

Ex-Post Monitoring of Completed ODA Loan Projects

Evaluator: Ryujiro Sasao (IC Net, Ltd.)

Project: Pakistan: "Project to Upgrade Generator No. 6 at the Bin Qasim Thermal Power Plant (1) (2)" (PK-P30, PK-P39)

Loan Outline

Loan Amount/Disbursement Amount: 27,525 million yen / 25,089 million yen
 Loan Agreement: March 1992 / November 1994
 Loan Completion: March 1999 / February 2001
 Ex-Post Evaluation: Fiscal Year 2001
 Executing Agency: Karachi Electric Supply Corporation Limited (KESCO) of Pakistan

Project Objective:

By expanding the 210-MW power generator and transformation-transmission facilities at the Bin Qasim Thermal Power Plant in the suburbs of Karachi city, the project aims to supply power to the areas surrounding Karachi, and thereby improve quality of life for local people and contribute to economic development in the target region.

Consultant: Tokyo Electric Power Services Co., Ltd. (TEPSCO)

Contractors: Marubeni, Interhom (PVT) Ltd. (Pakistan), Siemens Pakistan Engineering Co., Ltd./China Northwest Electric Power Group (Pakistan/China)

Overview of Results

Item	At time of ex-post evaluation	At time of monitoring																																		
Effectiveness & Impact Effectiveness	<p>(1) Power generator No. 6</p> <ul style="list-style-type: none"> This generator's performance has exceeded initial targets and expectations. However, premature deterioration is a concern, because its equipment has been used heavily. <p style="text-align: center;">Table 1: Operating Conditions of Generator No. 6</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Year</th> <th></th> <th>97-98</th> <th>98-99</th> <th>99-00</th> </tr> </thead> <tbody> <tr> <td rowspan="2">Maximum output (MW)</td> <td>target</td> <td>210</td> <td>210</td> <td>210</td> </tr> <tr> <td>actual</td> <td>219 (104%)</td> <td>213 (101%)</td> <td>210 (100%)</td> </tr> </tbody> </table>	Year		97-98	98-99	99-00	Maximum output (MW)	target	210	210	210	actual	219 (104%)	213 (101%)	210 (100%)	<div style="border: 2px solid black; padding: 5px; margin-bottom: 10px;"> <p>Power output has largely maintained at the target levels after the ex-post evaluation. As it has remained a vital power supply source in the target region, its effectiveness is high.</p> </div> <p>(1) Power generator No. 6</p> <ul style="list-style-type: none"> The operating conditions of the power generator were carried out largely as planned at the time of the ex-post evaluation, and overall have been quite good. An increase in operation shutdowns since 2000 has been due to the work being done on equipment which required repairs. <p style="text-align: center;">Table 1: Operating Conditions of Generator No. 6</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Year</th> <th></th> <th>00-01</th> <th>01-02</th> <th>02-03</th> <th>03-04</th> <th>04-05</th> </tr> </thead> <tbody> <tr> <td rowspan="2">Maximum output (MW)</td> <td>target</td> <td>210</td> <td>210</td> <td>210</td> <td>210</td> <td>210</td> </tr> <tr> <td>actual</td> <td>210 (100%)</td> <td>200 (95%)</td> <td>205 (98%)</td> <td>205 (98%)</td> <td>207 (99%)</td> </tr> </tbody> </table>	Year		00-01	01-02	02-03	03-04	04-05	Maximum output (MW)	target	210	210	210	210	210	actual	210 (100%)	200 (95%)	205 (98%)	205 (98%)	207 (99%)
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Total power output (GWh)	target	981	1,174	1,174
	actual	931 (95%)	1,443 (123%)	1,468 (125%)
Capacity utilization rate (%)	target	63.83	63.83	63.83
	actual	60.57 (95%)	73.63 (115%)	75.13 (118%)
Thermal efficiency (%)	actual	-	-	38.17
Power consumption for plant operation (%)	actual	-	-	5.85
Shutdown time (hours)	actual	-	-	72.28

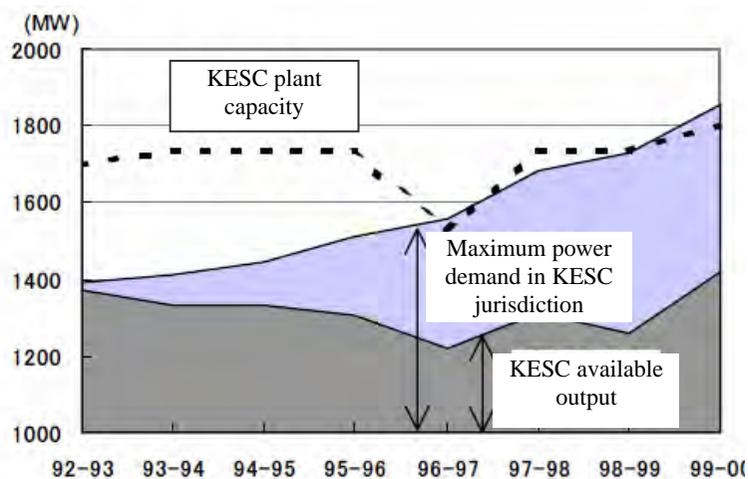
- Looking at the entire target region, demand has been increasing at a rate of 5.14% annually over the past five years, but supply from the KESC power plants has leveled off; supply has in fact fallen short of the plant's capacity. The generator that was refurbished has been supplying 13.6% of the power supply volume to the target region, and will contribute to meeting the stringent power demands of the area.

Total power output (GWh)	target	1,542	1,542	1,542	1,542	1,542
	actual	1,461 (95%)	1,510 (98%)	1,492 (97%)	1,551 (101%)	1,472 (95%)
Capacity utilization rate (%)	target	90.0	90.0	90.0	90.0	90.0
	actual	79.4 (88%)	82.1 (91%)	81.1 (90%)	84.1 (93%)	80.0 (89%)
Thermal efficiency (%)	actual	36.74	36.06	35.95	36.49	36.32
Power consumption for plant operation (%)	actual	6.05	6.10	6.32	6.06	6.23
Shutdown time (hours)	actual	541	413	398	367	622

Source: KESC

- This generator provides 15.8% of the total power supply to the target region over 2004 - 2005, and has remained an important power supply source. However, whereas demand over the entire region has continued to increase, rising 3.4% per year over the past five years, KESC has not built any new power plants, meaning that supply has leveled off. KESC has gradually increased its power supply purchases from the Pakistan Water Power and Development Authority (WAPDA) and other independent power providers so as to cope with the increasing power demand.
- Overall, the area has continued to suffer from a chronic shortage of power. Planned shutdowns have also continued as in the past (see 2).

Figure 1: Change in Power Demand and Supply in the Target Region



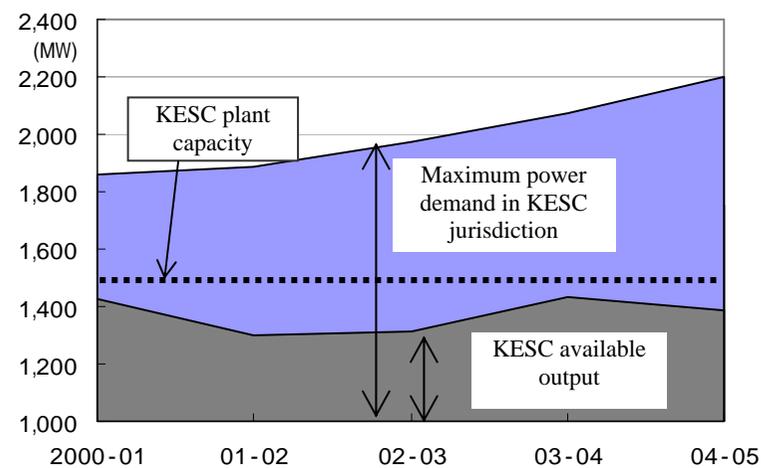
(2) Power transmission and transformation facilities

- Power supply cutbacks were greatly reduced from about 102 GWh for 1998 - 1999 to 7.3 GWh for 1999 - 2000.

Table 2: Changes in the Planned Shutdowns for the Target Region

Year	Maximum Power Supply Cutback (MW)	Power Supply Cutback (MWh)
94-95	286	30,853
95-96	268	53,188
96-97	341	85,934
97-98	300	50,201
98-99	338	101,963
99-00	238	7,307

Figure 1: Change in Power Demand and Supply in the Target Region



Source: KESC

(2) Power transmission and transformation facilities

- While maximum power supply cutbacks have tended to decrease slightly, they are largely the same. Because some of the data was unavailable, the situation with supply cutback volume is unclear. However, discussions with related institutions indicate that ex-post evaluation levels have clearly improved over those at the time of project start-up in the 1990s.

Table 2: Changes in the Planned Shutdowns for the Target Region

Year	Maximum Power Supply Cutback (MW)	Power Supply Cutback (MWh)
00-01	262	Unclear (data unavailable)
01-02	201	Unclear (data unavailable)
02-03	141	Unclear (data unavailable)
03-04	80	Unclear (data unavailable)
04-05	220	Unclear (data unavailable)

Source: KESC

(3) Financial Internal Rate of Return (FIRR)

- Negative (at time of appraisal: 9.3%)
- In spite of an increase in system loss rates due to the electricity theft and steep rise in fuel prices, the electricity prices were kept intentionally low for government policy.

(Cost) Capital costs, fuel costs, operation and management costs
 (Benefit) Increment in sales proceeds from generator No. 6

Table 3: FIRR Calculation Basis

	Power output (GWh)	Sales price (Rp/kWh)	Fuel cost (Rp/kWh)	System loss rate (%)
At time of appraisal	1,174.2	1.89	0.373	21.0
Actual figures (at time of ex-post evaluation)	1,443.0 ~ 1,468.0	2.33 ~ 2.56	1.16 ~ 1.85	31.5 ~ 38.6

Note: Prices all show the price fixed in 1997.

(3) Financial Internal Rate of Return (FIRR)

- It is difficult to recalculate the FIRR because the executing agency would not provide detailed information pertaining to cash flow. However, because the system loss rates and power generation volume are essentially at the same level as at the time of the ex-post evaluation, and both electricity prices and fuel prices have increased, it is estimated that the FIRR is on par with ex-post evaluation levels.

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	Power output (GWh)	Sales price (Rp/kWh)	Fuel cost (Rp/kWh)	System loss rate (%)
At time of appraisal	1,174.2	1.89	0.373	21.0
Actual figures (at time of ex-post evaluation)	1,443.0 ~ 1,468.0	2.33 ~ 2.56	1.16 ~ 1.85	31.5 ~ 38.6
Actual figures (at time of follow-up monitoring: 2004-2005)	1,471.6	4.56	3.09 (2005)	34.2

Source: Created by evaluators.

Note: Figures at the time of the appraisal and actual figures indicate prices fixed in 1997. Actual figures have not been revised.

Impact

(1) Social Impact

- Planned shutdowns, which are thought to adversely affect the people and industry of Karachi city from general households to the industrial sector, have been reduced. (See Effectiveness [2])

(1) Social Impact

Survey on Ex-post Monitoring analyzes the following four indicators, ~ .

GRDP of the Karachi Region

Although GDP data for the Karachi region alone (encompassing all of Sindh state) has not been maintained, World Bank estimates show that over the 2004-2005 year period it was a little over US\$28 billion, of which proceeds from electricity and gas supply were over US\$1 billion, according to the executing agency.. Moreover, the electricity and gas sector is thought to have reached growth in excess of 10% from 1991 to 2005 (unconfirmed). Since Karachi is Pakistan's largest industrial and commercial region, it is assumed to have improved in correlation with Pakistan's overall GNP trends.

Table 4: Pakistan's GNP

Year	2000-01	01-02	02-03	03-04	04-05
Actual GDP growth rate (%)	1.8	3.1	4.7	7.5	8.6

Source: Pakistan Economic Survey

Accidental power outage time per year and per consumer household (min / year • household)

The number of accidental power outages per year and per consumer household (times / year • household)

- We were not able to obtain accurate information on either of these factors, but we estimate that they are very likely to have increased compared to pre-project execution years. Among the reasons for this is the fact that total power output is insufficient relative to regional demand; this despite the performance of power generation equipment including generator No. 6. Moreover, electricity theft is a problem, as is the insufficient operation and maintenance of the overall transmission grid on the part of KESC.

The number of power users and usage volume

- Both the number of users and usage volume have tended to increase since the start of the facilities' operation. Considering the fact that KESC has no particular plans to construct power plants within its jurisdiction, it is expected that the project has made a certain contribution to satisfying the increasing power usage in the target region.

Table 5: No. of Power Users and Usage Volume

No. of Power Users	1997 - 1998 (At time facilities started operation)	2003 - 2004
Residential Users (people)	1,060,000	1,350,000
Commercial Users (people)	337,004	407,902
Industrial Users (people)	28,048	32,574
Power Usage Volume (GWh)	6,138	7,832

Source: KESC

	<p>(2) Environmental Impact</p> <ul style="list-style-type: none"> There have been no notable problems in terms of the impact for noise and vibrations on private homes, the effect of thermal discharge on the ocean, or conditions in the surrounding atmosphere. The executing agency's smoke emissions monitoring system is out of commission and needs to be repaired. 	<p>(2) Environmental Impact</p> <ul style="list-style-type: none"> According to an internal audit conducted by the executing agency in March 2006, SOX (sulfur oxide), NOX (nitrogen oxide), noise, and drainage are all within the limits prescribed by the National Environment Quality System (NEQS), which operates under the Environmental Protection Agency that which administers the environment. Since the smoke emissions monitoring system was installed ten years ago and is no longer functioning adequately, it is in the process of repair. In addition, a vehicle for ambulatory monitoring of the surrounding atmosphere (provided through a loan from KfW) is in operation, but because the program has some problems, it is scheduled to be improved.
<p>Sustainability</p> <ul style="list-style-type: none"> Project sustainability Operation and management conditions 	<p>(1) Technology</p> <ul style="list-style-type: none"> The power plant has 862 employees, of whom 122 are managers and 740 are workers (it is unclear whether or not they are technicians). Through rationalizations conducted under the guidance of the Asian Development Bank (ADB), new hires and the replacement of retirees has been suspended. <p>(2) Organizational Structure</p> <ul style="list-style-type: none"> Operation and management of the project was done under KESC, one of two power companies in Pakistan which operates the Bin Qasim thermal plant. KESC has 12,499 employees (as of June 1999). The Pakistani government has expressed its intention to restructure the power sector through means such as sharing functions, liberalizing the electricity market, and reforming structures through, for example, privatization. 	<div style="border: 2px solid black; padding: 5px; margin-bottom: 10px;"> <p>The executing agency, and operation and maintenance organization have continued to freeze the employment of new personnel since the ex-post evaluation. The executing agency's financial deficit has not improved from the time of ex-post evaluation. Following privatization of the executing agency in December 2005, countermeasures to remedy both these problems are expected.</p> </div> <p>(1) Technology</p> <ul style="list-style-type: none"> The power plant has a total of 746 employees, of whom 149 are technicians. Since the time of the ex-post evaluation, the plant has lost 116 employees (13.5% of total). This is due to the fact that new hiring has been frozen since 1996 as part of the restructuring effort. In order to attain a minimum technical level (to maintain the minimum technical level as an organization), there is an intention to gradually increase the number of employees from now on. All of the engineers have BAs in engineering and the boiler operators have public qualifications. They also have the opportunity to receive training at KESC's training facilities and foreign institutes. There is a manual in the generator's control room, and it is being put to use. <p>(2) Organizational Structure</p> <ul style="list-style-type: none"> The operation and management systems are the same as at the time of the ex-post evaluation. KESC was privatized in December 2005. (The capital structure is such that 27% of its capital is owned by the government and public sector, and 73% is owned privately. The CEO is German.) KESC consists of 10,188 employees (as of July 2006), which is a decrease of 2,311 employees (18.5%) from the ex-post evaluation. This is due to the fact that, new hires have been frozen for several years—since 1996. ADB's support for rationalizing the executing agency was the driving force behind KESC's privatization. The resulting improved administration of operations should contribute to overall sustainability. The various measures taken following privatization, and their effects, are unclear

	<p>(3) Financial Status</p> <ul style="list-style-type: none"> • KESC’s financial status has worsened year by year. Reasons for this include the fact that electricity prices are set by a government policy that does not reflect steep increases in heavy oil prices, an increase in system loss rates due to electricity theft, and the burden of high credit costs. KESC is also heavily dependent on borrowing as the accounts receivable turnover period has grown longer. • As a measure against the steep rise in heavy oil prices, the Pakistani government places priority on using domestically produced natural gas for the power sector. Gas accounts for 44% of the Bin Qasim power plant’s output (February 2001). <p>Operation and Maintenance Conditions</p> <ul style="list-style-type: none"> • Power generator No. 6 has been operating well, and has had no particular problems. However, there is concern that premature deterioration may result from excessive operation and failure to perform periodic inspections. 	<p>because of restrictions on information gathering. Opinions on-site suggest that concrete results should be looked at from a long-term perspective.</p> <p>(3) Financial Status</p> <ul style="list-style-type: none"> • KESC’s earnings performance has not improved. With regard to ordinary profit and loss, the deficit of approximately 7.3 billion Pakistani rupees in 1998 expanded to one of 11.9 billion rupees in 2004. The reasons are basically the same as at the time of the ex-post evaluation. Over three years starting in FY2002 assistance was provided by the government. Even though it resulted in final profits and losses showing a net profit of 460 million rupees in FY2004, there are no expectations for further governmental assistance. • The switch to gas as a fuel for power generation is proceeding and as of 2005 gas accounted for 76% of power generated. Compared to the time of the ex-post evaluation, this comes to a saving of 1.266 billion rupees per year. This corresponds to 3.2% of sales proceeds. Although demand for gas is expected to surpass supply from 2008 to 2010, its gas fuel supply a long-term contract was signed between KESC and gas supply companies, so there should be no problems. <p>Operation and Maintenance Conditions</p> <ul style="list-style-type: none"> • Operation and maintenance work is performed periodically in accordance with the manual from the machinery manufacturer, and sufficient consumables are stored. Generator No. 6 is operating well for the most part, but problems on specific components and abrasion have been noted, and an overhaul is scheduled for December 2007.
<p>Lessons Learned, Recommendations, Information Resources and Monitoring Methods</p> <p>(1) Follow up on lessons learned and recommendations made in</p>	<p>(1) No lessons or recommendations are mentioned.</p>	<p>The executing agency needs a new plan to cope with the increased demand for power in the entire target region, as well as a study to improve financial conditions.</p> <p>(1) Follow-up on recommendations and lessons from the ex-post evaluation</p> <ul style="list-style-type: none"> • Not applicable. <p>(2) Lessons from ex-post monitoring evaluation and recommendations for securing sustainability</p> <ul style="list-style-type: none"> • A reduction of planned shutdowns to cope with the increased power demand is urgently needed, and the executing agency as a whole needs to make an all-out effort to construct new power plants or improve the transmission and distribution grid. • Cooperation in the disclosure of information was not sufficiently obtained, making it difficult to assess relevance through data collection or monitoring of project relevance. When the management is transferred to new organization (following privatization), it

<p>ex-post evaluation report or in later evaluations</p> <p>(2) Proposals for securing sustainability and instructions given at time of follow-up monitoring</p>		<p>should be done in a way that ensures continued smooth operations.</p>
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