

Country Name	The Project for Energy Efficiency Improvement of Power Plant in Turkey
Turkey	

I. Project Outline

Project Cost	263 million yen	
Project Period	December 2006 - November 2008	
Implementing Agency	Electric Generation Company (EUAS)	
Cooperation Agency in Japan	Chugoku Electric Power Co., Inc.	
Related Projects	-	
Background	<p>Turkey turned to be an electricity importing country in 1997 as a result of high electricity demand accompanying high economic growth. Further, the electricity demand was projected to grow at 7.7% per annum from 2005 to 2020 and therefore the import of electricity was projected to increase. In order to respond to the growing demand for electricity and to curb further dependency on energy import, the government of Turkey had promoted energy efficiency improvement since late 1970s and Electric Generation Company (EUAS) had played a major role in improving energy efficiency. Rehabilitation of existing thermal plants was considered to be an effective means to improve energy efficiency, and there was an urgent need for EUAS to rehabilitate thermal power stations that had been operating for between 20-25 years. However, EUAS did not have the ability to appropriately plan, implement and control rehabilitation, nor did it possess adequate rehabilitation technology or know-how. Accordingly, the Turkish government requested the Japanese government for a project to improve energy efficiency improvement capability (generating facility rehabilitation planning and outline design ability and operation and maintenance ability) of EUAS through the implementation of transfer of technology at a model thermal power plant.</p>	
Inputs	Japanese Side	Turkish Side
	<ol style="list-style-type: none"> Experts 13 experts for 10 areas. Trainees Received 18 persons Local Cost 18 million yen 	<ol style="list-style-type: none"> Staff allocated 22 persons Land provided An office for experts, training facilities provided at Orhaneli, equipment for use in workshops, accommodations for participants
Project Objectives	Overall goal The energy efficiency of model power plant (Orhaneli) is improved.	
	Project Objective The capacity for energy efficiency improvement at model power plant (Orhaneli) is improved.	
	Outputs <ul style="list-style-type: none"> Output1: The skills of C/Ps for equipment diagnosis are developed. Output2: The skills of C/Ps for environmental measure are developed. Output3-1: The skills of C/Ps for planning of rehabilitation are developed. Output3-2: The skills of C/Ps for designing of rehabilitation are developed. Output4: The skills of C/Ps for operation and maintenance of power facility are developed. Output5: The training system of EUAS for energy efficiency improvement is enhanced. 	

II. Result of the Evaluation

Summary of the Evaluation
<p>Rehabilitation of existing aged thermal power plants (TPPs) was inevitable for Turkey, and energy efficiency improvement at TPPs was one of the strategies of energy efficiency strategy document. Therefore, capacity building of EUAS's TPPs was needed for energy efficiency improvement because they did not have sufficient ability of rehabilitation planning, outline design, and operation and maintenance. Orhaneli Thermal Power Plant (Orhaneli TPP) was selected as a model power plant for the project activities.</p> <p>This project has partially achieved the project objective. Compared to the past works of similar type TPP in EUAS, a rehabilitation plan (excitation system replacement) of equivalent or better cost performance has been formulated at Orhaneli TPP. However, the project has not achieved the project objective in terms of adoption of documents by EUAS, because EUAS has not completed Turkish translation of reports/guidelines/booklets, etc. and has not distributed them to all other EUAS TPPs. Nevertheless, the project has largely achieved overall goal since the total unplanned outage hour per year has been decreased and capacity utilization has improved at Orhaneli TPP as a result of the implementation of the preventive maintenance and the rehabilitation based on the rehabilitation plan developed by the project.</p> <p>As for sustainability, some problems have been observed in terms of institutional/operational aspect and technical aspect because of insufficient number of engineers at Orhaneli TPP as well as EUAS, and lack of training programs due to less communication among relevant departments and top officials (decision makers) for further dissemination and application of the technology and knowledge acquired by the project. For relevance, the project has been relevant with Turkey's development policy, development needs, as well as Japan's ODA policy. For efficiency, the project cost significantly</p>

exceeded the plan.

In the light of above, this project is evaluated to be partially satisfactory.

1 Relevance

This project has been highly relevant with Turkey's development policy in terms of energy efficiency and efficient use of existing coal-fired thermal power plants, development needs for energy efficiency issues at EUAS TPPs as well as Japan's ODA policy at the time of both ex-ante evaluation and project completion.

Therefore, its relevance is high.

2 Effectiveness/Impact

The project has somewhat achieved the project objective. The project has achieved project objective in terms of development of a rehabilitation plan (indicator 1): compared to the past works of similar type TPP in EUAS, a rehabilitation plan (excitation system replacement) of equivalent or better cost performance has been formulated at Orhaneli TPP. However, the project has not achieved the project objective in terms of adoption of documents by EUAS (indicator 2). EUAS has not completed Turkish translation of the reports, plans, specifications, manuals etc. and has not distributed them to all other EUAS TPPs, thereby has not been able to apply the rehabilitation technology and knowledge to other TPPs, although most of English documents including operations and maintenance manual of the boiler and excitation system, rehabilitation design document and rehabilitation plan/design manual are adopted and actually used at Orhaneli TPP.

Nevertheless, the project has largely achieved the overall goal: capacity utilization and unplanned outage hours have improved at Orhaneli TPP. Before 2007, the total unplanned outage hour per year was around 1,000 hours with 57% capacity utilization. With the implementation of preventive maintenance and regular data measurement which were introduced by the project, and rehabilitation of boiler and exciter based on the rehabilitation plan developed by the project, the total unplanned outage hour per year was decreased to 336 hours with 70.69% capacity utilization in 2011¹.

No negative impact was observed in terms of natural environment and land acquisition. The current values of SO₂ and Dust at Orhaneli TPPs are under standard values. NO_x exceeds the current Turkey's upper limit, however, once DENOX facility is installed, which should be obligatorily installed by 2019, the value would satisfy the standard.

Therefore, its effectiveness/impact is fair.



New exciter system procured



Digital monitor of new exciter system

3 Efficiency

Although the project period was within the plan, some inputs were not appropriate for producing outputs expected by Turkish side because translation of documents into Turkish has been delayed. And the project cost significantly exceeded the plan (more than 160% of planned budget) because of the additional requests by Turkish side for enlargement of the project framework with new contents including the addition of five new subjects (Facility Diagnosis Improvement Support, Rehabilitation Plan, Boiler Efficiency Maintenance/Improvement, Facility Maintenance Ability Improvement, Excitation System Operation/Maintenance/Management Ability Improvement, Support for Training System for Improving Capability of Energy Efficiency Optimization), implementation of 5-day technology transfer (six times) at Orhaneli TPP together with the preparation of lecture notes, 4-week training in Japan for totally 16 counter-parts in 2007 and 2008, and 5-day observation visit to Japan for two top level officials in 2007. Addition of new subjects on the Project resulted in sharp increase in Japanese experts MM dispatched to Turkey.

Therefore, efficiency of this project is fair.

4 Sustainability

The project has some problems in institutional and technical aspects of the implementing agency. As to institutional aspect, the importance of the role and responsibility of EUAS in the areas of power generation, and energy efficiency improvement has not changed because the application of the energy efficiency law are expected in the near future, and because privatization has no impact, since there is no concrete plan for the privatization of EUAS TPPs. On the other hand, there is a problem that the number of engineers at Orhaneli as well as EUAS as a whole has decreased: some has retired and some transferred to private sector, and those positions have not been filled up. Therefore, sustaining maintenance and rehabilitation practices with the decreasing number of engineers might become difficult at the Orhaneli level. Besides, top level officials have been replaced very often in recent years and therefore, acquainting top level officials with the project could not be succeeded neither by Thermal Power Plants Department nor by Training Department. Without initiatives of top level officials, the capacity development of TPPs at EUAS with the project outputs and application of the project outputs to other EUAS TPPs might face problems in the future.

Regarding the technical aspect, there is currently no problem on the operation of Orhaneli TPP, since the technology and knowledge was established through technical transfer seminars and the training program in Japan or disseminated by individual counterparts through regular inspections, and by formulating rehabilitation plans, training programs and other activities. However, since four out of eight counterparts left the Orhaneli TPP, and since regular wrap-up training and

¹ Capacity utilization and unplanned outage hours were set as indicators for overall goal of "energy efficiency improvement" instead of more direct indicators such as gross thermal efficiency (comparison of power output and fuel input) because it is impossible to measure and compare the plant efficiency in terms rated output since output of Orhaneli TPP does not reach rated output due to the insufficient heating value of fuel, and because there is no device for accurately measuring the amount of input fuel.

technology transfer seminars for engineers who have 3-5 years of experience could not be organized neither by the Training Department nor by Thermal Power Plants Department due to lack of well coordination and communication between them, there might be a problem in the future for further dissemination and application of technology and knowledge within Orhaneli and to other TTPs. No problem has been observed in policy background, since energy efficiency improvement is consistent with the government's policies, and with net profit of TL2.5 billion (1.38 bUS\$) in 2010, and TL1 billion (555.56 mUS\$) in 2009 there is no financial problems of the implementing agency either.

Therefore, sustainability of this project effect is fair.

III. Recommendations & Lessons Learned

Recommendations for Implementing agency

1. Even though department head and/or above level officials assigned/promoted to another department/organization, new assigned officials should be informed well with the contents and benefits of the project by the responsible department. Strong ownership of both top level officials and responsible departments is the key for successful sustainability in terms of dissemination and application of the technology and knowledge acquired by the project.
2. Outputs of Orhaneli TPP should be disseminated and shared with other power plants in regular manner through wrap-up trainings and technology transfer seminars. In order to organize smooth implementation of said-trainings, strong coordination between Thermal Power Plants Department and Training Departments is a must.

Lessons learned for JICA

When implementing similar kind of project, coordination between relevant departments should be well-established at the time of the project and should be kept after the completion of the project.