The Republic of the Philippines

Ex-Post Evaluation of Japanese ODA Loan
Calaca Coal-Fired Thermal Power Plant No. 1 Unit Environmental Improvement Project

External Evaluator: Ryujiro Sasao, IC Net Limited

0. Summary

This project aimed to improve the environment surrounding the Calaca Coal-Fired Thermal Power Plant on the island of Luzon in the Philippines and to spur the building of the Calaca Power Plant No. 2 Unit by expanding on facilities to prevent coal dust emissions and the spontaneous combustion of coal and by upgrading electrostatic precipitators. Implementation of this project was in line with the policies of the Republic of the Philippines (in the electric power and environmental sectors) and its development needs and with Japan's ODA policy. Therefore its relevance is high. The External Evaluator was able to see evidence that the implementation of this project reduced air pollution and noise roughly as planned and was able to infer that it had a net positive effect on the health of local citizens. While the project stayed within the budget for project cost, the project period significantly exceeded the plan; therefore efficiency of the project is fair. No major problems have been observed in the structural, technical or financial aspects of the operation and maintenance of this project; thus sustainability of the project effect is high.

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

1. Project Description

Project Site

Windbreak Fence installed in the Project

1.1 Background

According to the six-year Medium-Term Philippine Development Plan (MTPDP) established in 1987, the construction of the Bacon Manito Geothermal Power Plant and the Calaca Coal-Fired Thermal Power Plant No. 2 Unit was supposed to increase the 1986 installed capacity of 6,455 MW by nearly 600 MW to 7,050 MW by 1992. In reality, installed capacity increased only 244 MW because of delays in power plant construction and halted operations at existing power plants[1]. As a result, peak demand on the Luzon Grid (one of three electrical power systems in the Philippines, it includes the Calaca Coal-Fired Thermal Power Plant from this project) often exceeded the available capacity, and the number of blackout days reached 103

[1] In fact, the combined installed capacity of the Calaca Coal-Fired Thermal Power Plant No. 1 and No. 2 Units is 600 MW.

in 1990.

The launch of the Calaca Coal-Fired Thermal Power Plant No. 1 Unit in September 1984 immediately brought about hardships such as air pollution due to coal dust emissions (which were generated in the process of unloading coal from transport vessels and moving it to storage areas, and while in storage), odor due to spontaneous combustion of coal (while in storage) and noise generated when safety valves kicked in. The National Power Corporation (NPC) used its own funds to implement measures to prevent coal dust emissions, spontaneous combustion of coal and other phenomena and was striving to improve conditions, but further measures were required.

1.2 Project Outline

The objective of this project is to improve the environment surrounding the Calaca Coal-Fired Thermal Power Plant and spur the building of the Calaca Power Plant No. 2 Unit by expanding on facilities to prevent coal dust emissions and the spontaneous combustion of coal and by upgrading electrostatic precipitators and, thereby contributing to improving the health of local citizens and the supply-demand balance of electricity on the Luzon Grid.

Loan Approved Amount/ Disbursed Amount	6,112 million yen / 2,987 million yen
Exchange of Notes Date/ Loan Agreement Signing Date	December, 1992 / March, 1993
Terms and Conditions	Interest Rate: 3.0% Repayment Period: 30 years (Grace Period: 10 years) General untied (Same conditions as consultants)
Borrower / Executing Agency[2]	Republic of the Philippines / National Power Corporation (NPC)
Final Disbursement Date	July, 2000
Main Contractor	Consilium CMH Babcock (Sweden) and 17 other companies
Main Consultant	(omitted because less than 100 million yen)
Feasibility Studies, etc.	JICA studied the condition of environmental measures of No. 1 Unit via contractor in 1991
Related Projects (if any)	Calaca Coal-Fired Thermal Power Plant No. 1 Unit Construction Project (export credit from Export-Import Bank), Calaca Coal-Fired Thermal Power Plant No. 2 Unit Expansion Project (yen loan)

2. Outline of the Evaluation Study

2.1 External Evaluator

Ryujiro Sasao (IC Net Limited)

[2] The Calaca Coal-Fired Thermal Power Plant was privatized in July 2009 and is currently being operated by the Sem-Calaca Power Corporation, an affiliate of DMCI Holdings.

2.2 Duration of Evaluation Study

The External Evaluator performed an evaluation study as follows in the course of this ex-post evaluation:

Duration of the Study: November 2011 - September 2012 (from the beginning of the contract through the month in which finished products were delivered)

Duration of the Field Study: February 4 - March 3, 2012 and April 22 - May 7, 2012

2.3 Constraints during the Evaluation Study

More than 12 years have passed since the completion of this project. Moreover, as the Calaca Coal-Fired Thermal Power Plant was privatized in July 2009, information from the period during which this project was implemented was not stored well enough, and some evaluation study agendas did not allow for sufficient confirmation of details.

3. Results of the Evaluation (Overall Rating: A)

3.1 Relevance (Rating: 3)[3]

3.1.1 Relevance with the Development Plan of the Philippines

The need for the development of domestic power sources to meet demand for electricity that grew an average of 8% per year was stressed in the electric power sector at the time of the appraisal in "Chapter 4: Improving Infrastructure" of the MTPDP (Medium-Term Philippine Development Plan) 1993 - 1998.

By the time of this ex-post evaluation, a chapter in the MTPDP 2011 - 2016 called "Accelrating Infrastructure Development" put forth the need for an increase of power generated to 16,550 MW across the entire country during the plan period of 2009 - 2030 if peak demand for power grew at an average rate of 4.5% per year[4]. The chapter also spoke to the need to develop reliable power sources with a variety of sustainable energies. Furthermore, coal accounted for a top share of 27.4% of power sources in 2009, highlighting the need for sustainability on the environmental aspect.

In the environmental sector, "Chapter 3: Sustainable Agri-Industrial Development" of the MTPDP 1993 - 1998 proposed as policy objectives the introduction of reliable air quality monitoring in urban areas and the development of appropriate technology for controlling air pollution resulting from industrial development.

By the time of this ex-post evaluation, the environmental/natural resources field in the MTPDP 2011 - 2016 has proposed the specific objective of "reducing air pollution in Metro Manila and other major urban areas" based on the recognition that air quality was bad in the country's major urban areas, and one measure put forth toward that end was monitoring major industry for compliance with environmental standards.

In terms of development policy for the electric power sector, a steady push into building the Calaca Coal-Fired Thermal Power Plant No. 2 Unit and launching operations was required to actually develop electric power as called for by plans in place at the time of the project appraisal. The coherence between recent electric power sector policy and this project has not changed, either.

This project played an absolutely vital role in addressing the need to take action on the environmental aspect and ramp up environmental monitoring for the No. 1 Unit as conditions of

[3] This project aimed to improve both the surrounding environment and supply-demand for electricity, so relevance was analyzed in terms of both environment and electric power.

[4] Installed capacity across all of the Philippines in 2010 was 16,359 MW.

project implementation with regard to the Environmental Compliance Certificate (ECC) for the No. 2 Unit. Therefore, in terms of development policy for the environmental sector, this project was in line with the spirit of policy both at the time of appraisal and at the time of this ex-post evaluation.

3.1.2 Relevance with the Development Needs of the Philippines

The current state of development needs in the electric power sector is as follows: the total installed capacity of Philippine power utilities was 16,359 MW in 2010; broken down by grid (network of power distribution lines), the Luzon Grid, the biggest one, accounted for 11,981 MW (73.2% of the total), the Visayas Grid for 2,407 (14.7%) and the Mindanao Grid for 1,971 MW (12.0%)[5]. Next, we consider the relation among installed capacity, available capacity and peak demand in Luzon Grid. The installed capacity of the Luzon Grid was as written above (11,981 MW in 2010), and in September 2011, the available capacity and peak demand were 7,963 MW and 7,048 MW, respectively, leaving a reserve capacity of 915 MW (Based on newspaper reporting). Though not as dire as the time around 1991 when a tight supply-demand balance caused frequent power outages, the above figures indicate more stringent circumstances than those of the mid-1990s, when the supply-demand balance relaxed. The combined installed capacity of the Calaca Coal-Fired Thermal Power Plant No.1 and No. 2 Units is 600 MW, representing 5% of the Luzon Grid's 11,981 MW in 2010. Though not a hearty share, the Calaca Coal-Fired Thermal Power Plant makes a significant contribution to the Luzon Grid considering the aforementioned supply-demand balance.

Next, on the subject of power sources, development of geothermal, hydraulic and coal-fired thermal power progressed based on the 1980s policy calling for a departure from dependence on oil and a move toward using domestic energy. Table 1 shows trends in power source structure:

Table 1: Trends in Philippines Domestic Power Source Structure (%)

Year	1980	1990	2010
Oil	63.7	43.3	19.5
Hydraulic	24.6	35.3	20.8
Geothermal	11.7	14.7	12.0
Coal	0	6.7	29.8
Other	0	0	17.9

Source: Appraisal Document, Department of Energy

Coal-fired thermal power went from nonexistent in 1980 to the top share of nearly 30% by 2010. The fuel cost of coal-fired thermal power is not as low as hydraulic or geothermal power, but it is highly stable, and that is very important in the tight supply-demand environment of the Philippines[6].

Development needs in relation to this project on the environmental aspect are as follows: namely, as expressed in the background section, further action in addition to NPC countermeasures was needed at the time of the appraisal to address the air pollution caused by coal dust emissions, odor due to spontaneous combustion of coal, noise generated when safety

[5] Compared to the figures at the time of the appraisal in 1990, the Luzon Grid did not change much from its 71.7% share, but the Visayas Grid has grown from its 10.9% share to surpass the share provided by the Mindanao Grid.

[6] The El Niño climate pattern caused water levels in dams to drop in 2010 and pushed hydraulic power output down to 80% of its 2009 level. Geothermal power output also dropped 4% from 2009 to 2010 (because of stoppages due to problems with multiple generators at Visayas).

valves kicked in and other problems that appeared directly following the launch of the Calaca Coal-Fired Thermal Power Plant No. 1 Unit. The ECC issued by the Department of Energy and Natural Resources (DENR) for the Calaca Coal-Fired Thermal Power Plant No. 2 Unit in April 1992 required action to be taken on the environmental aspect and improvement of environmental monitoring for the No. 1 Unit as conditions of project implementation. Therefore, comprehensive environmental measures for both units were necessary.

The above clearly shows the development needs in relationship to this project in terms of supply-demand balance in the Luzon Grid, the advantages of coal-fired thermal power for the power source structure and the consideration of environmental aspects.

3.1.3 Relevance with Japan's ODA Policy

Japan's Official Development Assistance Charter formulated in 1992 mentioned its priority on Asia in the regional aspect and also stated "Dealing with global issues such as environment issue and population increase" as one of 5 major thematic issues.

This project aimed to improve the air around power plants and the rest of the environment by introducing facilities to prevent coal dust emissions and the spontaneous combustion of coal and by increasing the number of electrostatic precipitators, and it is in line with the above Charter in terms of both region and theme[7]. Thus, this project is clearly consistent with Japan's ODA policy.

In light of the above, this project has been highly relevant to the Philippines' development plan, development needs as well as Japan's ODA policy. Therefore its relevance is high.

3.2 Effectiveness (Rating: 3)

3.2.1 Quantitative Effects (Operation and Effect Indicators)

Although no quantitative indicators were put in place at the time of the appraisal, the External Evaluator was able to confirm the following environmental improvement issues:

(1) Prevent coal dust emissions
(2) Prevent odor due to spontaneous combustion
(3) Prevent sea water intrusion
(4) Prevent particulate emissions
(5) Prevent noise
(6) Establish an environmental monitoring system

By the time of this ex-post evaluation, approximately 12 years have passed since the completion of this project. First and foremost, the report of evaluation on the "Calaca Coal-Fired Thermal Power Plant No. 2 Unit Expansion Project/Additional Loan Project"

[7] Japanese government's "Country Assistance Program for the Philippines" was formulated in 2000 for the first time. Other policy documents related to Japan's aid for the Philippines at the time of appraisal were not obtained, either. Accordingly, the above Charter was quoted as reference. Although released after the project implementation, the Foreign Economic Cooperation Project Policy (developed in 1999) states as follows and it also shows the project's consistency with the Japan's aid policy. "3. Assistance by Region/Country: V. Philippines, The focus is on assistance toward strengthening the economic structure of the Philippines to provide for sustained growth; mitigating restrictive factors of poverty and regional disparities; providing support that benefits environmental preservation measures that include disaster management; developing human resources and establishing systems."

conducted in 1998, when this project was near completion, indicated that environmental improvement measures were continuing according to plans. Furthermore, the Evaluator did not observe coal dust emissions or spontaneous combustion on power plant property and confirmed that all was well with water quality at drain outlets.

Next, Table 2 is a collection of the results of environmental monitoring implemented as needed in the area surrounding the power plant[8] (the External Evaluator obtained data through 2011) at the time of this ex-post evaluation. The main indicators that correspond to the environmental improvement issues above have been cleared by Philippines environmental standards and in many cases represent an improvement over time after the project implementation. With regard to the environmental monitoring system, Environmental Section of the Power Plant Facilities Division has been established. The section consists of one chief engineer, two environmental monitoring experts and three full-time workers and they monitor various sorts of data.

Table 2: Environmental Monitoring Results

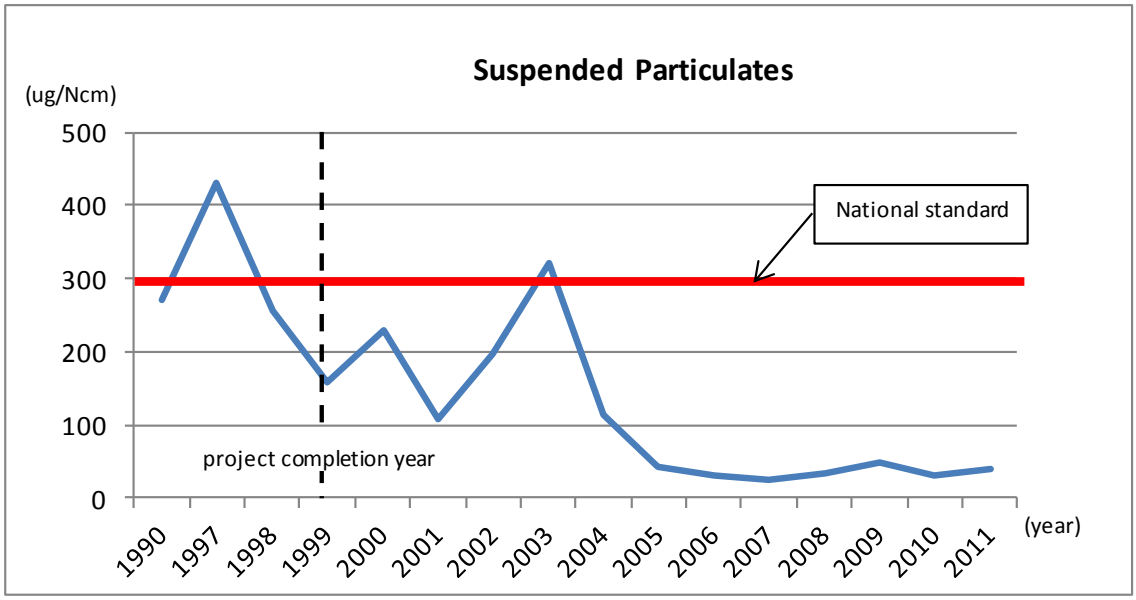
Area	Issue	Compliance with 2011 Domestic Environmental Standards?	Trend Analysis
Air*	1. Ambient Air		
	Suspended Particulates	Yes	Declining annually since 1997.
	Sulfur Dioxide (SO_2)	Yes	Below domestic standard values since 1990 and continuing to fall, particularly since 1999.
	Nitrogen Dioxide ($NO_{2)}$	Yes	Consistently below domestic standard values since 1990 and particularly falling significantly for several years since 1998.
	2. Stack Emission		
	Sulfur Dioxide	Yes	Consistently below domestic standard values since 1999.
	Particulates	Yes	Below domestic standard values since 1999 with some exceptions.
Noise		Yes	Below domestic standard values and declining annually since 1998.
Water Quality	Effluent – Outfall Physico – Chemical Parameters	Yes	Figures have been below domestic standard values in recent years, and there is a clear trend of improvement following the project.
	Effluent – Outfall Heavy Metals	Yes	Figures have been below domestic standard values in recent years, and there are many heavy metals that are not detected at all.
	Groundwater – Outfall Physico – Chemical Parameters	Yes	Figures have been below domestic standard values in recent years, and there is a clear trend of improvement following the project.
	Groundwater – Heavy Metals	Yes	Figures have been below domestic standard values in recent years, and there are many heavy metals that are not detected at all.

*Note: Air monitoring is the so-called ground level pollutant concentration (concentration at the landing point). There are no factories, expressways or facilities that could affect these figures nearby, so the External Evaluator was able to infer that this project is responsible for the trend toward improvement. Since there were no clear standards concerning

[8] Air monitoring is conducted three kilometers away from power plants judged to be the most appropriate for detecting the effects of power plants near the surface of the ground.

discharge concentration in the Philippines at the time of appraisal of this project (1992), discharge concentration monitoring instruments were not used. This power plant began monitoring discharge concentration in 2002 to comply with legislation that went into effect in 1999, but statistics dating back several years are not kept because of trouble with the monitoring instruments. Discharge concentration is now being monitored again, and the latest records show that discharge concentration at this power plant is below domestic standard values. The following are actual measurements of main indicators as of May 2012 (all units mg/Ncm, national standard values in parentheses): Sulfur oxide: 1,071 (1,500) Nitrogen dioxide: 34 (1,500) Nitrogen monoxide: 429 (1,500) Carbon monoxide: 1 (500) Particulates: 52 (200)

Below are graphs expressing the part of aforementioned data.



Note: According to the Environmental Section at the power plant, figures exceeded domestic standard values in 2003 because of high winds that dried the air and led to high airborne particulate matter activity. The section conjectured that it was a temporary phenomenon, and the indicators have improved without any specific treatment.

Figure 1: Target Indicator: Suspended Particulates

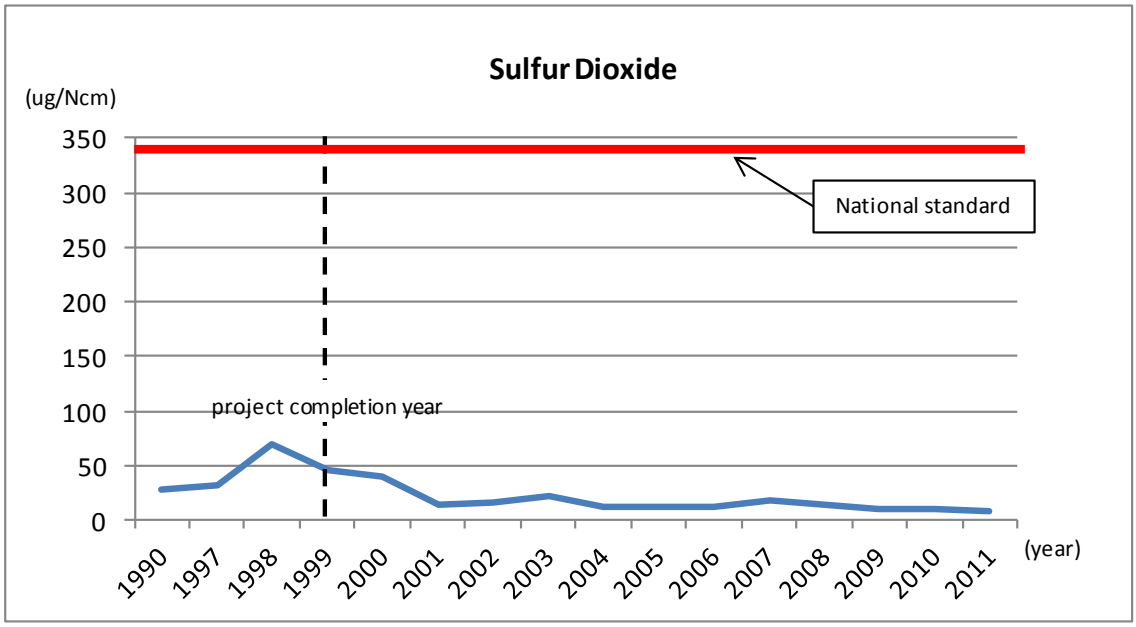


Figure 2: Target Indicator: Sulfur Dioxide

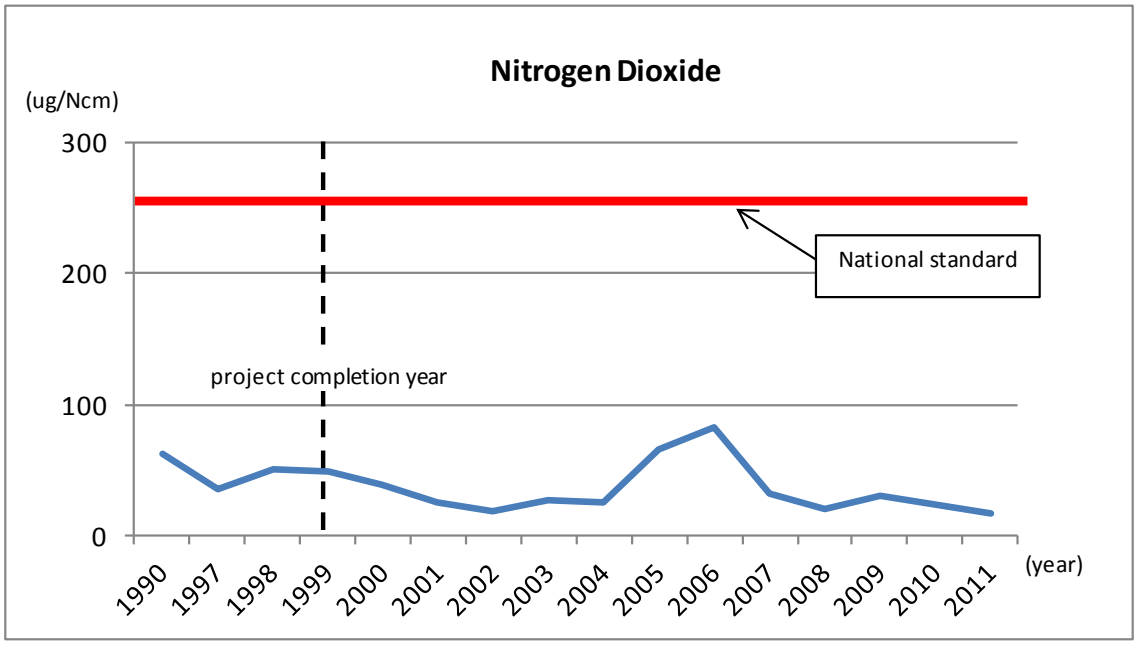


Figure 3: Target Indicator: Nitrogen Dioxide

Annex I shows the plant's general performance as a thermal power plant, and each indicator has reached a roughly appropriate level. However, 27 years have passed since the No. 1 Unit began operations in September 1984, and deteriorating facilities increase the frequency of facility inspections and parts replacement, which has a negative effect on the rate of operation.

3.2.2 Qualitative Effects

During the initial field study, surveyors conducted interviews of a random sample of citizens in all 10 barangays[9] with which the power plant was involved. The target sample for the study was 142 people, and their backgrounds are mainly as follows: average age of 48, 58% women, and among the people from the sample, 50 housewives, 16 agricultural workers and 13 self-employed workers.

The questionnaire asked local citizens to comment on the environment in their neighborhoods at three points in time in particular: before the project (around 1990), just after the project was completed (1999 and on) and at the time of this ex-post evaluation (2012). (Note: Much time had passed since the project was implemented and that it was not always easy for citizens to recall the three times separately. The information below is offered as a reference only.) To be specific, there were five items: coal dust emissions, particulate emissions, noise, odor and sea water intrusion. Interviewees were asked to rate each of the five items on a five-level scale (None/Negligible, Very Slight, Slight, Moderate, Severe) for each of the three times. Below are summarized results from the answers received[10].

The most common reply was "None/Negligible" for every item, regardless of which of the three times, and the ratio of "None/Negligible" increased over time, when we compare "Before project", "Right after project" and "Present". However, the External Evaluator noted "Moderate" and "Severe" answers even for the most recent time, though there were not many of those answers in each item. While the total number of "Moderate" and "Severe" answers for particulate emissions is trending downward, the External Evaluator did not note any change over the years for coal dust emissions, noise or odor. (See Annex II for details)

A breakdown of conditions by barangay clearly shows that the barangays of Baclaran and Carenawan accounted for over 80% of the "Severe" answers for coal dust emissions, noise and odor. This is because these two barangays experience the effects of being directly downwind of the power plant throughout most of the year[11].

Interviews of the Health Sections of the two cities that include the aforementioned 10 barangays showed that there has been improvement to the quality of air and other items.

In addition, an interview with the Batangas Province Office of DENR indicated there were some complaints about environmental problems in the past but lately there have not been any in particular. The office also takes part in multi-party monitoring[12] of this power plant as required by laws and regulations, and it is satisfied with the plant's environmental measures.

3.3 Impact

3.3.1 Intended Impacts

Appraisal documents and such only show outcome levels, and their definition of "impact" is unclear. Given the characteristics of this project, impact can reasonably be viewed as the health

[9] A "barangay" is the smallest administrative unit, managed and operated by the barangay captain, who is appointed in elections within the realms of cities and towns, and functions as a liaison for various government services.

[10] There are no expressways or landfills that could affect the living environment near the citizens' neighborhoods.

[11] It is not possible to confirm particular improvement in these barangays looking only at the total number of "Moderate" and "Severe" answers, but detailed interviews were conducted separately with a barangay counselor (village executive who assists the captain) and a health worker in Baclaran. Those people reported that nearly all items were showing a trend of improvement from year to year and that the extent of the problem recognized was much more minor than indicated on the questionnaires to residents.

[12] According to DENR ordinance, the plant works with outside entities such as DENR and local government units (LGU) to monitor air, noise and water quality each quarter. The results are put together in reports to be shared between the entities that took part in the monitoring.

of local citizens and the stability of the supply-demand balance of electricity on the Luzon Grid. The External Evaluator noted evidence of such impact as follows:

(1) Health of Local Citizens

The External Evaluator was able to confirm that this project had a positive influence on the health of local citizens by combining the following study results of this ex-post evaluation as follows:

① Results of interviews of specific barangay community leaders

Detailed interviews were conducted with a barangay counselor (village executive who assists the captain) and a health worker in Baclaran (Population: 2,329), the barangay that is most susceptible to the effects of being downwind of the power plant. They reported a gradual decrease in the number of people suffering from respiratory ailments from its peak around 1990. It is worth noting two comments about the power plant describing how it sends physicians on a mission once per year to give health checkups and administer medicine and how it sends workers out to answer complaints received from the villagers by listening to them.

② Interviews with health sections of city offices

The aforementioned 10 barangays are a part of the two municipalities of Balayan and Calaca, and interviews were conducted with the Health Section at each city office.

- Balayan (the barangays of Baclaran and Carenawan belong to Balayan):

According to the interviewed physician, problems with coal dust reached their peak in the late 1990s. She also reported a decline of number of people suffering from respiratory ailments from the peak of around 2000 as observed at the clinics[13].

- Calaca:

According to the interviewed nurse, the amount of coal dust visible around their homes before had gone down considerably in recent times, and the number of respiratory ailments had also decreased (though there are no exact statistics).

(2) Stability of the supply-demand balance of electricity on the Luzon Grid

As described previously, the installed capacity of the Luzon Grid was 11,981 MW in 2010. In September 2011, the available capacity and peak demand were 7,963 MW and 7,048 MW, respectively, leaving a reserve capacity of 915 MW. Though not as dire as the time around 1991 when a tight supply-demand balance caused frequent power outages, the above figures indicate more stringent circumstances than those of the mid-1990s, when the supply-demand balance relaxed.

The combined installed capacity of the Calaca Coal-Fired Thermal Power Plant No.1 and No. 2 Units is 600 MW, representing 5% of the Luzon Grid total in 2010. Though not a hearty share, the Calaca Coal-Fired Thermal Power Plant makes a significant contribution to the Luzon Grid considering the aforementioned supply-demand balance and a current status that cannot allow for stoppages. It is worth noting that the External Evaluator noted the same opinions from

[13] However, other factors that may have improved citizens' health include the power plant sending the missions to the barangays to manage their health, the doubling of the local health budget over the previous decade, and the increase in health care staff.

BATELEC, the power distribution association that provides electricity to the Calaca Area, in interviews with related personnel.

3.3.2 Other Impacts

(1) Impacts on the Natural Environment

This project aimed to improve the environment surrounding the power plant, so below are items the External Evaluator was able to study and confirm other than the items written up in the Intended Impacts section.

Action was actually taken on the environmental measures and environmental monitoring for the Calaca Coal-Fired Thermal Power Plant No. 1 Unit was actually ramped up, as conditions of project implementation with regard to the Environmental Compliance Certificate (ECC) for the No. 2 Unit, and the No. 2 Unit was actually built.

It is worth noting that the External Evaluator checked the current status of the land on which the site survey was conducted and did not feel that there were any particular problems with air, odor or noise.

Coal is still being stored outdoors in the coal yard, but the power plant is planning to build a roofed facility to cover the coal this year and further intensify the prevention of coal dust emissions.

(2) Land Acquisition and Resettlement

No land acquisition or resettlement occurred as a result of this project.

(3) Other Impacts

None.

In light of the above, this project has largely achieved its objectives, therefore its effectiveness is high.

3.4 Efficiency (Rating: 2)

3.4.1 Project Outputs

Table 3 shows planned project details and actual results.

Table 3: Planned Project Details and Actual Results

Item	Planned	Actual
1. Prevention of coal dust emissions		
1) Installation of continuous type unloader* 1	2 sets	As planned
2) Installation of water spray system to the coal receiving hoppers	1 set	As planned
3)Repair/reinstallation of dust cover for coal conveyor belts	1 set	None (the cover had been removed from the project scope since it had already been repaired)
4) Tree planting	1 set	Not included in the project scope; the power plant took it upon itself to do this work
5)Installation of windbreak fence around	2 sets	As planned

the coal yard		
2.Prevention of odor due to spontaneous combustion of coal		
1) Restoration of water spray systems	3 sets	As planned
2) Establishment of temperature monitoring system for coal stack piles	1 set	As planned
3. Prevention of sea water contamination: Ramp in the settling pond for easy access of mechanical equipment	1 set	Removed from the project scope because it had already been installed
4. Prevention of particular emissions		
1)Upgrading of electrostatic precipitator	1 set	As planned
2) Retrofit of economizer ash handling system	1 set	As planned
5. Prevention of Noise: Silencer for safety valves	1 set	As planned
6. Environment monitoring: Procurement of environmental monitoring equipment	11 items, 14 sets	6 items, 6 sets[*2]
7. Other: Training of NPC personnel on coal dealing equipment and ash handling system	On-the-job training (OJT) on the new machinery, overseas training on handling coal and ash, etc.	Details unclear

*Notes:1. A type of machine that unloads coal and other bulk cargo.
2. The main reason for reducing the requirement in the project scope was that, upon a re-examination, the need to introduce some of the machinery had waned.

As described above, a considerable portion of the planned number of machines was installed and introduced. As for the items not introduced as part of this project, some of said machinery and equipment had already been installed, and a re-examination of the project scope revealed that the need to introduce some of it had waned. Thus, changes to the project scope did not have a negative effect on project objectives.

3.4.2 Project Inputs

3.4.2.1 Project Cost (Sub-rating: 3)

The project cost in the initial plan was 6.112 billion yen as foreign currency plus 60.35 million PHP (Philippine Peso) as local currency (290.27 million yen[14]) for a total of 6.402 billion yen. The project called for yen loans to make up the entire amount of foreign currency. Thus the remaining amount of local currency was supposed to be paid out of the Philippines government budget.

The actual project cost was 2.987 billion yen plus 146 million PHP (636.56 million yen[15]) for a total of 3.624 billion yen, and yen loans did indeed make up the entire amount of foreign currency. Accordingly, the remaining amount of local currency was paid out of the Philippines government budget.

If viewed entirely in Japanese yen, the actual project cost was 56.6% of the budget.

[14] The exchange rate (as of January 1992) was 4.81 yen to one PHP.
[15] The exchange rate (as of July 1997) 4.36 yen to one PHP.

Table 4: Project Cost: Planned vs Actual

Units: 1 million yen (foreign); 1000 PHP (local)

Item	Initial Plan (time of appraisal)			Actual Cost		
	Foreign currency (all yen loans)	Domestic currency (all Philippine government funds)	Total (1 million yen)	Foreign currency (all yen loans)	Domestic currency (all Philippine government funds)	Total (1 million yen)
Facilities for environmental measures	4,771	46,000	4,993	2,850	138,300	3,453
Facilities for environmental monitoring	95	500	97	81	7,100	112
Consulting services	96	1,000	101	56	600	58
Price escalation	595	8,074	634	0	0	0
Contingency	555	4,774	578	0	0	0
Total	6,112	60,348	6,402	2,987	146,000	3,624

Note: The exchange rate was 4.81 yen per one PHP in the initial plan and 4.36 yen per one PHP as of July 1997

As demonstrated above, the actual project cost came in far below the initial budget. Below are the main reasons for the disparity:

- Project scope cancellation in certain areas (dust cover for the coal transport conveyor, a portion of environmental monitoring instruments)
- Actual purchase prices were lower than expected (especially the high-priced continuous coal unloader and coal storage yard windbreak fence)
- Reduced costs in Japanese yen because of the strong yen

Even if the initial budget were adjusted to 6.25 billion yen to account for the project scope cancellation in certain areas, the actual cost would still come in at only 58.0% of the budget.

3.4.2.2 Project Period (Sub-rating: 1)

This project was supposed to last for three years and three months from the time of the loan agreement (L/A) signing in April 1993 until the completion[16] of machinery installation in June 1996. L/A was actually signed in March 1993, but the machinery installation was completed in October 1999. In other words, the project period was supposed to be 39 months but lasted for 80, which is 205.1% of the plan, grossly exceeding the planned period.

Overall, each machine was installed roughly according to plans, but it probably took time to procure the machines before they could be installed. The External Evaluator attempted to obtain background information during the field study but was unable to do so because maintenance organizations had left few records of the past. JICA internal documents as at 1998 include the following information:

[16] Generally, the project period begins on the day L/A is concluded, but the place for explaining the project period on the appraisal report made no mention of the L/A conclusion date. However, using only this fact to assign the project period start to the initial activity (activities involving prevention of coal dust emissions and drainage outflow) would mean that this project was handled differently than other projects, so the project period start date is the day on which the L/A was concluded as it would be in general cases.

(1) Procured the second continuous coal unloading equipment after procuring and testing the first because its effectiveness with the coal to be used needed to be confirmed beforehand.
(2) Careful consideration was required on the need for and method of increasing the number of electrostatic precipitators because the quality of domestic coal supplied decreased and the ratio of coal blending with foreign coal changed.
(3) Rebid on ash handling equipment and mufflers three times.

The above procurement issues likely had more of a hand in delaying on-site operations than any external factors, but they were probably unavoidable in the pursuit of proper machinery.

3.4.2.3 Consulting Service: Details Unclear

3.4.3 Results of Calculations of Internal Rates of Return (IRR)

Due to the nature of the project, a quantitative analysis of the internal rate of return was not possible, so there are no planned values. Thus, the External Evaluator has omitted ex-post recalculations.

In light of the above, although the project cost was within the plan, the project period was significantly exceeded. Therefore efficiency of the project is fair.

3.5 Sustainability (Rating: 3)

3.5.1 Structural Aspects of Operation and Maintenance

The Calaca Coal-Fired Thermal Power Plant was sold off to DMCI Holdings, Inc., in July 2009.

DMCI Holdings was established in 1995 and was listed on the Philippine Stock Exchange in the same year. The company has developed its business around construction and engages in projects in construction, real estate, water, mining, electric power and roads. The Calaca Coal-Fired Thermal Power Plant is operated by the Sem-Calaca Power Corporation, an entity within DMCI's Mining Division (it belongs to that division because the division provides coal for fuel). DMCI plans to ramp up its work in power generation in the future.

The Sem-Calaca Power Corporation employs 323 people and is comprised of departments specializing in facilities, general affairs, operations, coal management, maintenance and technical services. There are 165 employees in the Operations and Maintenance Division (98 in the Operations Division, 67 in the Maintenance Division) (employees are generally the same NPC employees as those from before the privatization).

According to interviews with the power plant, employee duties are clearly divided and there are enough of them to handle the work. Annual turnover and retirement rates are low, and the organization is stable.

The organization is stable, employee duties are clearly divided, and there are a sufficient number of employees to carry out operations and maintenance at the power plant. In light of the above, there are no particular structural issues.

3.5.2 Technical Aspects of Operation and Maintenance

There are probably no particular technical issues, either. There are at least four employees working on power plant operations and maintenance who have at least 15 years of experience and degrees in specialized fields that qualify them to be core engineers.

The actual work is done according to manuals[17], and power plant personnel have indicated that they do not face any particular technical problems in terms of operations. Operation and effect indicators are largely adequate and, combined with previous information, show that there are no particular problems with the technical level of employees engaged in operations and maintenance management. Multiple employee training programs are being implemented for employees at several levels in line with annual training plans.

3.5.3 Financial Aspects of Operation and Maintenance

This section will demonstrate that the maintenance budget is sufficient and that the actual business of the power plant is running in the black. There are no particular financial issues; return on sales (net profits) in 2010 and 2011, the two years following the 2009 privatization, were 16.5% and 19.3%, respectively, good marks when compared to management benchmarks for Japanese and foreign electric power providers.

Deteriorating facilities at power plant buildings that had been in service for many years warranted more frequent facility inspections and parts replacement. Thus actual maintenance costs increased from 380 million PHP in 2007 to around 1.023 billion PHP in 2011. The amount required to cover maintenance costs has been secured, and important parts are being replaced as necessary as reported in the next section. The Sem-Calaca Power Corporation, which operates the power plant, posted a net profit of 1.437 billion PHP in 2010.

3.5.4 Current Status of Operation and Maintenance

As Table 5 demonstrates, the main facilities are largely operating well.

Table 5: Main Facilities/Machinery Operational Status

Facility/Machinery Name	Status	How problems are handled
Continuous type unloader of coal	One of the two machines is not running due to its age.	The power plant has procured another unloader and is now running a total of two; this did not interfere with work.
Water spray systems to the coal receiving hoppers	Operating without any particular problems.	
Windbreak fence	Operating without any particular problems.	
Water spray systems for the prevention of odor due to spontaneous combustion of coal	Operating without any particular problems.	
Temperature monitoring system for coal stack piles	Operating without any particular problems.	
Electrostatic precipitator	Operating without any particular problems.	Defective parts[18] are currently being replaced.
Ash handling system	Still operating, but some pumps are under repair.	See “Status” to the left.
Silencer for safety valves	Operating without any particular problems.	

[17] 1. BMH Marine Operation and Maintenance Manual for Screw Type Coal Unloader; 2. ABB Operations and Maintenance Manuals for Electrostatic Precipitator – First Row; and others.

[18] To be specific, collecting plates, emitting wires, EP hopper internal parts, etc., are being replaced.

Environmental monitoring system	Some are in operation and others have become unusable due to age.	Instruments that have become unusable are being replaced as necessary[19].

No major problems have been observed in the structural, technical or financial aspects of the maintenance of this project. Therefore sustainability of the project effect is high.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

Implementation of this project was in line with the policies of the Republic of the Philippines (in the electric power and environmental sectors) and its development needs and with Japan's ODA policy. Therefore its relevance is high. The External Evaluator was able to see evidence that the implementation of this project reduced air pollution and noise roughly as planned and was able to infer that it had a net positive effect on the health of local citizens. While the project stayed within the budget for project cost, the project period significantly exceeded the plan; therefore efficiency of the project is fair. No major problems have been observed in the structural, technical or financial aspects of the operation and maintenance of this project; thus sustainability of the project effect is high.

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

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

Facilities are being operated well at present, but it is expected to maintain and update equipment with continued consideration paid to the surrounding environment because some equipment provided on loans is due for updating.

4.2.2 Recommendations to JICA

None.

4.3 Lessons Learned

One noteworthy fact is, after the implementation of this project, that the power plant continually improves the systems themselves and sends physicians and nurses on a mission once per year to surrounding communities (barangays) it affects to give health checkups and administer medicine to citizens. In addition, local citizens offered praise for the way the plant promptly sends workers out to answer any complaints received from the villagers by listening to them. This approach by the power plant likely contributes to the mitigating of the negative effects of power plant operation to the area and can serve as a good example of how power plants, whether public or private, should carry out such operations.

[19] For example, the old Portable SO2 Analyzer has been replaced by an Ambient Air Quality Monitoring System.

Comparison of the Original and Actual Scope of the Project

Item	Original	Actual
1.Project Outputs		
(1) Prevention of coal dust emissions		
1) Installation of continuous type unloader	2 sets	As planned
2) Installation of water spray system to the coal receiving hoppers	1 set	As planned
3)Repair/reinstallation of dust cover for coal conveyor belts	1 set	None (the cover had been removed from the project scope since it had already been repaired)
4) Tree planting	1 set	Not included in the project scope; the power plant took it upon itself to do this work
5)Installation of windbreak fence around the coal yard	2 sets	As planned
(2) Prevention of odor due to spontaneous combustion of coal		
1) Restoration of water spray systems	3 sets	As planned
2) Establishment of temperature monitoring system for coal stack piles	1 set	As planned
(3) Prevention of sea water contamination: Ramp in the settling pond for easy access of mechanical equipment	1 set	Removed from the project scope because it had already been installed
(4) Prevention of particular emissions		
1)Upgrading of electrostatic precipitator	1 set	As planned
2) Retrofit of economizer ash handling system	1 set	As planned
(5) Prevention of Noise: Silencer for safety valves	1 set	As planned
(6) Environment monitoring: Procurement of environmental monitoring equipment	11 items, 14 sets	6 items, 6 sets
(7) Other: Training of NPC personnel on coal dealing equipment and ash handling system	Training in and outside the Philippines	Details unclear
2.Project Period	April 1993 - June 1996 (39 months)	April 1993 - October 1999 (80 months)
3.Project Cost Amount paid in Foreign currency Amount paid in Local currency Total Japanese ODA loan portion Exchange rate	 6,112million yen 290million yen (60 million PHP) 6,402million yen 6,112million yen 1 peso = 4.81 yen (As of January 1992)	 2,987million yen 637million yen (146 million PHP) 3,624million yen 2,987million yen 1 peso = 4.36 yen (As of July 1997)

Annex I. Performance indicators of Calaca coal power plant

Year	1997	2000	2003	2004	2005	2006	2007	2008	2009	2010	2011
Max Outputs (MW) （Upper: No.1 unit, Lower: No.2 unit）	300	288	289	258	207	207	204	183	183	186	187
	300	300	294	277	295	300	298	214	217	251	310
Load Factor (%)*	81.6	69.1	61.5	58.0	69.8	74.2	76.6	87.5	85.3	85.5	82.5
	72.2	73.9	65.8	73.6	64.3	72.5	66.4	83.8	85.1	68.0	67.7
Gross thermal efficiency (%)*	36.6	35.1	33.6	30.9	31.6	31.5	33	33.6	32.8	30.9	30.8
	34.7	32.7	32.0	31.8	32.7	32.2	32.2	31.4	31.9	31.2	31.5
Net Energy Generation (GWh)	1,482	1,202	955	891	1,009	753	988	552	651	840	572
	703	1,192	1,147	1,229	704	1,340	1,056	424	990	668	1,065
Energy Sales, Luzon (MillionKWh=GWh)	27,354	28,473	22,656	23,622	23,458	22,787	23,883	24,003	17,392	n.a.	n.a.

Source: Calaca power plant

*Note: This is a reasonable level as compared to Japanese and other countries' performance.

Annex II. Results of questionnaire survey to local residents living around the plant (Number of repliers)

1. Coal Dust Emissions

	Before	After	Ex-post evaluation*
None/Negligible	40	47	64
Very slight	41	39	27
Slight	33	25	21
Moderate	14	17	13
Severe	11	12	14
Don't Know	3	2	3

*（2012）

2. Particulate Emission

	Before	After	Ex-post evaluation
None/Negligible	51	56	69
Very slight	39	33	27

Slight	17	25	19
Moderate	16	10	7
Severe	2	3	5
Don’t Know	17	15	15

3. Noise

	Before	After	Ex-post evaluation
None/Negligible	45	40	52
Very slight	47	48	43
Slight	24	27	25
Moderate	11	16	12
Severe	5	3	1
Don’t Know	10	8	9

4. Odor

	Before	After	Ex-post evaluation
None/Negligible	34	38	53
Very slight	34	27	22
Slight	31	33	24
Moderate	21	23	22
Severe	14	18	18
Don’t Know	8	3	3

5. Sea Water Intrusion

	Before	After	Ex-post evaluation
None/Negligible	27	27	27
Very slight	4	4	4
Slight	1	1	1
Moderate	0	0	0
Severe	0	0	0
Don’t Know	110	110	110