USAID ENERGY POLICY PROGRAM

BEST PRACTICES IN THERMAL OPERATIONS AND MAINTENANCE POST-TRAINING REPORT

JANUARY 29, 2015

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DISCLAIMER

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CONTENTS

ACRONYMS

CMMS	Computerized Maintenance Management System
G2G	Government to Government
GENCO	Generation Company
IPPs	Independent Power Producers
NPCC	National Power Control Centre
O&M	Operations and Maintenance

EXECUTIVE SUMMARY

To support power generation activities, EPP delivered training on best practices in operations and maintenance (O&M) for GENCO's I (Jamshoro), II (Guddu) and III (Muzaffargarh). This training focused on developing industrial safety standards, cost controls, improved heat-rate testing techniques, improving project management and financing capabilities, increasing plant efficiency, achieving operational excellence, improving fuel management, enhancing protection, instrumentation, and controls. Participants developed knowledge and skills to improve efficiency and delivery of services at their respective plants, and they have committed to implementing the suggested changes as they carry out their day-to-day duties.

This report presents the results of the EPP's focus group discussions with participants who attended the "Best Practices in Thermal O&M" training in 2014. The report aimed to identify the extent of learning and application in the workplace. Twenty participants from GENCOs I, II, & III along with five female student participants, totaling to 65 participants, received training on best practices on thermal O&M on June 2014.

INTRODUCTION

To support generation activities, EPP delivered training on best practices in operations and maintenance (O&M) for GENCO's I (Jamshoro), II (Guddu), and III (Muzaffargarh). This training focused on developing industrial safety standards, cost controls, improved heat rate testing techniques, improving project management and financing capabilities, increasing plant efficiency, achieving operational excellence, improving fuel management, enhancing protection, instrumentation, and controls. EPP's two-week training course, conducted during March through June 2014 in batches of three, focused on increasing participant knowledge of modern techniques to improve thermal O&M that will result in an increased energy supply. The chart below details the training participants:

Participant Organization	March 31 - April 11		May 19-30		June 9-20		Total
	M	F	M	F	M	F	
GENCO 1-Jamshoro	7	-	6	-	7	-	20
GENCO II-Guddu	6	-	7	-	6	-	19
GENCO III-Muzaffargarh	6	-	7	-	7	-	20
GENCO Holding Company Limited	1	-	-	-	-	-	1
Air University	-	-	-	-	-	1	1
NUST	-	-	-	-	-	4	4
Total	**20**	**-**	**20**	**-**	**20**	**5**	**65**

The in-classroom training focused on improving the current practices at thermal power plants with respect to plant culture, project management, maintenance planning, fuel management, and power plant tariff strategies. The training compliments EPP's continued support to all the three GENCOs through Government to Government (G2G) agreements and policy reform efforts.

Participants shared their specific feedback about training outcomes, challenges, and identified areas for additional training. All the participants are effectively using the newly acquired skills from the training at the thermal power plants in their respective departments, including; efficiency of the heat rate, timely repairing of the steam leakages that were causing huge losses, and reducing the overall fuel consumption. During the discussions, the participants identified challenges related to National Power Control Centre (NPCC) shutdowns, communication gaps with the senior and mid-level management, and old equipment as detriments to improving O&M procedures.

Participants identified gaps and suggestions to further strengthen plant efficiency, including providing training to their senior supervisors and managers on the same O&M skills for better implementation of O&M knowledge, skills and attitudes; coordinate exposure visits to other power plants especially to Independent Power Plants (IPPs); and proposed training for thermal plants Human Resource and Administration personnel.

Conclusions about Training Impact

The overall focus group discussion confirms that the O&M training successfully provided participants with advanced and up-to-date knowledge of best practices and skills to take back to their own institutions. The trainees acquired new skills such as: identification of steam leakages, heat-rate balancing, and maintenance techniques. They are now using these skills and increasing their contribution towards improvement in operations at their respective power plants.

METHODOLOGY

To track sustainability of EPP's trainings, the focus group discussions were conducted to gauge the long-term effects of O&M training skills and implementation of the training assignments at power plants.

Six focus groups were conducted, two each in each GENCO. A total of 47 participants attended the discussions held in September and October 2014.

GENCO	Date Conducted	No. of Participants
GENCO I-Jamshoro	September 24-25, 2014	16
GENCO III-Muzaffargarh	October 1-2, 2014	16
GENCO II-Guddu	October 15-16, 2014	13
Total		**45**

At the end of each training, participants received assignments to complete and submit with a given deadline. Assignments included:

- Demonstrate how to detect the leaks in seals and how to fix them,
- Teach the Operators how to read and understand control logics, after study and calculations upgrade the equipment,
- Meet with technical team and implement the outcome in order to improve the output,
- Improve the efficiency of air heaters, implement and comply with the outlines of the training to get better efficiency for a new plant and calibration of instruments.

During focus group discussions, EPP followed up on those assignments to track implementation and any achievements made during the assignment period. Participants provided information in two ways: written responses and group discussion.

Discussions were one-hour in length, comprised of a qualitative data analysis questionnaire, and the responses were digitally recorded using a voice recorder and documented in a report afterwards.

FINDINGS

Outcome 1: Skills Learned

Participants commented that the training increased their knowledge of necessary O&M skills to improve plant efficiency. One of the participant from GENCO III, noted:

> *"The course has enhanced our skills requisite for breaker maintenance. I am now able to deal with gas leakages from circuit breaker leakage; the improper function of compressor was causing moisture content at moving mechanism. It has increased knowledge of moisturizer control mechanism and by using the newly acquired skills we are able to repair existing breakers."*

The participants also indicated that the O&M training improved their communication skills in order to operate plant more safely and efficiently. As one of the participant noted:

> "*Following the training course, I have placed intercom numbers of the concerned staff at different places so to communicate any problem swiftly."*

Participants indicated that they are currently implementing the learned skills from the O&M training at their respective thermal power plants. They said they are now able to perform the required research processes and practice the international standards to increase the plant's efficiency.

> *"My assignment was focusing on "Performance of Cooling Tower"; the main reason to carry out the assignment was to diagnose reasons for poor performance of cooling towers especially during summer season and to suggests ways to improve plant efficiency. Following the newly learned skills, I was able to decrease in inlet temperature of water entering into the condenser for proper condensation of steam exhausted from LP turbine. As a result of which I am able to decrease 1° C temperature of water."*

One of the participants reported that before the training he was not familiar with the techniques used in Computerized Maintenance Management System (CMMS):

> *"I have learned the techniques used in Computerized Maintenance Management System (CMMS). Prior to the training, many of the participants were unfamiliar with these techniques. Following the training course, we are now able to identify obstacles in CMMS implementation, learned the proper guidelines on its implementation and utilization"*

Outcome 2: Challenges

Limited resources: Participants shared that limited resources prevented implementation of O&M skills learned. One of the participants from GENCO II appreciated the efforts on limited fuel and lengthy procurement process leading to major overhauling periods.

Shut down approvals for the power plants: Participants detailed that NPCC would not allow for required shutdowns for maintenance, which may lead to long-term damage. One GENCO I participant noted:

> "*The plant itself is outdated and requires overhauling more frequently."*
> *"Moreover, the shutdowns can help in maintenance, which will result in producing 220 Megawatts of power instead of 150 Megawatts. Nonetheless, we have received United States Government's funding for overhauling of plant but the bidding tender got cancelled three times as we did not get the shutdown for plant."*

Old and obsolete equipment: Many participants mentioned outdated technology as a detriment to using new O&M techniques.

Delays in procurement: Long procurement procedures and lengthy processes delays routine power plant functions. One participant from GENCO I cited the metallurgy issues for procurement

"Metallurgy is one the major reason of the procurement delays. It takes time for the engineers to extract metals from the ores, purifying and alloying metals, causing major losses in terms of machinery and money. Procurement procedures need to be changed for a better implementation of the learned best practices."

Outcome 3: Suggestions

Duration of the Training: Two of the participants from GENCO I pointed out that the duration of the training program was short as compared to the training content that required more understanding. On the contrary, one participant was of the view that the training sessions should be divided into three groups for specific departments, i.e., electrical, mechanical, and operational.

On-Site Training: One participant from GENCO I stated that it would be better if the training were delivered on-site at their power plants for better practical understanding of techniques and procedures.

Senior Level: Some participants suggested arranging trainings for executive level staff including chief engineers to support O&M improvements and implementation by their subordinates.

Training for Other Departments: A participant from GENCO II recommended training for human resources and financial departments to improve the maintenance activities.

Field Visits: Participants recommended field visits to operational facilities and exchanges with IPPs (independent power purchasers) to improve O&M studies.

CONCLUSION

The focus group discussions confirm that the O&M training program met the anticipated outcomes. Participants particularly appreciated the focus on theoretical knowledge, training manuals, and the efforts of the international trainers. EPP anticipates additional training opportunities for GENCOs to reinforce O&M best practices and ensure sustainability.

ANNEX-I: FOCUS GROUP DISCUSSION SUMMARY

CATEGORY 1: SKILLS LEARNED AND IMPLEMENTATION

"The training was very good from an operation and maintenance point of view. It was a great review of our engineering education; we got the chance of awareness regarding heat rate and efficiency. Through this training, we got the idea of chances of improvements for plant that we normally ignore [e.g.,] the plant faults like steam leakages. As a whole we got a chance of reviewing."

"We pass on the knowledge to other colleagues on what we have learned during the O&M training. In our plant mostly engineers are having more than 20 years of work experience and we felt that this training was overall a refresher of our education and experience."

"It was a general training of thermal power station and we got the revision especially related to efficiency of plants and learned the steps to improve the efficiency of steam power stations, which mainly focused that how to reduce the fuel consumption and how to minimize the leakages and loses of steam. We are implementing these in our power plant like minimizing the leakages, control of the consumption of fuel, and use of efficient auxiliaries."

"Definitely our skills and technical knowledge have enhanced through this training. No doubt we got exposure through this training and it was international standard training. I was more benefited from this training because I belonged to hydel power house and I recently came to thermal power so I learned from basics to advanced from this training."

"The course we attended was ideally designed and we gained the knowledge of mechanical and operational field through the training and assignments."

"Through the training we learned the operational and maintenance issues to control the plant leakages and cover these in initial stages."

"We personally gained knowledge through the training; no doubt we were weak in some fields/areas but through this training we have learned and overcome our weak points."

"Being an engineer, in the beginning our approach was that of how the thing is going. But after attending the training, we started thinking of innovations like we learned about heat rates so we are now noticing the heat rate and started calculating the heat rate in the beginning of shift and in the end too. Secondly, we have learned about heat balancing and proactive maintenance so we get attentive if there is some issue in heat rate or balancing and swiftly contact to concerned authority to overcome the problem as we are facing loss. Our mind sets have been changed after attending the training especially regarding the operations."

"I am working in instrumentations and control department since many years. I have learned calibration and use of instruments, laws of accuracy through the O&M training. My current duties are with operations departments; we are now calculating the heat rate in every shift, and now we actively point out the leakages too. My assignment was according to my current work that what are the things which can be added to increase the efficiency of cool plant, we do not have any cool plant now but it's going to start in near future."

"I am a shift engineer – we pointed out the maximum causes of low condenser. The training was very beneficial and informative for us and we learned a lot from it and it helped us to build up a plant culture."

"Before attending the training we never measured the efficiency, but now every shift engineer knows the previous shift efficiency. We are now aware of these things and started measuring the performance of plant and also detecting the small issues."

"Before attending the training we were not observing our work but after attending it we are now noticing that every work we do is affecting somewhere. It was a refresher course for us, we were performing practically but we were far away from theory, but from this training we got to know the theory again and while doing assignments we learned different parameters like heat loss and heat rate."

"Through the training we learned the planning so we are now trying to perform better and we are identifying the smallest issues, and we quickly inform the maintenance engineer to resolve the issue to avoid the future difficulty. E.g., I recently faced the problem like this that I identified the problem of plant, i.e., tripping of fan, then I quickly inform the concerned engineer to resolve the problem soon because plant is effecting for this issue even [as] I helped the concerned engineering to rectify the issue."

"As a shift engineer, previously we used to just highlight the changes of parameters, but as we learned that plant issues are interrelated with each other now we monitor it first and swiftly convey to concerned department to resolve the issue rapidly to avoid loss of generation."

"I am basically instrument engineer, we have learned about maintenance and techniques on how to increase the efficiency during the training so now we are focusing more on attending the faults during the shutdown. Our purpose is to improve megawatts so we try to maintain the efficiency of plant during running or shutdown phase; we also apply the precautions to avoid problems."

"During the training, we learned about latest technologies trends. Our instruments and control are 25 years old and these are having switches, which are creating trouble. Due to this, the monitoring and control of plant is not proper and as a result so many damages happen. We are now moving to new computerized plant which will be control by software. With the help of USAID we are working on its designing with some Chinese team; once its completed it will be in DCS with healthy protection and it will be controlled and monitored properly. Efficiency and reliability will be also increased and ratio of faults will be minimized as we learned during the training."

"I am a mechanical engineer from maintenance department; we were using the raw water with the help of in-take pumps from river for cooling of plant, but it frequently damages the pumps. We got a guideline through training that we can take underground water by drilling ground (boring for water) for cooling of plant so now we are processing it in our plant. Secondly we learned the alignments and also learned to swiftly respond to any faults as this can affect other parts too."

"We have learned maintenance management techniques, many of the participants were unfamiliar with these techniques. While applying these techniques we are facing some obstacles regarding maintenance techniques, e.g. predictive maintenance and use of technical tools, but at the same time we are resolving these obstacles following the instructions given during the O&M training."

"I was a Director Management Maintenance Systems (MMS) when I attended the training, but now I am Resident Engineer and I am now trying to implement the change of plant culture that I have learned during the training. Here staff usually works less in duty hours and extend the work for over time. I am trying to discontinue this and succeeded in it so far. We are motivating the staff to work more on duty hours to increase the efficiency of plant and I am checking the status of duties from staff on daily basis."

"My assignment was Performance of Cooling Tower; there was very poor performance of cooling tower. We have 16 cooling tower cells and their performance was low due to bad water showering; we have now changed the material of water showering of two cells, like nozzles, and also changed the distribution pipes to increase the performance of cooling tower to avoid the load and inefficiency of plant."

"Our vision of Operation and Maintenance is very much clear after attending the O&M training course by USAID."

"We have learned best practices of power plant in the training. We have learned about the parameters related to plant efficiency; we are concerned about heat rate, the parameters to improve the heat rate. We are now focusing on trying maximum to achieve designed parameters. Before the training we were ignoring the value of carbon monoxide, but after the training we are now focusing on recommended value of carbon monoxide to save the fuel consumption."

"I have selected my topic myself, i.e., communications; it was a great topic indeed. The training helped us to improve our communication skills within the plant, e.g., yesterday we had a problem in our plant that is trip of equipment and it had low pressure. We immediately communicated the whole situation with the concerned person and got it resolved it. The discussion of problems with the concerned person is communication. The things we were told in the O&M training were not new, we already knew many of them but we learned well how to communicate the problems."

"We were not continuously monitoring the heat rate, but after attending the training we are noticing the efficiency of heat rate. There are different components of plant, like boiler and condenser, and we are checking them regularly. If there is some fault that happens then we try to resolve it quickly. Like we experienced that a cooler has tubes in it and we were observing the inputs of tubes but it did not get the output correctly, then we concluded the cause was that there was high scaling in the tubes. Then we use methods of cleaning the tubes and it resolved and gave the accurate heat rate."

"The training was very helpful for us. We learned many things especially to measure the steam leakages, and how to improve the efficiency of plant. And we are trying to observe the steam leakages to increase the efficiency of our plant."

"We have been brainstormed from training. By sharing experiences with instructor, we learned that not to take minor faults lightly; we should seriously take actions against each minor and major faults to improve the overall efficiency of heat rate."

"Being a plant engineer we learned all the aspects of training to monitor all the things from fuel consumption to exhaust temperature; all the things are countable. We learned to focus overall efficiency of plant."

"Basically the training was about best practices in Operational and Maintenance. We got overall knowledge to maintain efficiency of heat rate and how to run the plant efficiently and apply best practices. In the training we also learned about cultural change, that includes work ethics, coordination between departments, and communications skills. We just started developing it slowly. Previously we were not conscious about efficiency of plant, but we are trying to develop it in our plant but it requires coordination of high management."

"We are now more conscious regarding the efficiency of plant. Efficiency is a broad term. In one word we can say efficient running of plant; it involves huge engineering, planning, and coordination."

"We were facing the problem of variation in temperature so we discussed this issue in training with the trainers. They gave us some suggestions and after following those suggestions we are now able to remove those issues of variation in temperatures, like if the temperature is high, then we minimize the load to control the temperature,"

"The O&M training encouraged us to eliminate even small loses as these become huge amounts in terms of money over the period of time. The course also enhanced our capacity to carry out predictive, preventive maintenance to avoid the damages of equipment."

"[Through] the training manuals, lectures, and discussions held during the training course, I am now able to observe all the auxiliaries, fittings, pipelines, and valves at site in coordination with operation as well as maintenance engineers. The O&M training helped to resolve all the problems belonging to steam turbine condenser and bring generating units quickly."

"The O&M training has widely explained the various industrial standards obscured, locally and internationally in powerhouses. … Now heat rate is also taken into consideration for the generation unit."

"O&M training has long term benefits that cannot and may not be observed instantly. However, being at lower ladder in organizational hierarchy, we make sure that all techniques are used, which may be applicable to reduce fuel cost, improve heat rate, and minimize the losses. At the beginning for my assignment first aid kit was provided to case in case of any emergency."

"O&M training has prepared us for operation of plants on a commercial basis. For example: this training has provided the awareness for heat rate of any unit because a major portion of expenses is fuel cost. We got awareness of security too."

"O&M training has improved power plant measurement and management of fuel; I feel a positive change in my personality and management style after this training."

"We are thankful to the USAID and people of America who provided us this precious opportunity to understand the operation of plant on a commercial basis as per SOP standards of industrial organization of developed countries. The O&M training has covered all aspects of Industrial Standards."

"One thing that I have applied is friendly environment with subordinates and workers. I have gained experience that staff is working with interest. Example is that OS 415MW plant is under S/Down, I have engaged my staff in calibration of gauges, transmitters, and different switches"

"As Assistant Manager Electrical, I tried to plan, organize and lead day to day routine activities. I tried to make sure safety of personnel as well as equipment as learned from O&M training. I have designed a procurement plan, which can resolve the spare requirements of my electrical section."

"After getting operation and maintenance training, I am more capable and got knowledge in the area of operation of power plant."

"The steam leakages have been controlled. Also the auxiliary consumption has been minimized."

"After performing O&M training, all the techniques and methods were conveyed to organization."

"Running units, some procedures have been implemented according to guidelines given by O&M training."

"The participants who have gotten O&M training are trying to implement the ideas behind the thermal power plant up to maximum possible."

"In our organization proper industrial standards are not being adopted due to some instrumental effects and political conditions. But to some extent, these procedures are adopted, for example smoke of fuel is exhausted through chimneys, which are about 100m long. Condensation of gas and fuel is collected in

bands, and safety procedures are also adopted. After performing O&M training, safety procedures are improved according to procedures of O&M trainings."

"My organizational behavior has been changed as a result of O&M training by USAID. I have started thinking for maximization of efficiency a heat rate; I try to the best of my level to save auxiliary consumption. I suggested and instructed operation staff to keep unit transformers G-3 to G-6 in off position, when machines are standby to save no-load loses."

"Some procedures of fuel management are being implemented on G-9 and G-8 gas turbines according to instructions of O&M trainings and fruit full have been obtained."

CATERGORY 2: CHALLENGES

"If any leakage happens and we are facing loss and it requires the replacement of valves that can be cost 500,000 to 600,000 PKR, we cannot get it direct although there is a procurement process,"

"I want to add some points here, that if any engineer thinks to replace a valve of any reputed company, our procedure does not allow him to do so. We are bound to purchase to lowest rated valve, although the lowest rated equipment does not last longer."

"We have to follow the system which PPRA (Public Procurement Regulatory Authority) has imposed on us since 2004. We have faced many problems, e.g., replacements of the defected and damaged parts of plant by the best possible replacement brand available, but due to certain obligations we cannot procure the best."

"We are trying to work hard and give a better percentage than the other shifts; also there is a competition going on within the department with other shift teams, because the Board of Directors decided in the meeting to provide work performance based incentives to the engineers."

"We require more time for our assignments; this is achievable but difficult to manage the assignment along with the duties as we usually work on the weekends too."

"I required shutdown of powerhouse for completing my assignment and shutdown will be allowed from NPCC; once they allow this my assignment will be done, i.e., overhauling of plant."

"My assignment topic was the cause of low condenser vacuum. We only do treatment of clear water not raw water; we face the problem of low condenser because of back pressure, and due to these frequent efficiency losses and to avoid this loss and to maintain the load for 170 megawatts, we have to consume more fuel."

"The training was great. Mr. Ken was a genius person – he had huge knowledge and I gained a lot knowledge from him. My topics were not as such discussed in the training, i.e., high deficiency of field water and exchanges of heat efficiency so I personally had not gained anything related to my work,"

"My assignment can be done by team work. We are facing the issue of procurement – we cannot procure the items ourselves, we can just recommend to the concerned person."

"I have faced two major problems while working on my 220 kv circuit breaker: (1) It was stuck due to marshal content because it was pneumatically operated and having compressor with it, but we had overcome this issue with the help of instructions given by Mr. Ken. He also shared his experience regarding this. (2) Another fault we faced in the circuit breaker was the less gas pressure, the circuit breaker stops functioning, and [it is] blocked if gas pressure is low and we resolve the issue by observing the gas pressure. We are practically applying the things that we learned during the training."

"Both trainers Mr. Ilyas and Mr. Ken ere from mechanical side; there was no other trainer from electrical or instrument side. I asked few questions from them, but I was not satisfied and then they gave me the same assignment. I am now studying the case; they taught us very good on mechanical aspects but we did not learn much regarding electrical and instrumentation."

"We are facing challenges in coordination and communication. Being a middle management staff member, we require coordination with higher management staff and also with junior level staff. No doubt senior management staff are very cooperative but they have some limitations and as junior level staff are not experienced, so it's taking time to explicate them. These communication and coordination issues between staff members are challenges for us."

"We are facing some challenges like we do not have proper instrumentations for on-line or offline recording. Secondly the staff working in our plant is not as much trained; there is a tense environment within the plant and everyone has a work load, so there is some lack of coordination amongst staff members. Other than this we do not have laboratories or reporting mechanism for analysis SOPs."

"Our plants are overburdened and there is no proper shutdown of these."

"We are going through a common and healthy issue of financial constraint."

"The technology we are using in our plant is almost 35 years old, while other IPPs are benefited with new technologies, but we can't afford new technologies."

"We learned about fuel – that to run a plant through a gas is cheaper because gas is a cheaper fuel, but this is impossible in our country where there is a huge shortage of gas."

"[Due to] the non-induction of technical manpower, the GPCL is unable to deal with any sort of losses due to which the combustion air flow to burners increased and amperes of I.D. fan motors dropped."

"The biggest challenge is overhauling unit G-13, which tripped on high vibration last year. Several damages have been observed including condenser tubes. A lot of time and countless efforts have been carried out for its MOH. Hopefully, MOH will be carried out by Siemens, Germany where all the damaged equipment will be replaced by new ones Including all condenser tubes and seals."

"USAID is implementing an ERP system in CPGCL, which is without the CMMS module that is essential requirement to improve plant maintenance culture. There is a dire need of networking based planning software when the plant is automatically compiled in ERP. CMMS based network would further strengthen work efficiency of higher-ups, e.g., General Manager and Chief Executive Officer."

"As most of the machines of TPS Guddu are under shutdown so their uncertainty is felt by everybody working at this power station."

"Everybody wants change, nobody wants to change. Changing the working environment and behavior of engineers and workers is big challenge. We have club management style which needs to be changed; change is a process not a step, it takes a time."

"Being a public sector organization there are long procurement processes and the spare shortages."

"Mostly our plants at TPS Guddu are in shutdown position due to non-availability of spares. Best practices will be implemented as plants after starting of units according to instructions of O&M training."

"Unavailability of spare equipment, shortages of skilled staff, shortage of natural gas."

"The procedures and rules implemented or enforced by PPRA are main hindrances for procurement material."

"Union (T.U.) interference with management is also main course of resistance in implementation."

CATEGORY 3: SUGGESTIONS

"I would suggest USAID to conduct a comparative study between the publically run power plants and IPPs to measure the deficiency and identify potential ways to improve the overall performance of the publically owned power plant."

"I would suggest conducting the similar training course for the senior/top level managers working at the power plant in order to enhance their working knowledge and to improve their ability to know the underlying challenges faced by the junior level staff during the implementation of the learned-skills."

"The assignments should be given at the beginning of the training to carry out a proper planning as how and when to cover what aspect of the assignment. Many of us don't get much time during our working hours to complete the assignments due to the field work. "

"According to the training duration, the training should have had divisions into three different groups of mechanical, electrical, and operational. E.g., I work in the electrical department and I could have gained more if I was placed in the electrical group rather than learning the operational course. I could have strengthened my electrical and mechanical knowledge so I cannot contribute more effectively."

"Training duration should be increased in order to provide a more in-depth learning experience based on the training manual given. The current training contents required more time to develop a better understanding."

"The training was mostly focused in detailing more about the latest powerhouses; there should have been more detailed sessions about the steam plants as well."

"We have already raised the issue in the O&M training that specific sample has been trained, our management and lower staff were not trained, and there should be on-site training organized on monthly basis so the plant culture can be changed. We want some overall change of management in the plant."

"There should be a field visit to Independent power plants station as well to see their plant culture."

"There should be brief training regarding electrical and instrument side; the O&M was majorly based on mechanical and operational aspects."

"Only sample size was trained as we have more than 3000 staff members working in the plant. On-site Monthly local Workshops should be delivered to management staff instead of trainings."

"Computerized Management Maintenance System (CMMS) training should be delivered to the management staff by EPP energy experts."

"Further trainings should be continue for high level and low level management; it will be a great support for us."

"The training period was less; we suggest that there should be a specified training for efficiency of heat rate and ASME PTC 40 code to monitor plant efficiency."

"We have told to change the plant culture, but there should be a separate training for change of plant culture. Like other countries, we should develop procedures or SOPs within our plant."

"There should be more exposure visits to other plants so to share experiences with each other and to learn from practically."

"These sort of trainings should be continue by USAID."

"The process of further trainings and assignments be continued for the betterment of the power plant."

"The O&M training was mostly focused on operational activities of the Power Plant. Electrical equipment maintenance was neglected. Moreover, visits to Latest technology based state of the art plants will also increase our knowledge and vision."

"We required a networked based planning software real time integrated with the ERP and CMMS module, so that when-ever any GENCO II Engineer plan, schedule and update any maintenance activity of plant, the MIS department must should capable of generating a compiled report for the management."

"Training must be for every department."

"Finance department needs training for better utilization of financial resources available."

"Procurement department is slow and has lengthy procedure to follow. Proper training for quick procurement process is required."

"Such type of trainings should be continue for all the employees of CPGCL, Guddu."

"There should be HR department training for better utilization of human resources and plan for future needs of engineers and workers for this plant including recruitment."

"Our higher authority also needs to be trained so that they also learn best practices after that they can also help us in implementing best practices of O&M at plant."

"One thing is very clear that we people are bound with decisions of our supervisors. When authority implement decision for improvements it becomes very easy for Power management to follow. The supervisors may be called for training for improvements in organization culture."

"Industrial standards topic was not been discussed as it should be on in O&M training. Our organization is still lagging behind in understanding of industrial standards while working."

ANNEX-II: PARTICIPANT INFORMATION

Confidential information redacted

Confidential information redacted

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