
21	BISWAS Kshitish Chandra	Executive Director (Planning & Development), Participant of HRD training	APSCL
22	Md. Shah Alam Khan	Chief Engineer, Focal Point	APSCL
23	Yuzurio Susumu	Senior Director	JICA Headquarters
24	Konishi Hideaki		JICA Headquarters
25	Okada Yuka		JICA Headquarters
26	Hirata Koichi	Representative	JICA Bangladesh Office
27	Ahmad Mukammeluddin	Principal Program Manager	JICA Bangladesh Office
28	Habara Hidefumi	JICA Expert Team	Kansai Electric

Attendance List

No.	Name	Position	Company
29	Yoshitake Shigeru	JICA Expert Team	Kansai Electric
30	Doi Yoshihiro	JICA Expert Team	Kansai Electric
31	Kozakai Akira	JICA Expert Team	Kansai Electric
32	Obe Yuki	JICA Expert Team	Kansai Electric
33	Ichioka Hidenobu	JICA Expert Team	Kansai Electric

THE PROJECT FOR CAPACITY DEVELOPMENT FOR OPERATION AND MAINTENANCE OF THERMAL POWER STATIONS IN PEOPLE'S REPUBLIC OF BANGLADESH

1

OVERVIEW of INTERIM REPORT (Drafted)

October 2020

Japan International Cooperation Agency (JICA)

The Kansai Electric Power Co., Inc.

Contents

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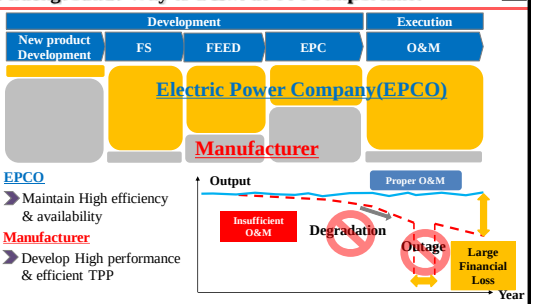
1. **Background: Why is O&M at TPPs important?**
2. Project Summary
3. O&M Training in Japan
4. Action Plan Implementation
5. Issue Analysis of O&M in TPP
6. KANSAI's Technical Proposal
7. Conclusion

1. Background: Why is O&M at TPPs important?

3



- ✓ EPCO plays an important role for TPP Project, **especially in O&M phase**.
- ✓ **Without proper O&M at TPPs, degradation and forced outages could cause large financial loss** even installing the high-efficiency equipment.

1. Background: Why is O&M at TPPs important?

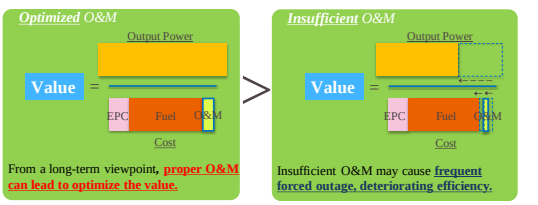
4

➢ *What value does EPCO create?*

$$\text{Value} = \frac{\text{Output}}{\text{Input}} = \frac{\text{Output Power (kWh)}}{\text{Cost ($)}}$$

[=CAPEX+ OPEX (Fuel, O&M)]

➢ *Why is proper O&M at TPPs important?*



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2. Project Summary: Capacity Building for O&M at TPPs

6

This JICA project aims to implement capacity building for O&M (Operation and Maintenance) at TPPs (Thermal Power Plants), in order to make continuous technical support for Bangladesh side.

Project Purpose

Overall Goal	Capacity of O&M of TPPs is strengthened.
Project Goal	Training capacity on O&M of TPPs is strengthened.

Project Output

Output 1	Current situation of O&M of thermal power stations is analyzed and training needs are identified.
Output 2	Instructors of TPP are trained and secured.
Output 3	Training curricula and materials of O&M are improved.
Output 4	O&M training at TPP is improved.

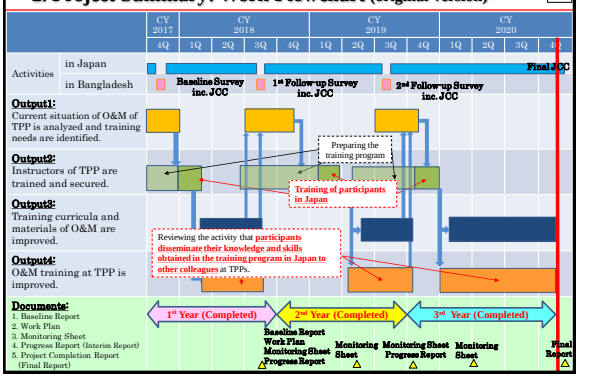
2. Project Summary: Capacity Building for O&M at TPPs

7

Targeted Type of Power Generation	Gas Turbine Combined Cycle (GTCC) ※Lecture on general introduction regarding coal fired power generation including advanced environmental practices in Japan
Project Sites	BPDB, EGCB, NWPGCL, APSCL, CPGCBL and RPCL's Thermal Power Plants (TPPs) in Dhaka and its suburbs
Counterpart	Power Division, Ministry of Power, Energy and Mineral Resources (MoPEMR) Bangladesh Power Development Board (BPDB) Electricity Generation Company of Bangladesh Limited (EGCB) North West Power Generation Company Limited (NWPGCL) Ashuganj Power Station Company Limited (APSCL) Coal Power Generation Company of Bangladesh Limited (CPGCBL) Rural Power Company Limited (RPCL)
Beneficiaries	O&M engineers and technicians who will be the core instructors to conduct trainings in each TPPs and/or Training Centers under public utilities
Duration	October 2017 – October 2020 (3 years)

2. Project Summary: Work Flowchart (original version)

8



2. Project Summary: Achievement of the Project (1/2)

9

Items	Monitoring Indicators	Achievement
Overall Goal : Capacity of O&M of Thermal Power Plants (TPP) is strengthened.	✓ O&M action plans are prepared and regularly updated in order to improve O&M through action plans.	✓ Through the implementation of the Action Plans, their dissemination activities **enhanced the basic technical & safety knowledge of the O&M staff of TPPs, reduced accidents at TPPs, and improved the O&M quality of the O&M staff of TPPs.**
Project Purpose : Training capacity on O&M of Thermal power stations is strenghened.	✓ Number of improved and/or new training courses regularly operated for O&M at targeted TPP.	Project Purpose has been achieved as follows. However, it is necessary to implement the Human Resource Development (HRD) Action Plan by management as planned in order to further strengthen the training capacity on O&M of TPPs. ✓ According to the regular training reports from the participants trained in Japan (28 engineers & 28 technicians), they **conducted 236 improved/new trainings for 2,661 O&M personnel at TPPs (in total).**
	✓ Number of assigned trainers who were trained and conduct training (in total).	✓ **28 engineers and 28 technicians** trained in Japan for dissemination to other colleagues at TPPs. The participants in respective trainings answered that they had almost achieved the training objective.
Output 1 : Current situation of O&M of TPP is analyzed, and training needs are identified.	✓ Training needs are compiled based on the current situation.	Output 1 has been achieved as follows. ✓ JET analyzed the current situation of O&M and training system at TPPs through 3 times of field surveys and interviews with participants trained in Japan. ✓ Based on these analysis results, JET confirmed the training needs of each technical level and proposed the training needs to Bangladesh side.
Output 2 : Instructors of TPP are trained and secured.	✓ Training program is prepared based on the training needs.	Output 2 has been achieved as follows. ✓ Based on the analysis of training needs shown in Output 1, JET prepared the training program which were held 3 times in Japan.

2. Project Summary: Achievement of the Project (2/2)

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Items	Monitoring Indicators	Achievement
Output 2 : Instructors of TPP are trained and secured.	✓ Number of trained instructors.	✓ **28 engineers and 28 technicians** were trained as expected instructors in the trainings in Japan.
Output 3 : Training curricula and materials of O&M are improved	✓ Training curricula and materials of O&M are proposed and modified if necessary.	Output 3 has been achieved as follows. ✓ The curricula and teaching materials for O&M training at TPPs have been improved as follows. • The trainings to be implemented by the participants were incorporated into the annual training program in some public utilities. • The training courses that had never been included in the training curriculum at each public utility were provided, such as Non-destructive Inspection, Pump Alignment and Fault Tree Analysis. • Most of the trainings were performed with utilizing the training materials provided by JET. • Some of the trainings were performed using training materials created by the participants based on training materials provided by JET.
Output 4 : O&M training at TPP is improved.	✓ Number of training (OJTs) conducted at TPP.	Output 4 has been achieved as follows **except for the unimplemented Action Plans by some participants (incl. management) due to Covid-19 pandemic**. ✓ According to the regular training reports from the participants trained in Japan (28 engineers & 28 technicians), they **conducted 236 improved/new trainings for 2,661 O&M personnel at TPPs (in total).**
	✓ Achievement level of action plans prepared by trained instructors.	✓ It seems that 44% of the trained instructors were able to implement the Action Plan as planned. **The remaining 56% of instructors seemed to be able to implement only partial Action Plans due to Covid-19 pandemic** and busy work. ✓ **Implementation of the HRD Action Plan by management is currently in progress.**

2. Project Summary: Project Evaluation (1/3)

11

Evaluation based on DAC (Development Assistance Committee) Evaluation Criteria

Criteria	Evaluation Results
Relevance	✓ **High** ✓ In the public power generation companies of Bangladesh, **it is an urgent task to efficiently operate and maintain gas-fired power generation**, which is consistent with the goal of the Project. ✓ 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 plants.** ✓ The Project is consistent with Japanese Official Development Assistance (ODA) policy for Bangladesh.
Effectiveness	✓ **High** ✓ Achievement of Project Outputs - **The Output 1 to 3 have been achieved.** As for the Output 4, there are the unimplemented Action Plans by some participants (incl. management) due to Covid-19 pandemic so far, but **the trainings conducted by the participants were highly evaluated, so it is considered that Output 4 has been mostly achieved.** ✓ 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 TPPs, so it is considered that the Project Purpose has been achieved.** ✓ 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 an average of 10.3 colleagues beyond the target of 10** in the Project.

2. Project Summary: Project Evaluation (2/3)

12

Evaluation based on DAC (Development Assistance Committee) Evaluation Criteria

Criteria	Evaluation Results
Impact	✓ **High** ✓ **Improvements of training capacity on O&M at TPPs have been confirmed.** In addition, as per the questionnaire surveys for management and participants, **improvements of O&M performance at TPPs have already been confirmed.** Therefore, **it is highly possible that Overall Goal will be achieved.** ✓ 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 TPPs.**
Efficiency	✓ **Relatively High** ✓ As for the inputs of the Japanese side, **the dispatch of the Japanese experts was not conducted as planned** due to the interruption of the 2nd survey (the 1st follow-up survey) and 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.** **The inputs of the Bangladesh side were carried out as planned.** ✓ 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.

2. Project Summary: Project Evaluation (3/3)

Evaluation based on DAC (Development Assistance Committee) Evaluation Criteria

Criteria	Evaluation Results
Sustainability	✓ **Relatively High** ✓ 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. ✓ 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 in order to enhance sustainability.** ✓ Implementation of the HRD Action Plan by management is currently in progress.

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3. 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.

3. O&M Training in Japan: Curriculum (Mechanical)

	Engineers	Technicians
General	✓ Introduction of the latest technology in TPP (inc. USC) ✓ Experience-based Safety Training ✓ Human Resource Development ✓ Quality Management ✓ Thermal Efficiency Management ✓ Tool Box Meeting (for Safety) ✓ Lessons Learned from Accidents ✓ Human Error Prevention ✓ Effective Maintenance for Quality Electric Power Infrastructure	✓ Introduction of the latest technology in TPP (inc. USC) ✓ Experiential Safety Training ✓ Experiential Quality Training ✓ Prevention of Accidents and Disasters ✓ Occupational HSE (especially Safety) ✓ Tool Box Meeting (for Safety)
Mechanical Maintenance	✓ Maintenance of GTCC ✓ Remaining Life Assessment (advanced) ✓ Feed Water Treatment ✓ Basic Training of Vibration (Balancing) ✓ Non-Destructive Inspection ✓ Welding Quality Management in Japan (inc. Welding Defect)	✓ General System and Outline of GTCC ✓ Maintenance of High Temperature and High Pressure Piping ✓ Overhauling Rotary Pumps (modifying more practical) ✓ Vibration and Balancing ✓ Metal Material ✓ Basics of Non-Destructive Inspection Skills ✓ Welding Procedure Management
Site Visit	✓ Site Visit on TPP (inc. observing actual overhaul work) ✓ Site Visit on Manufacturer's factory	✓ Site Visit on TPP (inc. observing actual overhaul work) ✓ Site Visit on Manufacturer's factory
JICA Original	✓ Issue Analysis ✓ Methodology to Formulate Action Plan	✓ Issue Analysis ✓ Methodology to Formulate Action Plan

3. O&M Training in Japan: Improvement in Curriculum

Example	Description	
Issue Analysis (For Engineers/Technicians)	Modified to make it easy for participants to analyze current issues and causes at TPPs in structured way.	
Tool Box Meeting (For Engineers/Technicians)	Added to curriculum to understand the importance of the safety and how to prevent accidents.	
Vibration and Balancing (For technicians)	Added to curriculum for technicians to make the training more practical.	
Observing actual overhaul work (For Engineers/Technicians)	Added to curriculum to deepen the understanding of current O&M situation in Japanese electrical power company.	

✓ JICA Expert Team conducted the training in Japan 3times during the duration of the Project.
✓ JICA Expert Team **continuously improved the contents of the training in Japan, reflecting the needs and feed-back of the participants.**

3. 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:

✓ **Can understand the importance of labor safety and equipment safety**
✓ **Can improve capability to properly use safety equipment ready for emergency situations**

3. O&M Training in Japan: Course Examples (2)

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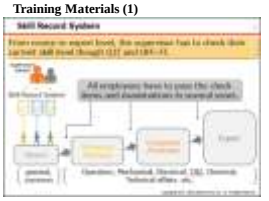
Example: Human Resource Development in Kansai (Lecture)

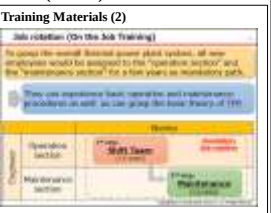
Training Item

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:

- ✓ **Can grasp HRD current situation in Japanese electrical power company**
- ✓ **Can find out the hints for improving HRD structure in Bangladesh**

3. O&M Training in Japan: Course Examples (3)

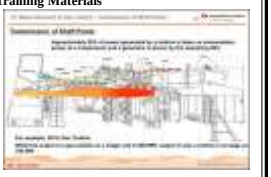
20

Example: Gas Turbine Combined Cycle (Lecture)

Training Item

1. Structure of Equipment
2. Maintenance Contents of Equipment
3. Preventive Maintenance Contents of Equipment
4. Equipment Trouble Case Study

Training Materials



Effects of Training:

- ✓ **Can understand structure and function of GTCC, GT, HRSG and GT Hot Parts**
- ✓ **Can improve capability to properly plan and supervise maintenance work of GTCC main equipment**

3. O&M Training in Japan: Course Examples (4)

21

Example: Non-Destructive Inspection (Lecture and Practical Training)

Training Item

1. PT (Penetrant Testing)
2. MT (Magnetic Particle Testing)
3. UT (Ultrasonic Testing)
4. RT (Radiographic Testing)

Training Materials

Effects of Training:

- ✓ **Can determine which NDI method to take according to various failure conditions.**
- ✓ **Can improve capability to properly plan, implement and supervise NDI procedure while ensuring high-level safety & quality.**

3. O&M Training in Japan: Course Examples (5)

22

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:

- ✓ **Can grasp O&M current situation in Japanese electrical power company**
- ✓ **Can understand the 5S methodology ("Sort", "Set In order", "Shine", "Standardize" and "Sustain") and its effects on quality of work**
- ✓ **Can understand how to well-operate aged-facilities**

3. O&M Training in Japan: Action Plan Presentation

23

Implementing their action plan in TPPs enables **not only participants but also their colleagues** to improve their O&M knowledge & skills.

About Action Plan

- ✓ Participants will be core instructors, and disseminate the knowledge and skills learned during O&M Training in Japan when they come back to Bangladesh.
- ✓ 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. Skill Development Training for Technical Personnel (Basic of Vibration, Pump Alignment, Experience-based Safety Training and Tool Box Meeting)
2. Activity (Tool Box Meeting)

Technician
1. Skill Development Training for Technical Personnel (Pump maintenance, NDI, Basic and Welding)
2. Activity (Tool Box Meeting)

Participants preferentially selected the feasible and important subjects as action plan items among the curriculum of the training in Japan.

3. O&M Training in Japan: Other Activities

24

We provided the participants with comprehensive O&M training as well as **opportunities to learn Japanese culture.**

- **Japanese Language Lesson:**

- **Home-Visit Program for Engineers**

- **Sightseeing in Kyoto: for Engineers & Technicians**

3. HRD Training in Japan: Overview

- We provided management with Human Resource Development (HRD) training in Japan **to realize more effective capacity building for O&M at TPPs**.
- HRD training consisted of Job Report Presentation, Visit on Kansai's Training Centers for engineers and technicians, Issue Analysis and Action Plan Presentation.
  HRD Action Plan prepared by management is as follows:
  - **Supporting, Promoting and Supervising JICA-trained Participants' Action Plan**
  - **Creating Provisions for future trainers & getting the experts through TOT**
  - **Purchasing modern Training Equipment**
  - **Implementing Training Need Assessment (TNA)**
  - **Requiring Top Management's Initiative on system evolving**

Human Resource Development (HRD) Issue Analysis

Site Visit on Training Center

3. HRD Training in Japan: Overview

Job Report Presentation

Site Visit on Training Center

Site visit on Himeji No.2 TPP

Action Plan Presentation

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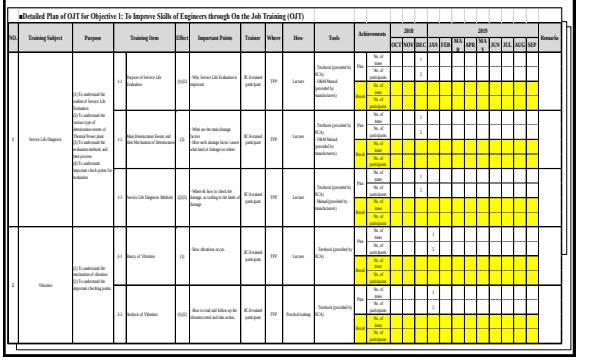
4. Action Plan Implementation: Format



■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 OCT	NOV	DEC	JAN	FEB	MAR	2019 APR	MAY	JUN	JUL	AUG	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 manufacturer)	Plan	No. of times			○										
												No. of participants			○										
											Actual	No. of times													
												No. of participants													
			1-2	Main Deterioration Events and their Mechanism of Deterioration	(1)	•What are the main damage factors •How each damage factor causes which kind of damage on where	JICA-trained participant	TPP	Lecture	Textbook (provided by JICA) O&M Manual (provided by manufacturer)	Plan	No. of times			○										
												No. of participants			○										
											Actual	No. of times													
												No. of participants													
			1-3	Service Life Diagnosis Methods	(1)(2)	•Where & how to check the damage, according to the kinds of damage	JICA-trained participant	TPP	Lecture	Textbook (provided by JICA) O&M Manual (provided by manufacturer)	Plan	No. of times			○										
												No. of participants			○										
											Actual	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			○										
												No. of participants			○										
											Actual	No. of times													
												No. of participants													
			2-2	Analysis of Vibration	(1)(2)	•How to read and follow up the vibration trend and take actions.	JICA-trained participant	TPP	Practical training	Textbook (provided by JICA)	Plan	No. of times			○										
												No. of participants			○										
											Actual	No. of times													
												No. of participants													

4. Action Plan Implementation: Findings

(Actual Conditions)

- ✓ **Before the pandemic of Covid-19**, JICA-trained engineers & technicians implemented their Action Plan **as previously arranged with active support from management**, and a series of their dissemination activities can help to **improve the O&M capacity at TPPs.**
- ✓ **Safety and Quality culture** is being improved through implementation of Action Plan such as 4S (Sort, Set in order, Shine and Standardize) activities and TBM (Tool Box Meeting).

4. Action Plan Implementation: Findings

Pump Alignment Training at BPDB

Training at BPMI by APSCL's participant

Lecture Training of Pump Alignment at EGCB

Safety training at NWPGCL

Tool Box Meeting Training at RPCL

Lecture Training at CPGCBL

4. Action Plan Implementation: Findings

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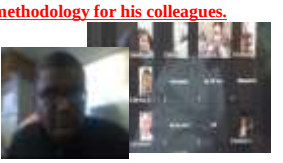
(Actual Conditions)

- ✓ JICA-trained engineers & technicians told that they fully utilize **training materials provided by JICA Expert Team**, and that **the practical subject like "pump alignment" was especially useful** among the training course in Japan because they can utilize the knowledge and skills directly to their work.
- ✓ **Recently, due to the response to the Covid-19**, it became difficult for JICA-trained engineers & technicians to implement their Action Plan. **However, one JICA-trained Engineer conducted online class 3 times on GTCC O&M, safety and 5S methodology for his colleagues.**



4. Action Plan Implementation: Findings

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(Actual Conditions)

- ✓ There are **no formalized information sharing system** for trouble, measures and safety information. They only share such kind of information personally, but certain company is now installing the computerized sharing system to comprehensively manage the necessary information.
- ✓ Training program is **focusing on mainly theoretical subject and not practical one.**

(Suggestion from JICA Expert Team)

- ✓ JICA Expert Team would like to request Bangladesh side for **the further understanding and continuous support for Action Plan implemented by JICA-trained engineers & technicians**.
  - ➢ Coordinating Engineers/Technicians work to implement their Action Plan as planned.
  - ➢ Preparing training equipment required for Action Plan implementation.
- ✓ **JICA Expert Team would like to suggest Additional Training to complement the action plan implementation in Bangladesh affected by the Covid-19.**

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7. Conclusion

5. Issue Analysis of O&M in TPP: Basic Concept

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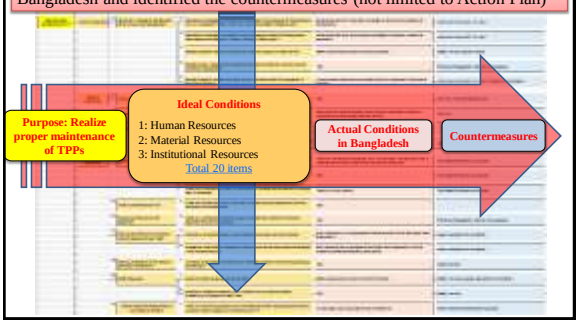
JICA Expert Team comprehensively analyzed O&M issues of TPPs in Bangladesh and identified the countermeasures (not limited to Action Plan)



5. Issue Analysis of O&M in TPP: Human Resources

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Category	Ideal Condition	Actual Condition	Countermeasure
Human Resources	Every personnel has basic knowledge on structure and maintenance procedure of the equipment.	(E) Some personnel don't have basic knowledge on structure & maintenance procedure of the equipment. (T) There are few staff with the necessary skills for maintenance.	Dissemination from Participants (E/T) about **GTCC (GT, ST, HRSG) etc.** Other training subjects like electrical and C&I for further improvement.
	Every personnel has basic knowledge on evaluation and maintenance method of the equipment.	(E) Most personnel don't have enough knowledge on evaluation method of equipment. (T) There are few staff with the necessary skills for maintenance.	Dissemination from Participants (E/T) about **NDI, Remaining Life Assessment, balancing etc.** Other training subjects like electrical and C&I for further improvement.
	Every personnel can perform required maintenance work with quality in a safe manner.	(E) In some cases, personnel are not able to perform maintenance in a safe manner. (T) Although the quality of work is secured, but safe work is not done.	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) In most cases, personnel are able to plan, manage and evaluate maintenance according to equipment condition. (T) The plant operation data is collected regularly (every hour etc.) and reflected in maintenance.	Dissemination from Participants (E/T) about **Maintenance of GTCC etc.** More specific training focusing on maintenance scheduling for further improvement.
	It's possible to identify causes when fault occurs, and plan for emergency & permanent measure.	(E) In most cases, personnel are able to plan for emergency & permanent measure. (T) We are able to investigate the cause of the problem and provide emergency measures, but we are not able to implement permanent measures.	Dissemination from Participants (E/T) about **Maintenance of GTCC etc.** More specific training focusing on RCA (Root Cause Analysis) for further improvement.

5. Issue Analysis of O&M in TPP: Material Resources

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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) In only few cases, tools and jigs are well managed. (T) Necessary tools are insufficient, not managed and not organized.	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) In most cases, consumables and spare parts are not well managed. (T) Consumables are enough, but there are no spare parts	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) Appropriate manuals are not available. (T) There is a shortage of manuals of old plants and Chinese plants.	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) In most cases, work procedure for each maintenance are not written. (T) Work procedures were prepared based on manufacturer's manual and O&M experience.	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 TPP: 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) In most cases, has no prescribed maintenance standard. (T) Although there are maintenance standards based on the manufacturer's recommendation, we can not maintain according the standards.	Dissemination from Participants (E) about **Risk Based Maintenance etc.** More specific training, especially of the latest technology (e.g. USC coal-fired plant).
	Each equipment has standard check points.	(E) In most cases, has standard check points but not follow them. (T) The standard check points are instituted, and maintenance staff is possible to judge pass / fail.	Dissemination from Participants (E) about **Risk Based Maintenance etc.** More specific training, especially of the latest technology (e.g. USC coal-fired plant).
	There is an institutional system to evaluate the maintenance standards and change them if necessary.	(E) There is no such system. (T) There is no system to evaluate (feedback) maintenance standards.	Dissemination from Participants (E) about **Risk Based Maintenance etc.** More specific training, especially of the latest technology (e.g. USC coal-fired plant).
	Power-cut maintenance work is planned, considering power generation plan and conditions of the equipment.	(E) Usually, not properly planned. (T) Although there is a power-cut maintenance work plan, it is not implemented as planned.	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) In most cases, there is no such system. (T) The operation data of the plant is accumulated and reflected in the maintenance plan.	Dissemination from Participants (E) about **Thermal Efficiency Management, Service Life Diagnosis etc.** More specific training, especially of the data utilization.

5. Issue Analysis of O&M in TPP: Institutional Resources

Category	Ideal Condition	Actual Condition	Countermeasure
Institutional Resources (2)	Information of faults/troubles is accumulated and shared with staff member.	(E) Not properly shared. (T) Information on the trouble is shared for corresponding work group (several people scale), but it is not shared to other departments and other plants.	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) Not properly shared and reflected. (T) Already shared.	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) Not properly reflected. (T) The inspection result can not be reflected in the next maintenance plan.	Dissemination from Participants (E/T) about **Quality Control etc.**
	Rules for safety measures are established.	(E) In many cases, there is no such established safety measure. (T) Although there are safety rules, workers do not follow the rules.	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) In most cases, such incidents are not shared. (T) Already shared.	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 no enough system to train the maintenance staff.	Dissemination from Participants (E/T) about **Human Resource Development.** Support from external resource may be necessary for further improvement in training system, training facilities etc.

5. Issue Analysis of O&M in TPP: 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 recognize through the Project that the following points to be improved.
  - ➢ Since trainings in Japan mainly focused on general contents of thermal power generation and its mechanical maintenance subjects, there is still room for improvement in;
    - **Basic skills & knowledge of electrical and C&I maintenance**
    - **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, there is still room for **improvement in organizational HRD system** such as the lack of practical trainings, mismatch in training needs and contents.

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6. KANSAI's Technical Proposal: Suggestion

(Suggestion from JICA Expert Team)

- ✓ JICA Expert Team would like to suggest following items for further improvement in O&M at TPPs in Bangladesh.
  1. **Technical Training in Japan**
     - i. Training Course of **electrical and C&I maintenance**
     - ii. Training Course of **more practical skills (Root Cause Analysis, Maintenance Scheduling Method, etc.)** focusing on specific power generation type, fuel type, etc.
     - iii. Training Course of **USC coal-fired plant technology**
  2. **Enhancement of HRD training system**
     - Includes training planning, training subjects reviewing, training teachers, providing training equipment (if necessary), etc.
     - Assume that the existing BPDB training center in Ghorashal will be the scope of the enhancement.

6. KANSAI's Technical Proposal : Technical Training

(1) Training Course of electrical and C&I maintenance

(Electrical training image) Structure of Generator

(I&C training image) Valve Control

- ✓ Training Course of **electrical and C&I maintenance** can enhance **basic skills & knowledge of engineers and technicians** as achieved in the training course of mechanical maintenance in this Project.

6. KANSAI's Technical Proposal : Technical Training

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(2) Training Course of more practical skills (Root Cause Analysis)

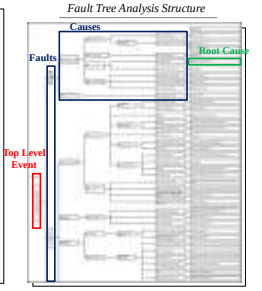
About Fault Tree Analysis (FTA)

1. Deductive Analytic Method
2. Visually indicating a failure path
3. Can identify the root causes of Trouble

Benefits of Fault Tree Analysis

- When trouble happens, engineers and technicians **can easily check the possible causes** at glance
- Engineers and technicians **can quickly identify the root causes of the trouble**
- Can prevent the recurrence of the trouble
- **Lead to reduce down-time of TPP**

Fault Tree Analysis Structure



✓ Fault Tree Analysis can **enhance analytic skills and knowledge** of engineers and technicians, that leads to **reduce down-time of TPP.**

6. KANSAI's Technical Proposal : Technical Training

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(3) Training Course of more practical skills (CPM for Maintenance Scheduling)

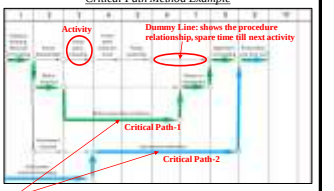
About Critical Path Method (CPM)

1. A project management method to schedule a set of activities
2. Use network diagrams to represent the necessary activities

Benefits of Critical Path Method

- Easily **visualize project activities and their relations**
- Easy to **revise the schedule**
- **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

✓ 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.**

6. KANSAI's Technical Proposal : Technical Training

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(4) Training Course of USC coal-fired plant technology

✓ Technical training of USC coal-fired technology **can enhance O&M capability** especially for engineers and technicians engaged in **Matarbari coal-fired power plant project**, and it can leads to **smooth startup of the project.**

6. KANSAI's Technical Proposal : Technical Training

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(4) Training Course of USC coal-fired plant technology

For Maintenance

Training Contents (tentative)	Purpose
Mechanical Maintenance	➢ To understand the basic structure and function of USC coal-fired plant ➢ To be able to properly plan and supervise maintenance work of USC coal-fired plant main equipment (boiler, steam turbine, etc.) and BOP (coal handling system, ash treatment system, etc.)
Electrical Maintenance	
C&I Maintenance	

For Operation / Technical Affairs

Training Contents (tentative)	Purpose
Plant Operation	➢ To understand the procedure of plant start-up and shut-down for main equipment and BOP ➢ To understand the procedure of material handling ➢ To be able to properly implement trouble shooting
Heat Efficiency Management	➢ To be able to monitor and analyze the heat efficiency
Water Treatment	➢ To understand the methods of feed water and waste water treatment specific to USC coal-fired plant ➢ To be able to prevent troubles caused by inappropriate water treatment

6. KANSAI's Technical Proposal: Enhancement of HRD training system

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(1) Enhancement of HRD training system

Establishment of Comprehensive Training System

Training planning

Training teachers

Training subjects review

Introducing Practical Training Equipment

✓ **Enhancement of HRD training system** (e.g. training planning, training subjects reviewing, introducing practical training equipment) can strengthen the **organizational O&M capability in Bangladesh** not depending on the skills and knowledge of individual engineers and technicians.

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7. Conclusion

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Summary of the JICA project

- ✓ We've already implemented the capacity building project for O&M at TPPs for around 3 years as follows:
  - ➢ Conducting **O&M training in Japan** based on the training needs and the current situation.
  - ➢ Reviewing **dissemination from JICA-trained participants to other colleagues** about knowledge and skills obtained in Japan.
- ✓ Through analyzing the O&M issues at TPPs, we suggest **the project is practical and effective to improve O&M capacity.**

For further improvement of O&M at TPPs

- ✓ **Engineers and Technicians** should continue to disseminate their Action Plan Activities with strong **support and promotion from Management**.
- ✓ When needing further support, you may have an **option to utilize external resources** at the request from MPEMR to JICA.

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(5)　第 4 回 JCC

MINUTES OF MEETING
FOR
THE FINAL JOINT COORDINATION COMMITTEE (JCC)
ON
THE PROJECT FOR CAPACITY DEVELOPMENT FOR OPERATION AND MAINTENANCE OF THERMAL POWER STATIONS
BETWEEN
THE JAPAN INTERNATIONAL COOPERATION AGENCY
AND
THE GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH

The Japan International Cooperation Agency (hereinafter referred to as "JICA") and the Government of the People's Republic of Bangladesh (hereinafter referred to as "GoB") established a Joint Coordination Committee (hereinafter referred to as "JCC") for the effective and successful implementation of the Project for Capacity Development for Operation and Maintenance of Thermal Power Stations (hereinafter referred to as "the Project").

The final JCC on the Project was held on 19th November 2021, through video conference, chaired by Dr. Shah Md. Helal Uddin, Joint Secretary (Planning-1), Power Division, Ministry of Power, Energy, and Mineral Resources (hereinafter referred to as "MoPEMR"). As a result of discussion in the final JCC Meeting, the Japanese side and the Bangladesh side have confirmed the main items described in the Annex.

Signed this (DD/MM/YYYY) : 29 / 12 / 2021

奥田英信

Mr. OKUDA Hidenobu
JICA Expert / Chief Advisor

Dr. Shah Md. Helal Uddin
Joint Secretary (Planning-1)
Power Division
Ministry of Power, Energy, and Mineral Resources

譲尾 譲尾

Mr. YUZURIO Susumu
Senior Director
Energy and Mining Group
Infrastructure Management Division
Japan International Cooperation Agency

ANNEX

1. Achievement of the Project

The JICA Expert Team explained the achievement of the Project using presentation report as attachment 2. Both sides agreed that the project purpose has been achieved considering evaluation indicators such as number of improved new training courses and number of trainers. However, the output 4, the improved operation and maintenance (hereinafter referred to as "O&M") training courses at thermal power stations, were negatively affected due to unexpected disruption caused by the spread of the Covid-19 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 4, the JICA Expert Team conducted the additional online O&M training.

In addition, 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 almost 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 Bangladesh 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 plants (hereinafter referred to as "TPP") to create enabling environment, in terms of staffs, finance, and equipment and facilities, for properly implement the Action Plan as planned in a systematic manner in order to further strengthen the training capacity on O&M of TPPs.

For this purpose, the JICA Expert Team requested further support from the Bangladesh side for the implementation and monitoring of Action Plans by JICA-trained engineers & technicians, even after finishing the Project.
The Bangladesh side acknowledged the contents of the explanation and agreed to meet the request from 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. Bangladesh side confirmed the contents.

(1) Actual Conditions

- ✓ Before the pandemic of Covid-19, JICA-trained engineers & technicians implemented their Action Plan as previously arranged with active support from management, and a series of their dissemination activities can help to improve the O&M capacity at TPPs.
- ✓ Safety and quality culture is being improved through implementation of Action Plan such as 4S (Sort, Set in order, Shine and Standardize)

activities and TBM (Tool Box Meeting).

- ✓ JICA-trained engineers & technicians told that they fully utilized training materials provided by JICA Expert Team, and that the practical subject like "pump alignment" was especially useful among the training course in Japan because they can utilize the knowledge and skills directly to their work.
- ✓ Recently, due to the response to the Covid-19, it became difficult for JICA-trained engineers & technicians to implement their Action Plan. However, some JICA-trained engineers conducted online lecture trainings and voluntary dissemination activities for their colleagues.

(2) Request from the Project Team (JICA-trained participants and JCC members)

- ✓ The JICA Expert Team requested the chair of the JCC, Additional Secretary (Planning) of MoPEMR Power Division, for the further understanding and continuous support for Action Plan implemented by JICA-trained engineers & technicians.
  - ➢ Coordinating the engineers/technicians' works to implement their Action Plan as planned.
  - ➢ Preparing training equipment required for Action Plan implementation.
- ✓ JICA-trained participants expressed the effects and usefulness of the Project. The followings are some specific examples.
  - ➢ JICA-trained engineer from NWPGCL was impressed with JICA Expert Team's practice of sharing lessons learned from past accidents and suggested that the same practice should be developed at TPPs in Bangladesh.
  - ➢ JICA-trained engineer from RPCL successfully solved pump vibration issue at TPP utilizing knowledge and skills regarding the vibration analysis and the alignment.
  - ➢ JICA-trained engineer from CPGCBL utilizes knowledges and skills regarding the vibration analysis, alignment and NDT (Non-destructive-testing) during the construction phase of TPP.
- ✓ The chair of the JCC requested the management members to further support for Action Plan implementation especially from the viewpoint of efficiency and sustainability.

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 TPPs as follows. Bangladesh side confirmed the contents.

(1) The JICA Expert Team comprehensively analyzed the O&M issues of TPPs in Bangladesh 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 with O&M training course in Japan and their Action Plan.

(3) On the other hand, JICA Expert Team recognize that, through reviewing the Project achievement, the following points need to be improved.

- ✓ Since trainings in Japan and additional online training were mainly focused on general contents of thermal power generation and its

mechanical and electrical maintenance subjects, there is still room for improvement in;

- Basic skills & knowledge of Control and Instrumentation (hereinafter referred to as "C&I") maintenance and 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 TPPs in Bangladesh. Bangladesh side confirmed the contents.

(1) Technical Training in Japan

- ✓ Training course of C&I maintenance and 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 capacity development project for O&M at TPPs for around 4 years, the JICA Project Team concluded that the Project is practical and effective to improve O&M capacity. They suggested that the Bangladesh side implement the Action Plan for further improvement of O&M at TPPs 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 in the final JCC
Attachment 2 Presentation Materials
Attachment 3 Project Monitoring Sheet Ver. 7 (drafted)
Attachment 4 Minutes of Meetings during the Mission

Attendance List

A virtual meeting of the Joint Coordination Committee (JCC) on "Project for Capacity Development for Operation & Maintenance of Thermal Power Stations"

Date: 19th November, 2021

Time: 10:15 am ~ 11:55 am (BST)

Method: Zoom Meeting Platform

No.	Name	Position	Company
1	Dr. Shah Md. Helal Uddin	Joint Secretary (Planning-1), Alternate Chair Person	MoPEMR Power Division
2	Tania Khan	Joint Secretary (Planning-2), Participant of HRD training	MoPEMR Power Division
3	Alia Meher	Deputy Secretary, Focal Point	MoPEMR Power Division
4	Muhammad Chishty Asheque	Assistant Chief	MoPEMR Power Division
5	Abul Kalam Azad	Executive Director (Project), Focal Point	CPGCBL
6	Muhammad Matiur Rahman	Deputy General Manager (HR&Admin), Participant of HRD training	CPGCBL
7	A.H.M Rokanuzzaman	Superintendent Engineer (Electrical), Participant of 4th training	CPGCBL
8	Md. Kamrul Islam	Executive Engineer (Desgin-1), Participant of 4th training	CPGCBL
9	Mohammad Kowser	Sub-Divisional Engineer (Mechanical), Participant of 3rd training	CPGCBL
10	Mannaf Sm Abdul	XEN (Planning & Mechanical), Participant of 1st training	CPGCBL
11	Md. Ashraf Hossain	Chief Engineer (O&M)	RPCL
12	Kamal Hossain	Deputy General Manager (HR&Admin), Focal Point	RPCL

Attendance List

No.	Name	Position	Company
13	Mohammad Ashikur Rahman	Manager (Training), Participant of HRD training	RPCL
14	Quazi A F M Mohiuddin	SDE, Gazipur Power Station, Participant of 1st training	RPCL
15	Islam MD Nurul	SDE, Mymensingh CCPP, Participant of 3rd & 4th training	RPCL
16	Biswas Kshitish Chandra	Executive Director (Planning & Project), Participant of HRD training	APSCL
17	Md. Shah Alam Khan	Chief Engineer, Focal Point	APSCL
18	Mahmud Mohammad Mahmudur Rahman	Deputy Director (XEN), Focal Point, Participant of 1st training	BPDB
19	Asaduzzaman Mohammed	XEN, Siddhirganj Power Station, Participant of 1st training	BPDB
20	Rahman Mahbubur	Assistant Engineer, Bhola 225MW CCPP, Participant of 3rd training	BPDB
21	Ibrahim Ahmad Shafi	Chief Engineer (P&D), Focal Point	EGCB
22	Atiqur Rahman	Deputy General Manager (HR), Participant of HRD training	EGCB
23	Al Obyed Bin Ahmed	SDE, Siddhirganj 335MW CCPP, Participant of 1st training	EGCB
24	Md. Abdus Samad	Executive Director (Engineering)	NWPGCL
25	Md. Anamul Haque	Deputy General Manager (HR), Focal Point, Participant of HRD training	NWPGCL
26	Pijush Bhattacharjee	XEN, Bheramara 410 MW CCPP, Participant of 3rd training	NWPGCL
27	Yuzurio Susumu	Senior Director	JICA Headquarters
28	Konishi Hideaki	Senior Advisor	JICA Headquarters
29	Shibata Kuri	Program officer	JICA Headquarters

Attendance List

No.	Name	Position	Company
30	Yamada Eiji	Program officer	JICA Bangladesh Office
31	Okuda Hidenobu	JICA Expert Team, Chief Advisor	Kansai Electric
32	Fukuda Naga	JICA Expert Team	Kansai Electric
33	Doi Yoshihiro	JICA Expert Team	Kansai Electric
34	Kozakai Akira	JICA Expert Team	Kansai Electric
35	Obe Yuki	JICA Expert Team	Kansai Electric
36	Ichioka Hidenobu	JICA Expert Team	Kansai Electric

OVERVIEW of FINAL REPORT

November 2021

Japan International Cooperation Agency (JICA)

The Kansai Electric Power Co., Inc.

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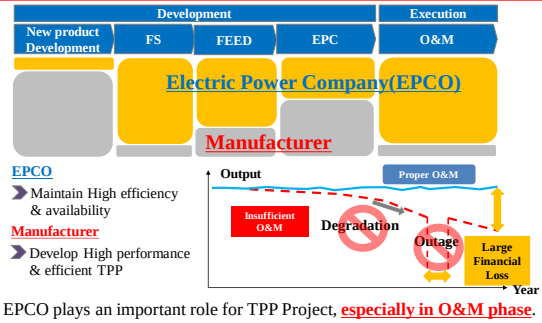
1. **Background: Why is O&M at TPPs important?**
2. Project Summary
3. O&M Training in Japan
4. Online O&M Training
5. Action Plan Implementation
6. Issue Analysis of O&M in TPP
7. KANSAI's Technical Proposal
8. Conclusion

1. Background: Why is O&M at TPPs important?



EPCO
- Maintain High efficiency & availability

Manufacturer
- Develop High performance & efficient TPP

✓ EPCO plays an important role for TPP Project, **especially in O&M phase**.

✓ **Without proper O&M at TPPs, degradation and forced outages could cause large financial loss** even installing the high-efficiency equipment.

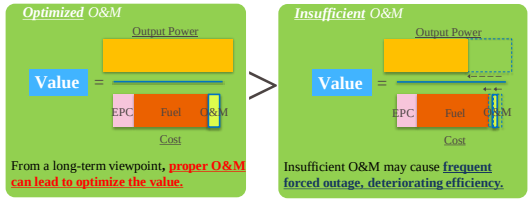
1. Background: Why is O&M at TPPs important?

➢ *What value does EPCO create?*

$$\text{Value} = \frac{\text{Output}}{\text{Input}} = \frac{\text{Output Power (kWh)}}{\text{Cost ($)}}$$

[=CAPEX+ OPEX (Fuel, O&M)]

➢ *Why is proper O&M at TPPs important?*



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2. Project Summary: Capacity Building for O&M at TPPs

This JICA project aims to implement capacity building for O&M (Operation and Maintenance) at TPPs (Thermal Power Plants), in order to make continuous technical support for Bangladesh side.

Project Purpose

Overall Goal	Capacity of O&M of TPPs is strengthened.
Project Goal	Training capacity on O&M of TPPs is strengthened.

Project Output

Output 1	Current situation of O&M of thermal power stations is analyzed and training needs are identified.
Output 2	Instructors of TPP are trained and secured.
Output 3	Training curricula and materials of O&M are improved.
Output 4	O&M training at TPP is improved.

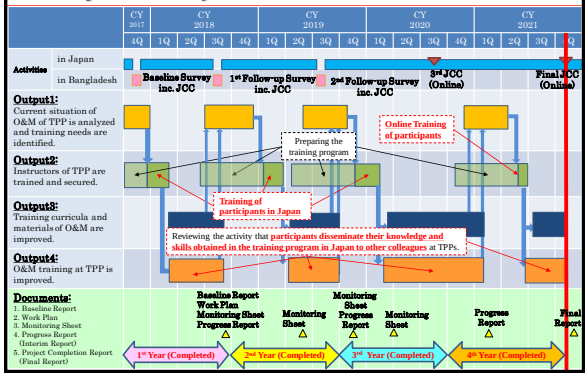
2. Project Summary: Capacity Building for O&M at TPPs

7

Targeted Type of Power Generation	Gas Turbine Combined Cycle (GTCC) ※Lecture on general introduction regarding coal fired power generation including advanced environmental practices in Japan
Project Sites	BPDB, EGCB, NWPGCL, APSCL, CPGCBL and RPCL's Thermal Power Plants (TPPs) in Dhaka and its suburbs
Counterpart	Power Division, Ministry of Power, Energy and Mineral Resources (MoPEMR) Bangladesh Power Development Board (BPDB) Electricity Generation Company of Bangladesh Limited (EGCB) North West Power Generation Company Limited (NWPGCL) Ashuganj Power Station Company Limited (APSCL) Coal Power Generation Company of Bangladesh Limited (CPGCBL) Rural Power Company Limited (RPCL)
Beneficiaries	O&M engineers and technicians who will be the core instructors to conduct trainings in each TPPs and/or Training Centers under public utilities
Duration	October 2017 – March 2022 (4.5 years)

2. Project Summary: Work Flowchart (revised version)

8



2. Project Summary: Achievement of the Project (1/2)

9

Items	Monitoring Indicators	Achievement
Overall Goal : Capacity of O&M of Thermal Power Plants (TPP) is strengthened.	✓ O&M action plans are prepared and regularly updated in order to improve O&M through action plans.	✓ Through the implementation of the Action Plans, their dissemination activities **enhanced the basic technical & safety knowledge of the O&M staff at TPPs, reduced accidents at TPPs, and improved the O&M quality of the staff at TPPs.**
Project Purpose : Training capacity on O&M of Thermal power stations is strengthened.	✓ Number of improved and/or new training courses regularly operated for O&M at targeted TPP.	Project Purpose has been achieved as follows. However, it is necessary to implement the Human Resource Development (HRD) Action Plan by management as planned in order to further strengthen the training capacity on O&M of TPPs. ✓ According to the training reports from JICA training participants, they **conducted 273 improved/new trainings for 2,997 O&M personnel at TPPs (in total).**
	✓ Number of assigned trainers who were trained and conduct training (in total).	✓ **46 engineers and 28 technicians were trained as expected instructors** in JICA training. The participants in respective trainings answered that they had almost achieved the training objective.
Output 1 : Current situation of O&M of TPP is analyzed, and training needs are identified.	✓ Training needs are compiled based on the current situation.	Output 1 has been achieved as follows. ✓ JICA Expert Team (JET) analyzed the current situation of O&M and training system at TPPs through 3 times of field surveys, interviews with JICA training participants, training need assessment and issue analysis training in JICA.
		✓ Based on these analysis results, JET confirmed the training needs of each technical level and proposed the training needs to Bangladesh side.
Output 2 : Instructors of TPP are trained and secured.	✓ Training program is prepared based on the training needs.	Output 2 has been achieved as follows. ✓ Based on the analysis of training needs shown in Output 1, JET prepared the training program which were held 3 times in Japan and the additional online training program.

2. Project Summary: Achievement of the Project (2/2)

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Items	Monitoring Indicators	Achievement
Output 2 : Instructors of TPP are trained and secured.	✓ Number of trained instructors.	✓ **46 engineers and 28 technicians were trained as expected instructors** in JICA training.
Output 3 : Training curricula and materials of O&M are improved	✓ Training curricula and materials of O&M are proposed and modified if necessary.	Output 3 has been achieved as follows. ✓ The curricula and teaching materials for O&M training at TPPs have been improved as follows. • The trainings to be implemented by the participants were incorporated into the annual training program in some public utilities. • The training courses that had never been included in the training curriculum at each public utility were provided, such as Non-destructive Inspection, Pump Alignment and Fault Tree Analysis. • Most of the trainings were performed with utilizing the training materials provided by JET. • Some of the trainings were performed using training materials created by the participants based on training materials provided by JET.
Output 4 : O&M training at TPP is improved.	✓ Number of training (OJTs) conducted at TPP.	Output 4 has been achieved as follows. ✓ According to the training reports from JICA training participants, they **conducted 273 improved/new trainings for 2,997 O&M personnel at TPPs (in total).**
	✓ Achievement level of action plans prepared by trained instructors.	✓ It seems that **48% of the trained instructors were able to implement only partial Action Plans due to the spread of the COVID-19** ✓ JET **conducted the additional training for complementing delays and deficit of Output 4 originally planned**, and 18 electrical engineers were additionally trained as expected instructors. ✓ **Implementation of the HRD Action Plan by management is almost completed, but some action plans are still in progress.**

2. Project Summary: Project Evaluation (1/5)

11

Evaluation based on DAC (Development Assistance Committee) Evaluation Criteria

Evaluation Summary

Evaluation Criteria	Evaluation Results
(1) Relevance	High
(2) Effectiveness	High
(3) Impact	High
(4) Efficiency	Relatively High
(5) Sustainability	Relatively High

Detailed Evaluation Results

(1) Relevance : High

Evaluation Aspects	Detailed Evaluation Results
Priority	✓ In the public power generation companies of Bangladesh, **it is an urgent task to efficiently operate and maintain gas-fired 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 plants.**
Consistency with the Japanese ODA policy	✓ The Project is consistent with Japanese Official Development Assistance (ODA) policy for Bangladesh.

2. Project Summary: Project Evaluation (2/5)

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(2) Effectiveness : High

Evaluation Aspects	Detailed Evaluation Results
Achievement of Project Outputs	✓ **The Output 1 to 3 have been achieved.** ✓ **The Output 4 was negatively affected due to unexpected disruption caused by the spread of the COVID-19** since activities relevant to the Output 4 were supposed to be carried out mainly in the last half of the Project. **JET conducted the additional training for complementing delays and deficit of Output 4 originally planned.** ✓ It is concluded that **the Project Outputs have been achieved at satisfactory level**, as the implementation of the additional activities complemented for the delay in Output 4.
Achievement of Project Purpose	✓ **The Project Purpose have been achieved considering evaluation indicators such as number of improved new training courses and number of trainers.** ✓ The Output 4 was negatively affected due to unexpected disruption caused by the spread of the COVID-19 since activities relevant to the Output 4 were supposed to be carried out mainly in the last half of the Project. JET conducted the additional training for complementing delays and deficit of Output 4 originally planned. ✓ It is concluded that **the Project Purpose have been achieved at satisfactory level, as the implementation of the additional activities complemented for the delay in Output 4.**
Beneficiaries of Project	✓ As to the beneficiaries of the Project, **each participant has been able to disseminate the knowledge and skills learned during JICA training to 626 colleagues beyond the target of 600** in the Project.

2. Project Summary: Project Evaluation (3/5)

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(3) Impact : High

Evaluation Aspects	Detailed Evaluation Results
Prospect of achieving Overall Goal	✓ **Improvements of training capacity on O&M at TPPs have been confirmed.** In addition, as per the questionnaire surveys for management and participants, **improvements of O&M performance at TPPs 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 TPPs.**

(4) Efficiency : Relatively High

Evaluation Aspects	Detailed Evaluation Results
Inputs	✓ As for the inputs of the Japanese side, **the dispatch of the Japanese experts was not conducted as planned** due to the interruption of the 2nd survey (the 1st follow-up survey) and the cancellation of the 4th survey (the 3rd follow-up survey) and the final survey. However, **those activities could be carried out by substituting email or web conference, which was appropriate to produce the outputs as planned.** ✓ **The inputs of the Bangladesh side were carried out as planned.**
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.

2. Project Summary: Project Evaluation (4/5)

14

(5) Sustainability : Relatively High

Evaluation Aspects	Detailed Evaluation Results
Policy / Institutional aspect	✓ It is **not predicted any policy or institutional change** that may affect the sustainability of the Project effects.
Organization aspect	✓ It is **not predicted any organization change on Bangladesh side** that may affect the sustainability of the Project effects. ✓ However, there is still room for improvement in organizational issues such as identifying training needs and designing trainings curricula, securing budget and equipment for practical training, etc. for effective and systematic HRD. **The HRD Action Plan prepared by management includes the items that resolve the organization issues, and it is considered that it is essential to implement the HRD Action Plan by management in order to enhance sustainability.** ✓ **Implementation of the HRD Action Plan by management is almost completed, but some action plans are still in progress.**
Technical aspect	✓ In JICA training, engineers and technicians prepared the Action Plans for improvement of the O&M capacity of TPPs. **Due to the dissemination of knowledge through the implementation of the Action Plans, basic technical and safety knowledge of the O&M staff at TPPs were enhanced, which lead to reduction in accidents at TPPs, and improvement of O&M quality of the staff at TPPs.** ✓ 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 by JICA training.**

2. Project Summary: Project Evaluation (5/5)

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(5) Sustainability : Relatively High

Evaluation Aspects	Detailed Evaluation Results
Financial aspect	✓ As aforementioned in the organization aspect, **it is necessary to secure budget and equipment for practical training for effective and systematic HRD.** The HRD Action Plan prepared by management includes the items that resolve the issues, and it is considered that **it is essential to implement the HRD Action Plan by management in order to enhance sustainability.**

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3. O&M Training in Japan: Overall Framework

17

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.

3. O&M Training in Japan: Curriculum (Mechanical)

18

	Engineers	Technicians
General	✓ Introduction of the latest technology in TPP (inc. USC) ✓ Experience-based Safety Training ✓ Human Resource Development ✓ Quality Management ✓ Thermal Efficiency Management ✓ Tool Box Meeting (for Safety) ✓ Lessons Learned from Accidents ✓ Human Error Prevention ✓ Effective Maintenance for Quality Electric Power Infrastructure	✓ Introduction of the latest technology in TPP (inc. USC) ✓ Experiential Safety Training ✓ Experiential Quality Training ✓ Prevention of Accidents and Disasters ✓ Occupational HSE (especially Safety) ✓ Tool Box Meeting (for Safety)
Mechanical Maintenance	✓ Maintenance of GTCC ✓ Remaining Life Assessment (advanced) ✓ Feed Water Treatment ✓ Basic Training of Vibration (Balancing) ✓ Non-Destructive Inspection ✓ Welding Quality Management in Japan (inc. Welding Defect)	✓ General System and Outline of GTCC ✓ Maintenance of High Temperature and High Pressure Piping ✓ Overhauling Rotary Pumps (modifying more practical) ✓ Vibration and Balancing ✓ Metal Material ✓ Basics of Non-Destructive Inspection Skills ✓ Welding Procedure Management
Site Visit	✓ Site Visit on TPP (inc. observing actual overhaul work) ✓ Site Visit on Manufacturer's factory	✓ Site Visit on TPP (inc. observing actual overhaul work) ✓ Site Visit on Manufacturer's factory
JICA Original	✓ Issue Analysis ✓ Methodology to Formulate Action Plan	✓ Issue Analysis ✓ Methodology to Formulate Action Plan

3. O&M Training in Japan: Improvement in Curriculum

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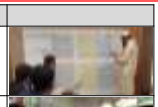
Example	Description	
Issue Analysis (For Engineers/Technicians)	Modified to make it easy for participants to analyze current issues and causes at TPPs in structured way.	
Tool Box Meeting (For Engineers/Technicians)	Added to curriculum to understand the importance of the safety and how to prevent accidents.	
Vibration and Balancing (For technicians)	Added to curriculum for technicians to make the training more practical.	
Observing actual overhaul work (For Engineers/Technicians)	Added to curriculum to deepen the understanding of current O&M situation in Japanese electrical power company.	

- ✓ JICA Expert Team conducted the training in Japan 3times during the duration of the Project.
- ✓ JICA Expert Team **continuously improved the contents of the training in Japan, reflecting the needs and feed-back of the participants.**

3. O&M Training in Japan: Course Examples (1)

20

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:

- ✓ **Can understand the importance of labor safety and equipment safety**
- ✓ **Can improve capability to properly use safety equipment ready for emergency situations**

3. O&M Training in Japan: Course Examples (2)

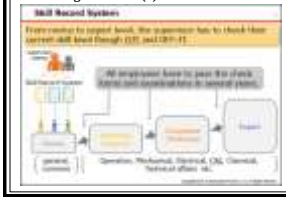
21

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:

- ✓ **Can grasp HRD current situation in Japanese electrical power company**
- ✓ **Can find out the hints for improving HRD structure in Bangladesh**

3. O&M Training in Japan: Course Examples (3)

22

Example: Gas Turbine Combined Cycle (Lecture)

Training Item

1. Structure of Equipment
2. Maintenance Contents of Equipment
3. Preventive Maintenance Contents of Equipment
4. Equipment Trouble Case Study

Training Materials

Effects of Training:

- ✓ **Can understand structure and function of GTCC, GT, HRSG and GT Hot Parts**
- ✓ **Can improve capability to properly plan and supervise maintenance work of GTCC main equipment**

3. O&M Training in Japan: Course Examples (4)

23

Example: Non-Destructive Inspection (Lecture and Practical Training)

Training Item

1. PT (Penetrant Testing)
2. MT (Magnetic Particle Testing)
3. UT (Ultrasonic Testing)
4. RT (Radiographic Testing)

Training Materials

Effects of Training:

- ✓ **Can determine which NDI method to take according to various failure conditions.**
- ✓ **Can improve capability to properly plan, implement and supervise NDI procedure while ensuring high-level safety & quality.**

3. O&M Training in Japan: Course Examples (5)

24

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:

- ✓ **Can grasp O&M current situation in Japanese electrical power company**
- ✓ **Can understand the 5S methodology ("Sort", "Set In order", "Shine", "Standardize" and "Sustain") and its effects on quality of work**
- ✓ **Can understand how to well-operate aged-facilities**

3. O&M Training in Japan: Action Plan Presentation

25

Implementing their action plan in TPPs enables **not only participants but also their colleagues** to improve their O&M knowledge & skills.

About Action Plan

- ✓ Participants will be core instructors, and disseminate the knowledge and skills learned during O&M Training in Japan when they come back to Bangladesh.
- ✓ 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. Skill Development Training for Technical Personnel (Basic of Vibration, Pump Alignment, Experience-based Safety Training and Tool Box Meeting)
2. Activity (Tool Box Meeting)

Technician

1. Skill Development Training for Technical Personnel (Pump maintenance, NDI, Basic and Welding)
2. Activity (Tool Box Meeting)

Participants preferentially selected the feasible and important subjects as action plan items among the curriculum of the training in Japan.

3. O&M Training in Japan: Other Activities

26

We provided the participants with comprehensive O&M training as well as **opportunities to learn Japanese culture.**

- **Japanese Language Lesson:**

- **Home-Visit Program for Engineers**

- **Sightseeing in Kyoto: for Engineers & Technicians**

3. HRD Training in Japan: Overview

27

- ➢ We provided management with Human Resource Development (HRD) training in Japan **to realize more effective capacity building for O&M at TPPs**.
- ➢ HRD training consisted of Job Report Presentation, Visit on Kansai's Training Centers for engineers and technicians, Issue Analysis and Action Plan Presentation.
  HRD Action Plan prepared by management is as follows:
  - **Supporting, Promoting and Supervising JICA-trained Participants' Action Plan**
  - **Creating Provisions for future trainers & getting the experts through TOT**
  - **Purchasing modern Training Equipment**
  - **Implementing Training Need Assessment (TNA)**
  - **Requiring Top Management's Initiative on system evolving**

Human Resource Development (HRD) Issue Analysis

Site Visit on Training Center

3. HRD Training in Japan: Overview

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Job Report Presentation

Site Visit on Training Center

Site visit on Himeji No.2 TPP

Action Plan Presentation

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4. Online O&M Training : Curriculum (Electrical)

30

- ➢ Based on the further training needs from Bangladesh side, JICA Expert Team conducted **additional O&M training to complement the Action Plan implementation** in Bangladesh affected by the Covid-19.
- ➢ The training was conducted online due to the spread of the Covid-19, and mainly focused on **Electrical Maintenance**.

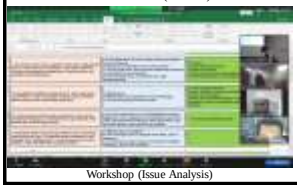
Category	Curriculum
General	✓ Human Resource Development ✓ Optimal Maintenance Planning (including Risk Based Maintenance) ✓ Thermal Efficiency Management ✓ Effective Maintenance for Quality Electric Power Infrastructure
Electrical Maintenance	✓ Fire Prevention Measures of Electrical Equipment ✓ Outline of Insulation ✓ Proper Maintenance of Medium Voltage Motor ✓ Proper Maintenance of Excitation System (incl. AVR) ✓ Proper Maintenance of Cable and Busduct ✓ Proper Maintenance of Generator ✓ Proper Maintenance of Transformer ✓ Proper Maintenance of Switchgear
JICA Original	✓ Issue Analysis ✓ Methodology to Formulate Action Plan

4. Online O&M Training: Overview

31

Online Lecture (Lecturer)

Online Lecture (Participants)



Workshop (Issue Analysis)

Action Plan Presentation

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8. Conclusion

5. Action Plan Implementation: Format

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■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	NOV	DEC	2019 JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	Remarks
1	Service Life Diagnosis	(1) To understand the outline of Service Life Evaluation (2) To understand the various types of deterioration events of Thermal Power plant (3) To understand the evaluation methods and their procedure (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			3										
											Result	No. of times													
												No. of participants													
			1-2	Main Deteriorations Events and their Mechanism of Deterioration	(1)(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			3										
											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			3										
											Result	No. of times													
												No. of participants													
2	Vibration	(1) To understand the mechanism of vibration (2) To understand the important check-ing 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			3										
											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			3										
											Result	No. of times													
												No. of participants													

5. Action Plan Implementation: Findings

34

(Actual Conditions)

- ✓ **Before the pandemic of Covid-19**, JICA-trained engineers & technicians implemented their Action Plan **as previously arranged with active support from management**, and a series of their dissemination activities can help to **improve the O&M capacity at TPPs.**
- ✓ **Safety and Quality culture** is being improved through implementation of Action Plan such as 4S (Sort, Set in order, Shine and Standardize) activities and TBM (Tool Box Meeting).

5. Action Plan Implementation: Findings

35

Pump Alignment Training at BPDB

Lecture Training of Generator at APSCL

Pre-maintenance Meeting at EGCB

Lecture Training of Transformer at NWPGCL

Optimal Maintenance Planning Training at RPCL

Lecture Training of Motor at CPGCBL

5. Action Plan Implementation: Findings

36

(Actual Conditions)

- ✓ JICA-trained engineers & technicians told that they fully utilize **training materials provided by JICA Expert Team**, and that **the practical subject like "pump alignment" was especially useful** among the training course in Japan because they can utilize the knowledge and skills directly to their work.
- ✓ **Recently, due to the response to the Covid-19**, it became difficult for JICA-trained engineers & technicians to implement their Action Plan. **However, some JICA-trained engineers conducted online lecture training and voluntary dissemination activities for their colleagues.**

5. Action Plan Implementation: Findings

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(Actual Conditions)

- ✓ There are **no formalized information sharing system** for trouble, measures and safety information. They only share such kind of information personally, but certain company is now installing the computerized sharing system to comprehensively manage the necessary information.
- ✓ Training program is **focusing on mainly theoretical subject and not practical one.**

(Suggestion from JICA Expert Team)

- ✓ JICA Expert Team would like to request Bangladesh side for **the further understanding and continuous support for Action Plan implemented by JICA-trained engineers & technicians**.
  - ➢ Coordinating Engineers/Technicians work to implement their Action Plan as planned.
  - ➢ Preparing training equipment required for Action Plan implementation.

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6. Issue Analysis of O&M in TPP: Basic Concept

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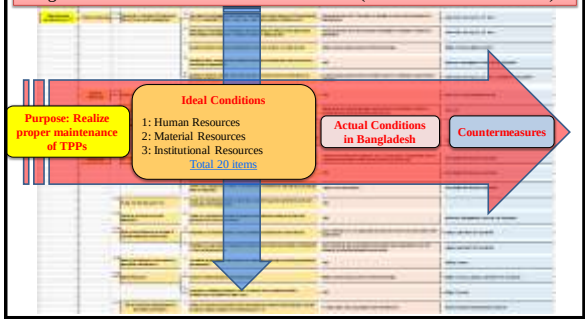
JICA Expert Team comprehensively analyzed O&M issues of TPPs in Bangladesh and identified the countermeasures (not limited to Action Plan)



6. Issue Analysis of O&M in TPP: Human Resources

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Category	Ideal Condition	Actual Condition	Countermeasure
Human Resources	Every personnel has basic knowledge on structure and maintenance procedure of the equipment.	(E) Some personnel don't have basic knowledge on structure & maintenance procedure of the equipment. (T) There are few staff with the necessary skills for maintenance.	Dissemination from Participants (E/T) about **GTCC (GT, ST, HRSG) etc.** Other training subjects like C&I for further improvement.
	Every personnel has basic knowledge on evaluation and maintenance method of the equipment.	(E) Most personnel don't have enough knowledge on evaluation method of equipment. (T) There are few staff with the necessary skills for maintenance.	Dissemination from Participants (E/T) about **NDI, Remaining Life Assessment, balancing etc.** Other training subjects like C&I for further improvement.
	Every personnel can perform required maintenance work with quality in a safe manner.	(E) In some cases, personnel are not able to perform maintenance in a safe manner. (T) Although the quality of work is secured, but safe work is not done.	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) In most cases, personnel are able to plan, manage and evaluate maintenance according to equipment condition. (T) The plant operation data is collected regularly (every hour etc.) and reflected in maintenance.	Dissemination from Participants (E/T) about **Maintenance of GTCC etc.** More specific training focusing on maintenance scheduling for further improvement.
	It's possible to identify causes when fault occurs, and plan for emergency & permanent measure.	(E) In most cases, personnel are able to plan for emergency & permanent measure. (T) We are able to investigate the cause of the problem and provide emergency measures, but we are not able to implement permanent measures.	Dissemination from Participants (E/T) about **Maintenance of GTCC etc.** More specific training focusing on RCA (Root Cause Analysis) for further improvement.

6. Issue Analysis of O&M in TPP: Material Resources

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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) In only few cases, tools and jigs are well managed. (T) Necessary tools are insufficient, not managed and not organized.	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) In most cases, consumables and spare parts are not well managed. (T) Consumables are enough, but there are no spare parts	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) Appropriate manuals are not available. (T) There is a shortage of manuals of old plants and Chinese plants.	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) In most cases, work procedure for each maintenance are not written. (T) Work procedures were prepared based on manufacturer's manual and O&M experience.	Making exiting procedures set in order. (E/T). If needed, **management may request the supplier/vender for additional manual.**

6. Issue Analysis of O&M in TPP: Institutional Resources

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Category	Ideal Condition	Actual Condition	Countermeasure
Institutional Resources (1)	Each equipment has prescribed maintenance standards such as frequency, details of maintenance work.	(E) In most cases, has no prescribed maintenance standard. (T) Although there are maintenance standards based on the manufacturer's recommendation, we can not maintain according the standards.	Dissemination from Participants (E) about **Risk Based Maintenance etc.** More specific training, especially of the latest technology.
	Each equipment has standard check points.	(E) In most cases, has standard check points but not follow them. (T) The standard check points are instituted, and maintenance staff is possible to judge pass / fail.	Dissemination from Participants (E) about **Risk Based Maintenance etc.** More specific training, especially of the latest technology.
	There is an institutional system to evaluate the maintenance standards and change them if necessary.	(E) There is no such system. (T) There is no system to evaluate (feedback) maintenance standards.	Dissemination from Participants (E) about **Risk Based Maintenance etc.** More specific training, especially of the latest technology.
	Power-cut maintenance work is planned, considering power generation plan and conditions of the equipment.	(E) Usually, not properly planned. (T) Although there is a power-cut maintenance work plan, it is not implemented as planned.	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) In most cases, there is no such system. (T) The operation data of the plant is accumulated and reflected in the maintenance plan.	Dissemination from Participants (E) about **Thermal Efficiency Management, Service Life Diagnosis etc.** More specific training, especially of the data utilization.

6. Issue Analysis of O&M in TPP: Institutional Resources

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Category	Ideal Condition	Actual Condition	Countermeasure
Institutional Resources (2)	Information of faults/troubles is accumulated and shared with staff member.	(E) Not properly shared. (T) Information on the trouble is shared for corresponding work group (several people scale), but it is not shared to other departments and other plants.	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) Not properly shared and reflected. (T) Already shared.	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) Not properly reflected. (T) The inspection result can not be reflected in the next maintenance plan.	Dissemination from Participants (E/T) about **Quality Control etc.**
	Rules for safety measures are established.	(E) In many cases, there is no such established safety measure. (T) Although there are safety rules, workers do not follow the rules.	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) In most cases, such incidents are not shared. (T) Already shared.	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 no enough system to train the maintenance staff.	Dissemination from Participants (E/T) about **Human Resource Development.** Support from external resource may be necessary for further improvement in training system, training facilities etc.

6. Issue Analysis of O&M in TPP: Findings

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(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 recognize through the Project that the following points to be improved.
  - ➢ Since trainings in Japan and additional online training mainly focused on general contents of thermal power generation and its mechanical and electrical maintenance subjects, there is still room for improvement in;
    - **Basic skills & knowledge of C&I maintenance and 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, there is still room for **improvement in organizational HRD system** such as the lack of practical trainings, mismatch in training needs and contents.

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7. KANSAI's Technical Proposal: Suggestion

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(Suggestion from JICA Expert Team)

- ✓ JICA Expert Team would like to suggest following items for further improvement in O&M at TPPs in Bangladesh.
  1. **Technical Training in Japan**
     - i. Training Course of **C&I maintenance and 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.
     - Assume that the existing BPDB training center in Ghorashal will be the scope of the enhancement.

7. KANSAI's Technical Proposal : Technical Training

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(1) Training Course of C&I maintenance

(C&I training image) tuning vibration sensor

(C&I training image) Valve Control

- ✓ Training Course of **C&I maintenance** can enhance **basic skills & knowledge of engineers and technicians** as achieved in the training course of mechanical and electrical maintenance in this Project.

7. KANSAI's Technical Proposal : Technical Training

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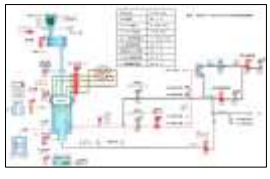
(2) Training Course of Plant Operation

(Operation training image) Plant Simulator



(Operation training image) Training Material (P&ID)

- ✓ Same as Maintenance, **Operation is another important part in O&M of TPPs.**
- ✓ Training Course of **Plant Operation** can enhance **basic skills & knowledge of plant operators** as achieved in the training course of mechanical and electrical maintenance in this Project.

7. KANSAI's Technical Proposal : Technical Training

(3) Training Course of more practical skills (Root Cause Analysis)

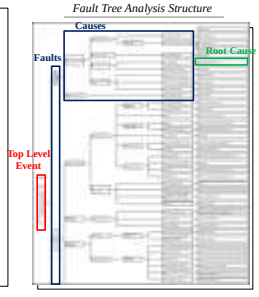
About Fault Tree Analysis (FTA)

1. Deductive Analytic Method
2. Visually indicating a failure path
3. Can identify the root causes of Trouble

Benefits of Fault Tree Analysis

- When trouble happens, engineers and technicians **can easily check the possible causes** at glance
- Engineers and technicians **can quickly identify the root causes of the trouble**
- Can prevent the recurrence of the trouble
- **Lead to reduce down-time of TPP**

Fault Tree Analysis Structure



✓ Fault Tree Analysis can **enhance analytic skills and knowledge** of engineers and technicians, that leads to **reduce down-time of TPP.**

7. KANSAI's Technical Proposal : Technical Training

(4) Training Course of more practical skills (CPM for Maintenance Scheduling)

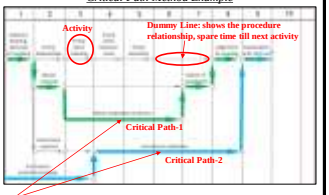
About Critical Path Method (CPM)

1. A project management method to schedule a set of activities
2. Use network diagrams to represent the necessary activities

Benefits of Critical Path Method

- Easily **visualize project activities and their relations**
- Easy to **revise the schedule**
- **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

✓ 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

✓ **Enhancement of HRD training system** (e.g. training planning, training subjects reviewing, introducing practical training equipment) can strengthen the **organizational O&M capability in Bangladesh** not depending on the skills and knowledge of individual engineers and technicians.

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7. Conclusion

Summary of the JICA project

✓ We've already implemented the capacity building project for O&M at TPPs for around 4 years as follows:
- Conducting **O&M training in Japan and online training** based on the training needs and the current situation.
- Reviewing **dissemination from JICA-trained participants to other colleagues** about knowledge and skills obtained in JICA training.

✓ Through analyzing the O&M issues at TPPs, we suggest **the project is practical and effective to improve O&M capacity.**

For further improvement of O&M at TPPs

✓ **Engineers and Technicians** should continue to disseminate their Action Plan Activities with strong **support and promotion from Management**.

✓ When needing further support, you may have an **option to utilize external resources** at the request from MPEMR to JICA.

添付資料 6-2-4

研修実績

(1)　第 1 回本邦研修

第 1 回本邦研修

(1) エンジニア研修（2018 年 1 月 14 日～2 月 17 日）

日程	時間	研修項目	研修場所
1 月 14 日 (日)	－	来日	－
1 月 15 日 (月)	10:00～10:55	ブリーフィング	JICA 関西
	11:00～12:00	プログラムオリエンテーション	
	12:00～13:00	コースオリエンテーション	
1 月 16 日 (火)	9:00～12:00	ジョブレポート発表	JICA 関西
	13:00～15:40	関西電力概要／燃料	
	16:30～17:30	日本語講習	
1 月 17 日 (水)	10:00～12:00	ジェネラル・オリエンテーション（歴史・文化）	JICA 関西
	13:00～16:00	火力発電所（ＧＴＣＣ概要／石炭概要）	
	16:30～17:30	日本語講習	
1 月 18 日 (木)	9:30～12:00	三菱電機株式会社　工場見学	三菱電機神戸製作所
	14:30～17:00	関西電力中央給電指令所見学、K-Vacs 説明	関西電力本店
1 月 19 日 (金)	10:00～16:00	アクションプラン作成指導（PCM 手法）	JICA 関西
1 月 20 日 (土)	－	休日	－
1 月 21 日 (日)	－	休日	－
1 月 22 日 (月)	9:00～12:00	オリエンテーション	関西電力 研修センター
	13:00～16:00	振動基礎技術	
1 月 23 日 (火)	9:00～12:00	振動基礎技術	関西電力 研修センター
	13:00～15:45	安全体感研修	
1 月 24 日 (水)	9:00～15:30	振動基礎技術	関西電力 研修センター
1 月 25 日 (木)	9:00～16:00	振動基礎技術	関西電力 研修センター
1 月 26 日 (金)	13:10～17:00	石川島播磨重工業株式会社　工場見学	IHI 相生工場
1 月 27 日 (土)	－	休日	－
1 月 28 日 (日)	－	休日	－
1 月 29 日 (月)	9:40～12:00	設備見学：姫路第二発電所	姫路第二発電所
	13:30～17:00	三菱日立パワーシステムズ株式会社　工場見学	MHPS 高砂工場
1 月 30 日 (火)	9:00～12:00	品質管理、効率管理	関西電力 研修センター
	13:00～15:30	過去教訓（あすなろ館）、ヒューマンエラー	
1 月 31 日 (水)	9:00～12:00	非破壊検査概要、ＭＴ	関西電力 研修センター
	13:00～16:00	ＭＴ、ＰＴ	
2 月 1 日 (木)	9:00～12:00	ＰＴ	関西電力 研修センター
	13:00～16:00	ＵＴ	
2 月 2 日 (金)	9:00～12:00	ＳＵＭＰ	関西電力 研修センター
	13:00～15:30	ＲＴ	
2 月 3 日 (土)	－	休日	－
2 月 4 日 (日)	－	日本文化体験	京都
2 月 5 日 (月)	13:30～16:20	川崎重工業株式会社　工場見学	川崎重工明石工場
2 月 6 日 (火)	9:00～16:00	振動基礎技術	関西電力 研修センター

2 月 7 日 (水)	9:00～12:00	人材育成、ＧＴＣＣ概要（ＳＴ，ＨＲＳＧ含む）	関西電力 研修センター
	13:00～16:00	ＧＴ＆高温部品	
2 月 8 日 (木)	9:00～16:00	ＧＴ＆高温部品、ＧＴＣＣの保全	関西電力 研修センター
2 月 9 日 (金)	13:30～15:30	設備見学：舞鶴発電所	舞鶴発電所
2 月 13 日 (火)	9:00～16:00	ＧＴ（発電機、制御）、給水処理	関西電力 研修センター
2 月 14 日 (水)	10:30～17:00	アクションプラン作成	JICA 関西
2 月 15 日 (木)	9:00～12:00	アクションプラン作成	JICA 関西
	13:00～14:45	アクションプラン発表	
2 月 16 日 (金)	10:00～11:00	評価会	JICA 関西
	11:00～11:30	閉講式	
	11:30～12:30	反省会	
2 月 17 日 (土)	－	離日	－

(2) テクニシャン研修（2018 年 1 月 14 日～2 月 3 日）

日程	時間	研修項目	研修場所
1 月 14 日 (日)	－	来日	－
1 月 15 日 (月)	10:00～10:55	ブリーフィング	JICA 関西
	11:00～12:00	コースオリエンテーション	
	12:00～13:00	プログラムオリエンテーション	
	14:00～17:00	ジョブレポート発表	
1 月 16 日 (火)	10:00～12:00	アクションプラン作成指導（PCM 手法）	JICA 関西
	13:00～15:40	関西電力概要／燃料	
	16:30～17:30	日本語講習	
1 月 17 日 (水)	10:00～12:00	ジェネラル・オリエンテーション（歴史・文化）	JICA 関西
	13:00～16:00	火力発電所（ＧＴＣＣ概要／石炭概要）	
	16:30～17:30	日本語講習	
1 月 18 日 (木)	9:30～12:00	アクションプラン作成指導（PCM 手法）	JICA 関西
	14:30～17:00	オリエンテーション	関電プラント テクノセンター
1 月 19 日 (金)	9:00～12:00	溶接施工の基礎	関電プラント テクノセンター
	13:00～16:00	安全体感訓練	
1 月 20 日 (土)	－	休日	－
1 月 21 日 (日)	－	休日	－
1 月 22 日 (月)	9:00～12:00	金属材料取扱い	関電プラント テクノセンター
	13:00～16:30	品質体感訓練	
1 月 23 日 (火)	9:00～12:00	高温高圧配管の保守	関電プラント テクノセンター
	13:00～16:30	ポンプ分解点検	
1 月 24 日 (水)	9:00～12:00	高温高圧配管の保守	関電プラント テクノセンター
	13:00～16:30	弁分解点検	
1 月 25 日 (木)	9:00～16:00	非破壊検査	関電プラント テクノセンター
1 月 26 日 (金)	13:10～17:00	石川島播磨重工業株式会社　工場見学	IHI 相生工場
1 月 27 日 (土)	－	休日	－
1 月 28 日 (日)	－	休日	－

1 月 29 日 (月)	9:40～12:00	設備見学：姫路第二発電所	姫路第二発電所
	13:30～17:00	三菱日立パワーシステムズ株式会社　工場見学	MHPS 高砂工場
1 月 30 日 (火)	9:00～12:00	計器類の保守	関電プラント テクノセンター
	13:00～16:30	事故災害未然防止	
1 月 31 日 (水)	10:00～17:00	アクションプラン作成	JICA 関西
2 月 1 日 (木)	9:30～12:00	アクションプラン作成	JICA 関西
	13:30～16:30	アクションプラン発表	
2 月 2 日 (金)	13:30～14:30	評価会	JICA 関西
	14:30～15:00	閉講式	
	15:00～16:00	意見交換会	
	16:00～17:00	反省会	
2 月 3 日 (土)	－	離日	－

(2)　第 2 回本邦研修

第 2 回本邦研修

(1) エンジニア研修（2019 年 2 月 24 日～3 月 30 日）

日程	時間	研修項目	研修場所
2 月 24 日 (日)	－	来日	－
2 月 25 日 (月)	10:00～11:00	ブリーフィング	JICA 関西
	11:00～12:00	プログラムオリエンテーション	
	13:00～14:00	コースオリエンテーション	
	14:00～16:00	ジョブレポート発表会	
2 月 26 日 (火)	9:00～16:00	アクションプラン作成指導（問題分析）	JICA 関西
	18:00～19:30	日本語講習	
2 月 27 日 (水)	9:00～12:00	アクションプラン作成指導（問題分析）	JICA 関西
	13:00～16:00	関西電力概要／燃料	
	18:00～19:30	日本語講習	
2 月 28 日 (木)	9:00～12:00	火力発電所概要（ＧＴＣＣ／石炭）	JICA 関西
	14:00～16:30	関西電力中央給電指令所見学、K-Vacs 紹介、RMC 見学	関西電力本店
	18:00～19:30	日本語講習	JICA 関西
3 月 1 日 (金)	10:00～12:00	オリエンテーション	関西電力 研修センター
	13:30～16:00	ＧＴＣＣ	
3 月 2 日 (土)	－	ホームビジットプログラム	－
3 月 3 日 (日)	－	休日	－
3 月 4 日 (月)	9:00～12:00	ガスタービン	関西電力 研修センター
	13:00～16:00	蒸気タービン	
3 月 5 日 (火)	9:00～12:00	排熱回収ボイラ	関西電力 研修センター
	13:00～16:00	高温部品	
3 月 6 日 (水)	9:00～16:00	余寿命診断	関西電力 研修センター
	16:00～16:30	研修レビュー	
3 月 7 日 (木)	13:00～16:00	石川島播磨重工業株式会社　工場見学	IHI 相生工場
3 月 8 日 (金)	9:15～11:45	設備見学：姫路第二発電所	姫路第二発電所
	13:30～17:00	三菱日立パワーシステムズ株式会社　工場見学	MHPS 高砂工場
3 月 9 日 (土)	－	休日	－
3 月 10 日 (日)	－	休日	－
3 月 11 日 (月)	13:30～16:15	設備見学：舞鶴発電所	舞鶴発電所
3 月 12 日 (火)	9:00～16:00	振動基礎技術	関西電力 研修センター
3 月 13 日 (水)	9:00～16:00	振動基礎技術	関西電力 研修センター
3 月 14 日 (木)	9:00～16:00	振動基礎技術	関西電力 研修センター
3 月 15 日 (金)	13:30～16:30	ヒューマンエラー／シミュレーター	姫路第二発電所
3 月 16 日 (土)	－	休日	－
3 月 17 日 (日)	－	休日	－
3 月 18 日 (月)	9:00～10:30	品質管理	関西電力 研修センター
	10:30～12:00	最適保守計画	
	13:00～14:30	ＧＴＣＣ制御	

	14:30～16:00	効率管理	
3 月 19 日 (火)	9:00～11:00	給水処理	関西電力 研修センター
	11:00～12:00	溶接管理	
	13:00～14:00	質の高いインフラ	
	14:30～16:00	人材育成	
3 月 20 日 (水)	9:00～12:00	安全体感	関西電力 研修センター
	13:00～14:30	過去教訓（あすなろ館）	
	14:30～15:30	アライメント調整	
	15:30～16:00	危険予知ミーティング	
	16:00～16:30	研修レビュー	
3 月 21 日 (木)	－	休日	－
3 月 22 日 (金)	9:00～11:30	ポンプアライメント	関西電力 研修センター
	11:30～12:00	危険予知ミーティング	
	13:30～16:00	ポンプアライメント	
3 月 23 日 (土)	－	休日	－
3 月 24 日 (日)	－	歴史街道講義	京都
3 月 25 日 (月)	9:00～16:00	非破壊検査	関西電力 研修センター
3 月 26 日 (火)	9:00～16:00	非破壊検査	関西電力 研修センター
	16:00～16:30	研修レビュー	
3 月 27 日 (水)	9:00～16:00	アクションプラン作成	JICA 関西
3 月 28 日 (木)	9:00～16:00	アクションプラン作成	JICA 関西
3 月 29 日 (金)	9:00～10:00	アクションプラン発表	JICA 関西
	10:00～11:00	評価会	
	11:00～12:00	閉講式	
	13:00～14:00	反省会	
3 月 30 日 (土)	－	離日	－

(2) テクニシャン研修（2019 年 2 月 24 日～3 月 16 日）

日程	時間	研修項目	研修場所
2 月 24 日 (日)	－	来日	－
2 月 25 日 (月)	10:00～11:00	ブリーフィング	JICA 関西
	11:00～12:00	プログラムオリエンテーション	
	12:00～13:00	コースオリエンテーション	
	14:00～17:00	ジョブレポート発表会	
2 月 26 日 (火)	9:00～16:00	アクションプラン作成指導（問題分析）	JICA 関西
	18:00～19:30	日本語講習	
2 月 27 日 (水)	9:00～12:00	アクションプラン作成指導（問題分析）	JICA 関西
	13:00～16:00	関西電力概要／燃料	
	18:00～19:30	日本語講習	
2 月 28 日 (木)	9:00～12:00	火力発電所概要（ＧＴＣＣ／石炭）	JICA 関西
	14:00～16:30	関西電力中央給電指令所見学、K-Vacs 紹介、RMC 見学	関西電力本店
	18:00～19:30	日本語講習	JICA 関西
3 月 1 日 (金)	9:00～11:00	オリエンテーション	関電プラント テクノセンター
	11:00～12:00	ＧＴ・ＳＴ・ＨＲＳＧ概要・構造	
	13:30～16:00	品質体感訓練	

3 月 2 日 (土)	－	休日	－
3 月 3 日 (日)	－	休日	－
3 月 4 日 (月)	9:00～16:30	非破壊検査	関電プラント テクノセンター
3 月 5 日 (火)	9:00～16:30	ポンプ分解点検	関電プラント テクノセンター
3 月 6 日 (水)	9:00～12:00	金属材料取扱い	関電プラント テクノセンター
	13:00～14:00	労働安全	
	14:00～16:30	安全体感訓練	
	16:30～17:00	研修レビュー	
3 月 7 日 (木)	13:00～16:00	石川島播磨重工業株式会社　工場見学	IHI 相生工場
3 月 8 日 (金)	9:15～11:45	設備見学：姫路第二発電所	姫路第二発電所
	13:30～17:00	三菱日立パワーシステムズ株式会社　工場見学	MHPS 高砂工場
3 月 9 日 (土)	－	歴史街道講義	京都
3 月 10 日 (日)	－	休日	－
3 月 11 日 (月)	13:30～16:15	設備見学：舞鶴発電所	舞鶴発電所
3 月 12 日 (火)	9:00～11:00	高温高圧配管の保守	関電プラント テクノセンター
	11:00～11:30	危険予知ミーティング	
	11:30～13:30	溶接施工基礎	
	13:30～14:00	危険予知ミーティング	
	14:00～16:30	溶接施工実習	
3 月 13 日 (水)	9:00～11:00	事故災害未然防止	関電プラント テクノセンター
	11:00～16:00	ＧＴ・ＳＴ・ＨＲＳＧ概要・構造	
	16:00～16:30	研修レビュー	
3 月 14 日 (木)	9:00～16:00	アクションプラン作成	JICA 関西
3 月 15 日 (金)	9:00～10:00	アクションプラン発表会	JICA 関西
	10:00～11:00	評価会	
	11:00～12:00	閉講式	
	13:00～14:00	反省会	
3 月 16 日 (土)	－	離日	－

(3)　第 3 回本邦研修

第 3 回本邦研修

(1) エンジニア研修（2019 年 11 月 17 日～12 月 21 日）

日程	時間	研修項目	研修場所
11 月 17 日 (日)	–	来日	–
11 月 18 日 (月)	10:00～11:00	ブリーフィング	JICA 関西
	11:00～12:00	プログラムオリエンテーション	
	13:00～14:00	コースオリエンテーション	
	14:00～17:00	ジョブレポート発表会	
11 月 19 日 (火)	9:00～17:00	アクションプラン作成指導（問題分析）	JICA 関西
	18:00～19:30	日本語講習	
11 月 20 日 (水)	9:00～12:00	アクションプラン作成指導（問題分析）	JICA 関西
	14:00～17:00	関西電力中央給電指令所見学、K-Vacs 紹介、RMC 見学	関西電力本店
	18:00～19:30	日本語講習	JICA 関西
11 月 21 日 (木)	9:00～12:00	関西電力概要／燃料	JICA 関西
	13:00～17:00	火力発電所概要（ＧＴＣＣ／石炭）	
	18:00～19:30	日本語講習	
11 月 22 日 (金)	13:00～17:00	石川島播磨重工業株式会社　工場見学	IHI 相生工場
11 月 23 日 (土)	–	休日	–
11 月 24 日 (日)	–	休日	–
11 月 25 日 (月)	9:00～12:00	三菱日立パワーシステムズ株式会社　工場見学	MHPS 高砂工場
	13:30～17:00	設備見学：姫路第二発電所	姫路第二発電所
11 月 26 日 (火)	13:00～17:00	設備見学：舞鶴発電所	舞鶴発電所
11 月 27 日 (水)	10:00～12:00	オリエンテーション	関西電力 研修センター
	13:00～15:00	質の高いインフラ	
	15:00～17:00	人材育成	
11 月 28 日 (木)	9:00～12:00	過去教訓（あすなろ館）	関西電力 研修センター
	13:00～17:00	安全体感	
11 月 29 日 (金)	9:00～10:30	品質管理	関西電力 研修センター
	10:30～12:00	最適保守計画	
	13:00～16:30	ＧＴＣＣ	
	16:30～17:00	週間レビュー	
11 月 30 日 (土)	–	休日	–
12 月 1 日 (日)	–	休日	–
12 月 2 日 (月)	13:30～17:00	川崎重工業株式会社　工場見学	川崎重工明石工場
12 月 3 日 (火)	9:00～12:00	蒸気タービン	関西電力 研修センター
	13:00～15:30	排熱回収ボイラ	
	15:30～17:00	作業前安全ミーティング(TBM)	
12 月 4 日 (水)	9:00～12:00	ポンプアライメント	関西電力 研修センター
	13:00～14:00	作業前安全ミーティング(TBM)	
	14:00～17:00	ポンプアライメント	
12 月 5 日 (木)	9:00～10:30	給水処理	関西電力 研修センター
	10:30～12:00	効率管理	
	13:00～14:00	溶接管理	
	14:00～16:30	ＧＴＣＣ制御	

	16:30～17:00	週間レビュー	
12 月 6 日 (金)	13:30～16:30	ヒューマンエラー／シミュレーター	姫路第二発電所
12 月 7 日 (土)	－	休日	－
12 月 8 日 (日)	－	休日	－
12 月 9 日 (月)	9:00～17:00	振動基礎技術	関西電力 研修センター
12 月 10 日 (火)	9:00～17:00	振動基礎技術	関西電力 研修センター
12 月 11 日 (水)	9:00～17:00	振動基礎技術	関西電力 研修センター
12 月 12 日 (木)	9:00～12:00	ガスタービン	関西電力 研修センター
	13:00～17:00	高温部品	
12 月 13 日 (金)	9:00～16:30	余寿命診断	関西電力 研修センター
	16:30～17:00	週間レビュー	
12 月 14 日 (土)	－	休日	－
12 月 15 日 (日)	－	歴史街道講義	京都
12 月 16 日 (月)	9:00～17:00	非破壊検査	関西電力 研修センター
12 月 17 日 (火)	9:00～17:00	非破壊検査	関西電力 研修センター
12 月 18 日 (水)	9:00～17:00	アクションプラン作成	JICA 関西
12 月 19 日 (木)	9:00～12:00	アクションプラン作成	JICA 関西
	13:00～15:00	アクションプラン発表	
12 月 20 日 (金)	10:00～11:00	評価会	JICA 関西
	11:00～12:00	閉講式	
	12:00～13:00	意見交換会	
	13:00～14:00	反省会	
12 月 21 日 (土)	－	離日	－

(2) テクニシャン研修（2019 年 11 月 17 日～12 月 14 日）

日程	時間	研修項目	研修場所
11 月 17 日 (日)	－	来日	－
11 月 18 日 (月)	10:00～11:00	ブリーフィング	JICA 関西
	11:00～12:00	プログラムオリエンテーション	
	13:00～14:00	コースオリエンテーション	
	14:00～17:00	ジョブレポート発表会	
11 月 19 日 (火)	9:00～17:00	アクションプラン作成指導（問題分析）	JICA 関西
	18:00～19:30	日本語講習	
11 月 20 日 (水)	9:00～12:00	アクションプラン作成指導（問題分析）	JICA 関西
	14:00～17:00	関西電力中央給電指令所見学、K-Vacs 紹介、RMC 見学	関西電力本店
	18:00～19:30	日本語講習	JICA 関西
11 月 21 日 (木)	9:00～12:00	関西電力概要／燃料	JICA 関西
	14:00～16:30	火力発電所概要（ＧＴＣＣ／石炭）	
	18:00～19:30	日本語講習	
11 月 22 日 (金)	13:00～17:00	石川島播磨重工業株式会社　工場見学	IHI 相生工場
11 月 23 日 (土)	－	休日	－

11 月 24 日 (日)	－	休日	－
11 月 25 日 (月)	9:00～12:00	三菱日立パワーシステムズ株式会社　工場見学	MHPS 高砂工場
	13:30～17:00	設備見学：姫路第二発電所	姫路第二発電所
11 月 26 日 (火)	13:00～17:00	設備見学：舞鶴発電所	舞鶴発電所
11 月 27 日 (水)	9:00～11:00	オリエンテーション	関電プラント テクノセンター
	11:00～12:00	ＧＴ・ＳＴ・ＨＲＳＧ概要・構造	
	13:00～17:00	品質体感訓練	
11 月 28 日 (木)	9:00～17:00	非破壊検査	関電プラント テクノセンター
11 月 29 日 (金)	9:00～12:00	金属材料取扱い	関電プラント テクノセンター
	13:00～14:00	労働安全	
	14:00～16:30	安全体感訓練	
	16:30～17:00	週間レビュー	
11 月 30 日 (土)	－	休日	－
12 月 1 日 (日)	－	休日	－
12 月 2 日 (月)	9:00～17:00	ポンプ分解点検	関電プラント テクノセンター
12 月 3 日 (火)	9:00～17:00	ポンプ分解点検	関電プラント テクノセンター
12 月 4 日 (水)	9:00～15:30	ポンプ分解点検	関電プラント テクノセンター
	15:30～17:00	教育施設見学	関西学院大学神戸三田キャンパス
12 月 5 日 (木)	9:00～12:00	振動の基礎	関電プラント テクノセンター
	13:00～17:00	振動解析	
12 月 6 日 (金)	9:00～12:00	振動の基礎	関電プラント テクノセンター
	13:00～16:30	振動解析	
	16:30～17:00	週間レビュー	
12 月 7 日 (土)	－	歴史街道	京都
12 月 8 日 (日)	－	休日	－
12 月 9 日 (月)	9:00～12:00	高温高圧配管の保守	関電プラント テクノセンター
	13:00～16:00	ＧＴ・ＳＴ・ＨＲＳＧ概要・構造	
	16:00～17:00	作業前安全ミーティング(TBM)	
12 月 10 日 (火)	9:00～11:00	事故災害未然防止	関電プラント テクノセンター
	11:00～12:00	溶接施工基礎	
	13:00～13:30	作業前安全ミーティング(TBM)	
	13:30～16:30	溶接施工実習	
12 月 11 日 (水)	9:00～17:00	アクションプラン作成	JICA 関西
12 月 12 日 (木)	9:00～15:00	アクションプラン作成	JICA 関西
	15:00～17:00	アクションプラン発表会	
12 月 13 日 (金)	9:00～10:00	評価会	JICA 関西
	11:00～12:00	閉講式	
	12:00～13:00	意見交換会	
	13:00～14:00	反省会	
12 月 14 日 (土)	－	離日	－

(3) マネジメント研修（2019 年 12 月 8 日～12 月 14 日）

日程	時間	研修項目	研修場所
12 月 8 日 (日)	―	来日	―
12 月 9 日 (月)	10:00～11:00	ブリーフィング	JICA 関西
	11:00～11:30	プログラムオリエンテーション	
	13:00～13:30	コースオリエンテーション	関西電力本店
	13:40～14:20	関西電力説明	
	14:20～16:00	ジョブレポート発表会	
	16:00～17:00	質の高いインフラ	
12 月 10 日 (火)	10:00～12:00	関西電力研修センター見学	関西電力 研修センター
	14:00～16:00	関電プラントテクノセンター見学	関電プラント テクノセンター
	16:00～17:00	人材育成	
12 月 11 日 (水)	10:00～14:00	設備見学：姫路第二発電所	姫路第二発電所
	15:00～16:00	関係者分析／問題分析	
12 月 12 日 (木)	9:00～15:00	アクションプラン作成	JICA 関西
	15:00～17:00	アクションプラン発表会	
12 月 13 日 (金)	10:00～11:00	評価会	JICA 関西
	11:00～12:00	閉講式	
	12:00～13:00	意見交換会	
	13:00～14:00	反省会	
12 月 14 日 (土)	―	離日	―

(4)　第 4 回オンライン研修

第 4 回オンライン研修

エンジニア研修（2021 年 5 月 31 日～6 月 10 日）

日程	時間		研修項目	研修場所 （オンライン配信場所）
	日本時間	バ国時間		
5 月 27 日 (木)	16:00～17:00	13:00～14:00	事前オリエンテーション（Zoom 接続テスト）	関西電力 研修センター
5 月 28 日 (金)	－	－	休日	－
5 月 29 日 (土)	－	－	休日	－
5 月 30 日 (日)	－	－	休日	－
5 月 31 日 (月)	13:00～14:00	10:00～11:00	開講式／コースオリエンテーション	関西電力 研修センター
	14:00～15:30	11:00～12:30	ジョブレポート発表会	
	16:30～17:30	13:30～14:30		
	17:30～17:00	16:00～17:00	アクションプラン作成指導（問題分析）	
6 月 1 日 (火)	13:00～15:00	10:00～12:00	アクションプラン作成指導（問題分析）	
	16:30～19:00	13:30～16:00		
6 月 2 日 (水)	13:00～14:00	10:00～11:00	人材育成	
	14:00～15:00	11:00～12:00	最適保守計画	
	16:30～17:30	13:30～14:30	質の高いインフラ	
	17:30～18:30	14:30～15:30	熱効率管理	
6 月 3 日 (木)	13:00～14:40	10:00～11:40	電気設備の火災予防	
	16:30～17:50	13:30～14:50	絶縁の概要	
	18:00～20:00	15:00～17:00	中電圧電動機の最適保全	
6 月 4 日 (金)	－	－	休日	－
6 月 5 日 (土)	－	－	休日	－
6 月 6 日 (日)	－	－	休日	－
6 月 7 日 (月)	13:00～15:00	10:00～12:00	励磁装置の最適保全	関西電力 研修センター
	16:30～17:30	13:30～14:30		
	17:50～20:10	14:50～17:10	ケーブル・バスダクトの最適保全	
6 月 8 日 (火)	13:00～15:00	10:00～12:00	発電機の最適保全	
	16:30～18:00	13:30～15:00		
	18:00～20:00	15:00～17:00	変圧器の最適保全	
6 月 9 日 (水)	13:00～15:00	10:00～12:00	開閉装置の最適保全	
	16:30～17:10	13:30～14:10		
	17:20～19:40	14:20～16:40	アクションプラン作成	
6 月 10 日 (木)	13:00～15:00	10:00～12:00	アクションプラン作成	
	16:30～17:30	13:30～14:30	アクションプラン発表会	
	17:30～18:30	14:30～15:30	閉講式	