Philippines

"Calaca II Coal-fired Thermal Power Plant Project"
"Calaca II Coal-fired Thermal Power Plant Project Additional Financing"

Report Date: March 1999

Field Survey: July, October 1999

Project Summary

L/A No.	PH-P76	PH-P141
Borrower	The Philippine Government	
Executing Agency	National Power Corporation	
Exchange of Notes	June 11, 1987	November 7, 1994
Loan Agreement Signing	September 25, 1987	December 20, 1994
Final Disbursement Date	August 8, 1997	July 25, 1997
Loan Amount	¥40,400 million	¥5,513 million
Loan Disbursed Amount (including charges)	¥38,468 million	¥5,164 million
Procurement Conditions	General Untied	
Loan Condition: Interest Rate, Repayment Period (grace period)	4.0% 30 years (10 years)	3.0% 30 years (10 years)

Reference

(1) Currency: Peso

(2) Exchange Rate: (IFS annual average market rate)

Year		1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Rate	Peso/US$	20.39	20.57	21.10	21.74	24.31	24.48	25.51	27.12	26.42	25.71	26.22	29.47
	Yen/US$	168.5	144.6	128.2	138.0	144.8	134.7	126.7	111.2	102.2	94.1	108.8	121.0
	Peso/Yen	8.27	7.03	6.07	6.35	5.96	5.50	4.96	4.10	3.87	3.66	4.15	4.11
Consumer price*		69.2	71.8	78.1	87.6	100.0	118.7	129.3	139.1	151.7	164.0	177.8	186.8

* 1990 = 100

(3) Rate at the time of appraisal: 1 peso = ¥7.6 (October 1986)

(4) Fiscal Year: January ~ December

(5) Abbreviation:

DENR: Department of Environment & Natural Resources
DOE: Department of Energy
ECC: Environmental Compliance Certificate
EIA: Environmental Impact Assessment
EIS: Environmental Impact Statements
MOA: Memorandum of Agreement
NEDA: National Economic & Development Authority
NPC: National Power Corporation
SCC: Semirara Coal Corporation

(6) Abbreviations used in this project

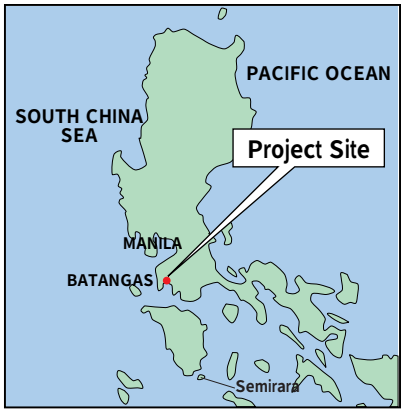
"Construction Project": Calaca II Coal-fired Thermal Power Plant Project [Loan Agreement in September 1987]

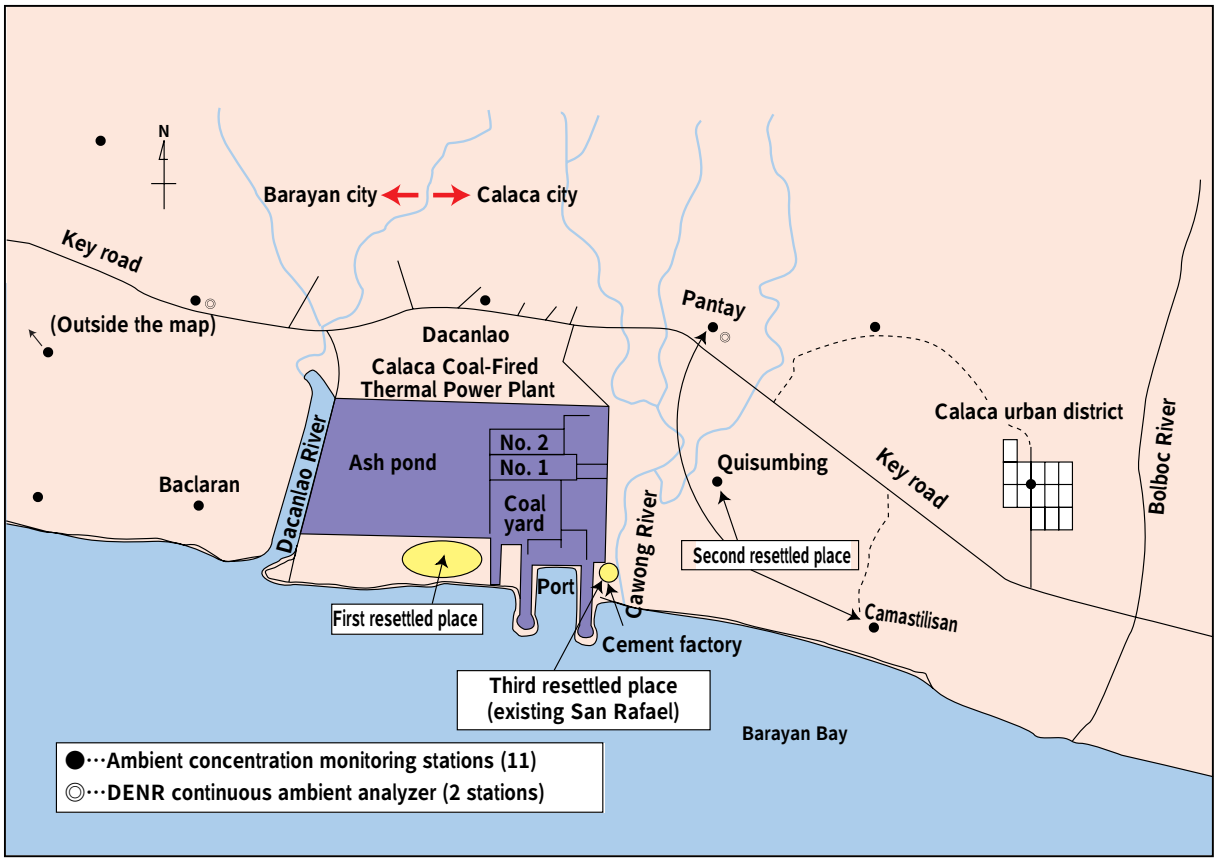
"Additional Project": Calaca II Coal-fired Thermal Power Plant Project (Additional Financing) [Loan Agreement in December 1994]

"This Project": Construction project of No. 2 generator combined with "Construction Project" and "Additional Project".

"Environmental Project": Calaca I Coal-fired Thermal Power Plant Environmental Improvement Project [Loan Agreement signing in March 1993]

Project Location





Foreword

In this project ("Calaca II Coal-fired Thermal Power Plant Project"), generator No.1, which was already in operation (with financing from the Export-Import Bank of Japan), was causing environmental pollution due to spontaneous combustion in the coal stockyard and flying coal dust from the coal transport equipment. Therefore the National Power Coporation (NPC), the executing agency, encountered strong opposition from local residents and NGOs. Thus NPC to devised some measures for environmental protection and public acceptance. The construction of No.2 generator could not begin until these measures were ready, causing a delay of over five years between the conclusion of the loan agreement and the start of construction. (In that time, Luzon Island suffered extremely severe power shortage between 1991 and 1993. To support NPC's environmental measures, JBIC provided finance for an environmental improvement project for No.1 generator separately from this project. No.2 generator made a steady progress once construction started, being completed and going into commercial operation in November 1995).

In the light of this historical background of the project, this evaluation will focus on the environmental protection and public acceptance in addition to the usual post-evaluation. We commissioned evaluations from third parties who examined environmental status and measures for public acceptance in separate studies, for which the reports are appended to this evaluation. The purpose to adopt the third-party evaluation to these areas is to examine, from an objective viewpoint, the problems which provoked resistance at the time, the factual basis of these problems, the measures taken to resolve them and the current situation. We hope that these studies will reveal the points which need to be considered in projects of this kind in the future.

1. Project Summary and Comparison of Original Plan and Actual

1.1 Project Summary and JBIC Portion

The "Calaca II Coal-fired Thermal Power Plant Project" (loan agreement in 1987) added a new No.2 generator (300MW) adjacent to the existing No.1 generator (300MW) as a base load power supply to alleviate the power shortage in the Luzon Grid. In addition, “Calaca II Coal-fired Thermal Power Plant Project Additional Finance” was provided to cover price increases brought about by changes in the specification and delays in the construction of No.2 generator and "Calaca I Coal-fired Thermal Power Plant Environmental Improvement" was implemented to counter environmental problems caused by the No.1 generator. The loan agreements for these two projects were signed in 1994 and 1993 respectively. The ODA loan covered the foreign currency portion of each project. In this report we will refer to these three projects as "construction project", "additional project" and "environmental project". The term "this project" refers to the construction and additional projects for the construction of No.2 generator together. The environmental project is not included in the post-evaluation because the implementation of the project is still under way, but it will be mentioned where appropriate in this report because it is closely linked to this project.

1.2 Background (At the Time of the Appraisal for the Construction Project)

The electrical power grid of the Philippines is broadly divided into three grids; Luzon, Visayas and Mindanao. Power demand is greatest in the Luzon Grid, which includes Metro Manila. In 1985 it provided approximately 76% of national power demand. According to supply and demand forecasts

made at the time, electrical power demand in the Luzon Grid would grow at an annual average of 4.8% between 1985 and 1995, exceeding supply by 1991[1]. This situation made the provision of base load supply a pressing task.

Since the oil crisis, the key targets of the Philippines' energy policy have been to limit reliance on imported oil and to develop domestic energy resources. The development of domestic coal and geothermal resources has been emphasized[2]. The Semirara coal field discovered on the island of Semirara in the 1940s has been developed since 1977 by the Semirara Coal Corporation (SCC), which was set up by the Department of Energy (DOE). In 1980 a coal supply contract was agreed between SCC and NPC, which is also under the authority of DOE. The plan was that this supply of coal would be used in generators No.1 and No.2 of the coal-fired power plant in Calaca, which is close to Semirara Island. The No.1 generator went into operation in 1984 and No.2 was scheduled to be built on the adjacent site (already acquired) under this project.

1.3 Comparison of Original Plan and Actual

① Project Scope

[Construction Project]

	Plan (at the time of appraisal)	Actual	Difference
Power Plant			
Boiler	1	Same as left	—
Turbine	1 (300MW output)	Same as left	—
Generator	1 unit	Same as left	—
Traction transformer	1 unit	Same as left	—
Electricity transmission facility			
Transmission line part	77km, 1 line	57km, 2 lines	-20km, +1 line
Transformer substation part	Extention of 2 transformer substations	—	Deleted
Consulting service	349 M/M	485.14 M/M	+136.14 M/M

(Source) Appraisal materials, NPC document.

[Additional Project]

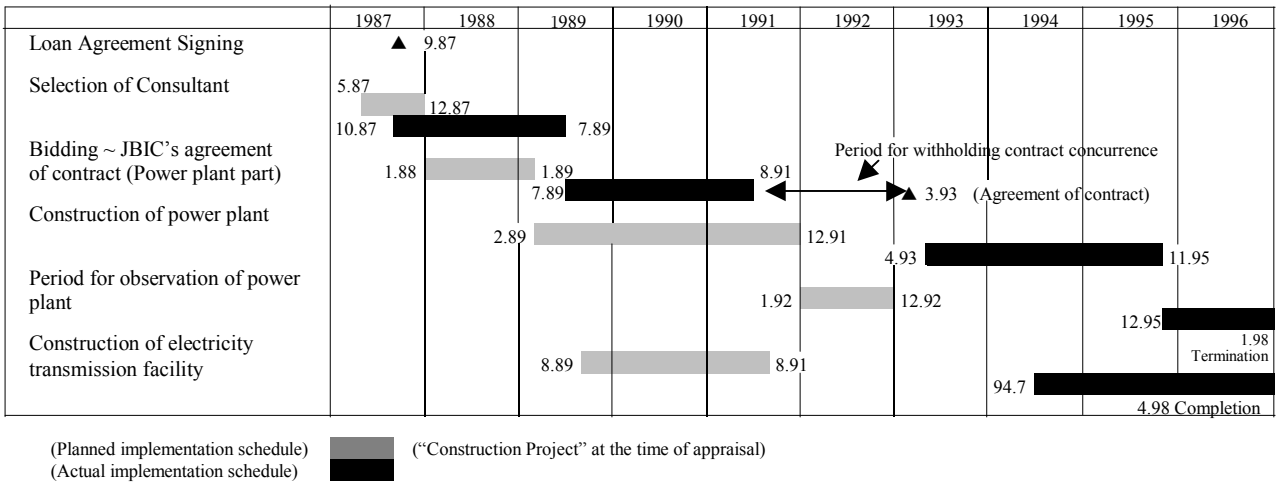
Major design alterations	Plan (at the time of appraisal)/Difference
・Increased boiler volume (1.6 fold) ・Added coal mixer (shared between No.1 and No.2) ・Enhanced electrostatic precipitator efficiency ・Added instrumentation equipment ・Increased chimney height (from 120m to 150m)	No difference

(Source) Appraisal materials, NPC document.

[1] The existing equipment had a stable generating capacity of 2,880MW, against an anticipated peak demand of 2,923MW.

[2] The Aquino administration, inaugurated in 1986, set a “Medium-term Development Plan for the Philippines 1987~1992”. One of the targets included in this plan was the raising of the share of coal-fired generation within nationwide power generation from 7% in 1986 to 13.3% by 1992.

② Implementation Schedule



(Source) Appraisal materials, NPC document.

③ Project Cost

	Plan (at the time of JBIC appraisal)			Actual			Difference [3]		
	JBIC portion (Addition)[1]	NPC portion[2]	Overall	JBIC portion (Addition)[1]	NPC portion[2]	Overall	JBIC portion (Addition)[1]	NPC portion[2]	Overall
Unit	¥ 1 million	1 million peso	¥1 million	¥ 1 million	1 million peso	¥1 million	¥ 1 million	1 million peso	¥1 million
Power Plant	42,552 (5,513)	1,089	46,647	42,008 (5,159)	813	45,186	-544 (-354)	-276	-1,461
Electricity transmission facility	1,331 (0)	242	2,241	666 (0)	177 [4]	1,356	-665 (0)	-65	-885
Consulting	1,030 (0)	27	1,132	915 (0)	27	1,021	-115 (0)	0	-110
Total	44,913 (5,513)	1,358	50,019	43,588 (5,159)	1,017	47,563	-1,324 (-354)	-341	-2,456
Contingency	1,000 (0)	105	1,395						

(Source) JBIC material/NPC material

(Notes) 1) (Addition) = "Additional Project portion out of overall JBIC portion ("Construction Project" + "Additional Project")

2) The planned value of NPC portion employed the reintegrated value at the time of appraisal of "Additional Project" (January 1994)

3) 562 million peso for land acquisition cost are excluded.

Yen exchange rate for NPC portion

At the time of appraisal of "Additional Project": 1peso = ¥3.76, $1 = ¥110

Actual : 1 peso = ¥3.91 (Weighted arithmetic average of IFS annual average rate from 1989 to 1997)

$1 = ¥104 (at the time of disbursement)

2. Project History

In this section we will examine the facts concerning this project in chronological order and describe the steps taken by the Philippine government, NPC, the Japanese government and JBIC to solve the problems. (See appendix "Project History of the Calaca Power Plant").

The design assumptions made in planning the Calaca Power Plant were that, based on the supply and demand forecast for the Luzon Grid, the total output would be 600MW (300MW x 2) and that the fuel used would be domestic Semirara coal. The feasibility study (F/S) was conducted in 1979 by Japanese and Philippine consultants. On the basis of this feasibility study, Barangay San Rafael[3] in Calaca[4] was selected as the site. In 1980 the entire population of the village (approximately 350 households) were resettled.

Construction of the No.1 generator began in 1981 with finance from the Export-Import Bank of Japan and it came on line in 1984. However, the quality of the Semirara coal supplied was inferior to that assumed in the design, and equipment breakdowns were frequent. In 1986 the decision was taken to run the power station on a mixture of Semirara and Australian coal. The Philippine government petitioned the Japanese government for a survey of ways to improve the operation of No.1 generator. The survey was conducted by JICA between 1986 and 1987. Preparations for No.2 generator continued and the Philippines government petitioned the Japanese government for an ODA loan for construction of the No.2 generator in October 1986. Acting on this request, JBIC carried out the study for the No.2 generator construction project in October 1986 and the Japanese government made a preliminary report to President Aquino when she visited Japan in November of that year (the Japanese government made this an aid project (special ODA loan) to assist the Aquino administration which came to power in February of that year). In 1987 NPC conducted an environmental impact assessment (EIA) for No.2 generator in order to qualify for an environmental compliance certificate (ECC). NPC submitted the environmental impact statement (EIS) to the Department of Environment and Natural Resources (DENR)[5]. After these procedures, the loan agreement for the construction project was signed in September 1987.

At that time, while the preparations for the construction of No.2 generator were under way, the residents near No.1 generator began to complain that it was causing environmental damage. It started in December 1986 when the residents of San Rafael complained to NPC about coal dust and asked to be resettled again. In mid-1989, storage of excessive amounts of coal in the coal stockyard[6] caused spontaneous combustion[7] on a large scale which intensified residents' complaints over odor and other problems.

These problems attracted close attention from NGOs and the mass media in the Philippines, as well as local residents, and NPC encountered resistance to the operation of No.1 generator and the further construction of No.2. From 1991, Japanese NGOs also began visiting the site and the Japanese

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3 The term "barangay" refers to a smallest administrative unit. The village is led by a barangay captain who is elected by the barangay residents. The municipality of Calaca comprises 40 barangays.

4 Calaca city in the state of Batangas in the south of Luzon island is situated approximately 115km south of the capital Manila, facing Barayan Bay to the south. To the north are hills covered with palms. Its population in 1998 was 55,218, of whom 60% work in agriculture and 30% in fishing. Its industry comprises only the Calaca Power Plant, a steel factory and a cement factory.

5 In the Philippines, implementation of projects is conditional upon the mandatory acquisition of an ECC from DENR. The ECC is issued when the EIS (broadly examining impact on the atmosphere, water quality and ecological systems) submitted to DENR by those in charge of the project is acknowledged as containing no environmental problems.

6 This happened because under the contract with the supplier, Semirara Coal Corporation (SCC) the amount supplied each month is to be at or above a set minimum volume. In September 1990 the contract was revised to alleviate the coal surplus.

7 This means the coal catches fire without any source of ignition. Spontaneous combustion releases gases containing sulfur which smells bad. Semirara coal has high volatile content, making it prone to spontaneous combustion. It is also fliable, producing fine particles which can be blown on the wind. Thus Semirara coal can easily cause environmental pollution. (A more detailed description of Semirara coal appears in 3.2.4).

government was questioned in the Diet, causing the issue to be taken up in Japan as well. At the same time as these developments, DENR conducted an inspection of the Calaca Power Plant in 1990 and JBIC commissioned experts to conduct a thorough environmental survey in 1991. The environmental problems are described in detail in section 3.3, but the main problems are the frequent spontaneous combustion in the coal stockyard and the scattering of coal dust from the coal transport equipment. In light of these problems, DENR suspended issuance of the ECC, making it conditional on the following:

[1] Solution of the environmental problems of No.1 generator.
[2] Agreement of the local residents to continue construction of the No.2 generator.

NPC opened public hearing at Calaca in April 1991, prepared an environmental improvement plan in May 1991 and began various other steps towards a solution. In July 1991 a memorandum of agreement (MOA) was agreed between NEDA (National Economic Development Authority), DENR and NPC pledging that NPC would strictly observe environmental standards and support social and economic development in Calaca (the approval of the mayor of Calaca with this memorandum was expected, but in the end it was not obtained. After NPC's vigorous efforts at communication with the locals, the mayor agreed in September 1992). The Japanese government and JBIC decided to withhold the concurrence for the start of construction until adequate measures had been taken to protect the environment and the residents. In August 1991, JBIC withheld the concurrence of contracts for the construction of No.2 generator which NPC had requested, citing the fact that ECC had not been granted and directing NPC to adopt a more detailed plan for environmental improvement. In September 1991, ODA loan was requested for the implementation of the environmental improvement plan. Despite the fact that the Mayor had not yet agreed to MOA, DENR granted ECC with conditions[8] in April 1992 to bring some progress. Acting on this move, NPC rapidly requested the contract concurrence from JBIC.

However, JBIC and the Japanese government wanted NPC to take more concrete steps to protect the environment and the residents and set the following conditions for the contract concurrence (October 1992):

[1] Adoption of methods to implement the multipartite environmental monitoring and the resettlement of the San Rafael relocatees[9], both of which are conditions for the ECC.
[2] The agreement signing of all the barangay captains of Calaca to the construction of No.2 generator.
[3] A clear statement by NPC that it would strictly comply with the new environmental standards (draft)[10].

In Japan, Diet members and NGOs were pushing for the installation of desulfurization devices and particularly close attention was being paid to the third condition. NPC decided that desulfurization devices would be unnecessary because they could comply with emission and environmental standards

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8 Failure to strictly observe these conditions would be grounds for revocation of the conditional ECC. The conditions were (i) implementation of prescribed environmental protection measures (detailed in Table 3-7), (ii) implementation of the content of the MOA, (iii) compensation and resettlement for the residents of San Rafael and (iv) implementation of multipartite environmental monitoring.

9 In 1989 the resettlement of the 316 households of San Rafael to other villages in Calaca began, but seven households remained who did not want to move out of the village. Finding a way to resettle those households became a condition of the ECC.

10 DENR unveiled its draft of new environmental standards in July 1992, which included a planned revision to the standard for SO_2 emissions (from 87.5ppm to 764ppm), but the standard was finally altered to 573.1ppm in March 1993.

by using low-sulfur coal (a mixture of Semirara coal and imported foreign coal). This argument was accepted by DENR. In January 1993 the Department of Energy (DOE) sent a letter to the Japanese government stating that NPC had made a firm commitment to abide by conditions [1] and [3]. Condition [2] was fulfilled in March of that year. The Japanese government explained the situation to Diet members and NGOs in Japan to gain their concurrence. Thus all conditions were cleared and JBIC signed the loan agreement for the construction of No.2 generator in March 1993.

After that, the construction proceeded steadily and No.2 generator came on line in November 1995. The resettlement of residents, which was a condition of the ECC, was completed in 1994 with the resettlement of the last remaining households and the multipartite monitoring team is still in force. The social development assistance for Calaca pledged by NPC in the MOA is also being implemented.

If the action of the Japanese government and JBIC over the environmental problems of the Calaca Power Plant is evaluated, at the stage of loan agreement, there might have been a better approach by being aware of the minor environmental problems and asking NPC to remedy these problems. After the initial stage, however, the series of measures taken by the Japanese government and JBIC may be highly evaluated, including withholding of contract concurrence and financing additional loan to secure the environmental protection and public acceptance.

3. Analysis and Evaluation

3.1 Evaluation on Project Implementation

3.1.1 Project Scope

The scope of this project was altered in both the power plant itself and in the electricity transmission equipment. The equipment specifications for the power plant (generator No.2) were altered and expanded, based on the experience of No.1 generator, to include measures for environmental protection and better handling of Semirara coal. The main changes as far as environmental measures are concerned were more efficient electrostatic precipitators and a higher chimney (150m instead of 120m). For handling Semirara coal, the boiler volume was raised by 60% to better suit the properties of the coal, and a coal mixer was added to mix Semirara coal with imported coal. These alterations and expansions increased the cost of the project, leading the Philippines government to ask the Japanese government for an additional loan in September 1991. These changes were essential for environmental and operational reasons and it was appropriate to agree to the requested additional loan. Among the transmission equipment, the transformer substation which was to have been used under the initial plan was approaching the limit of its capacity. This necessitated a change in the transmission route which shortened the transmission distance, although two lines were needed instead of one. There was also some overlap between the substation expansion portion of this project and an ADB electricity transmission project. Therefore the overlapping portions of this project were cancelled, making it considerably smaller.

3.1.2 Implementation Schedule

The loan closing for the construction project was September 1994, but the closing date was extended by two years and eleven months. This extension was necessitated by a delay for 45 months in the power plant portion of the project. This overall delay comprised the following delays:

[1] Fourteen months in the selection of consultants.
[2] Eleven months in bid evaluation.
[3] Twenty months when JBIC withheld their concurrence of the contract due to inadequate consideration for the environment and public acceptance by NPC.

For the transmission equipment portion of the project, JBIC finance covered procurement of the equipment and materials and the construction was funded by NPC. The construction stage suffered major delays, which were caused by disputes of land acquisition and appear to have been unavoidable (of 153 pylons, NPC had to go through acquisition procedures using court mediation for 49 of them).

3.1.3 Project Cost

During the contract negotiations that followed bidding (March 1991), it was realized that the cost of the construction project would overrun. The causes of the cost overrun are as shown in Table 3-1. Elements [1] to [3] in the table led the Philippine government to petition the Japanese government for an additional loan in September 1991, but the final value of the additional loan was set as shown in Table 3-1 after the construction of the No.2 generator began. A supplementary loan agreement was concluded in December 1994.

Table 3-1 Breakdown of the Cost Overrun (Foreign Currency Cost) in Power Plant Portion of the Project

(Units: Millions of Yen)

Elements	Amount
① Changes and additions to the specification for the No.2 generator equipment	3,371
② Inflation during bidding delays (delay of two years from 1988 to 1990).	1,875
③ Shortening of the implementation schedule (from 35 months to 31 months).	618
④ Increase during contract renegotiations (the contract deadlines passed while loan agreement was withheld).	1,933
⑤ Reduction due to exchange rate changes during contract renegotiations.	-2,284
Total	5,513

(Source) Appraisal materials for the additional project.

In the end, ¥1.324 billion of the loan remained unspent (not including contingency), but this happened because exchange rate fluctuations during the construction period (at the time of the loan disbursement) reduced the Yen-based costs of the generator, and because the electricity transmission equipment was scaled down.

3.1.4 Implementation Schedule

(1) Executing Agency

The executing agency for this project is National Power Corporation (NPC), the largest electricity company in the Philippines. NPC constructs and operates generation and transmission equipment and sells electricity to distribution companies and regional electricity distribution associations. They also sell electricity directly to large users. The entry of Independent Power Producers (IPPs) to the electrical power market has been permitted since 1991, but before that NPC was only the electrical

power developed in the country. For the implementation of this project, NPC set up a project office with 78 staff on the site comprising three departments for general management, civil engineering construction and electrical machinery. The project manager ran the project in cooperation with the relevant department of NPC head office.

NPC is scheduled for privatization in the next few years. At the time this report was being prepared, the Privatization Act had been submitted to the Philippine congress.

(2) Consultant

A consultant was employed for this project to give NPC technical support. The consultant, a Japanese company, was selected by a shortlist method. The consultant's terms of reference were mainly to assist in the bidding preparation and evaluation and contract negotiations, and to provide advice on construction and maintenance. The volume of services was estimated at the time of the appraisal for the construction project at 349M/M, but after that the construction work for the generator was split into three packages rather than one (sharing the construction between three contractors increased the amount of service involved in coordinating between contractors) and the project deadline was extended. These changes increased the volume of consultancy service to 485.14M/M. The employment of a consultancy firm was essential for the efficient implementation of the project and was effective in achieving that aim.

(3) Contractors

The JBIC finance covered the construction of the power plant and the procurement of equipment and materials for the transmission facilities. The former was divided into three packages (the boiler, the turbine generator and the transformer with its related works) and the latter was divided into five packages (pylons, electrical lines, overhead lines, insulators and accessories), with the contractors chosen by international competitive tender. The nationalities of the contractors selected for the eight packages are as shown in Table 3-2.

Table 3-2 Nationalities of Contractors for the Power Plant and Transmission Equipment

Package	Nationalities of Contractors
Boiler	Japan, United State of America
Turbine generator	Japan, France
Transformer related	Japan
Pylons (delivery of materials and equipment only, execution by local companies)	Republic of Korea
Electrical lines (delivery of materials and equipment only, execution by local companies)	Philippines
Overhead lines (delivery of materials and equipment only, execution by local companies)	United State of America
Insulators (delivery of materials and equipment only, execution by local companies)	Japan
Accessories (delivery of materials and equipment only, execution by local companies)	United State of America

After the completion of the power plant boiler, it suffered a succession of breakdowns (water leakage from the boiler tubes). Therefore the operational trial period of the contractor was extended by over a year in the case of the boiler. There were no problems with the work of the other contractors.

3.2 Evaluation on Operations and Maintenance

3.2.1 Operations and Maintenance Scheme

The operations and maintenance of this project is conducted by NPC Calaca Power Plant (in place of the project office used for the construction of the project, these tasks are handled by the organization established set up for the operations and maintenance of the power plant for the operation of No.1 generator). The official name of the Calaca Power Plant within NPC is the "Batangas Coal-Fired Thermal Power Plant". Organizationally, it comes under the jurisdiction of the Metro Manila Regional Office of NPC.

The staff of Calaca Power Plant was 486 in October 1998. Of these, 264 were engaged in operation, (power plant operation, coal handling and coal chemical analysis), 167 in maintenance management, ten in control systems and seven in environmental matters (the remainder work in administration and transportation). This size of workforce appears to be adequate, and workers in each field receive suitable training.

3.2.2 Operational Performance of Generation Equipment

The operational performance of generation equipment for both No.1 and No.2 generators is satisfactory. As Table 3-3 shows, Calaca Power Plant adequately fulfills its role of providing base load for the Luzon Grid. The capacity factor of each generator is both above the average for the Luzon Grid, and according to the monthly data, the two generators complement each other in keeping up the base load of electrical power.

However, the results of detailed analysis of the past operation status of No.2 generator show the following three problems with the equipment for No.2 generator.

① As described in the previous section, the quality of Semirara coal is very low, which means oil must be used as a supplementary fuel to keep it burning when load is low.

② Faults in the control system (data transmission systems for measurement, warnings etc.) caused extremely frequent shutdowns. Poor design of the containers for the sensors and terminal boards on site are thought to be the cause.

③ Generator shutdowns have been caused by interruptions in the transmission grid. In the case of coal-fired power plants, FCB action (a function which prevents damage to the generator when there is an interruption in the transmission grid) is more difficult to implement than in gas or oil-fired power plants. Nevertheless, repairs should be considered, taking into account the demands of stability in the system.

NPC should deal with these by adjusting the coal mixture for ① and by making rapid repairs for ② and ③.

Table 3-3 Operational Performance of Generation Equipment (January to September 1998) [1)]

	Units	No.1 Generator	No.2 Generator	Luzon Grid[2)]
Equipment capacity	MW	300	300	8,214
Maximum output	MW	300	300	4,845
Gross generation (monthly average)	MWh	138,151	128,084	2,492,167
Net generation (monthly average)[3)]	MWh	128,182	120,868	2,342,667
Coal usage (monthly average)	t	61,755	75,153	-
Average calorific value of coal used	kcal/kg	5,281	4,509	-
Net thermal efficiency [4)]	%	33.8	30.7	n.a.
Load factor [5)]	%	81.5	70.5	69.7
Capacity factor [6)]	%	63.2	58.6	43.3
Availability factor [7)]	%	77.1	84.2	73.4
Maintenance, planned outage rate [8)]	%	22.4	10.6	n.a.
Forced outage rate	%	0.3	3.3	7.1

(Source) NPC material

(Notes) 1) No.2 generator went into operation in November 1995, but the contractor operational trial period extended until January 1998. Therefore the statistics for 1998 are used.
2) Data for the Luzon Grid are averages for January ~ June 1998. Load factor is averages for 1997.
3) Net generation = Gross generation - consumption within the power plant.
4) Net thermal efficiency: The ratio between the net generation and the total quantity of heat supplied to generate that amount.
5) Load factor = Average electrical power/ Maximum electrical power (at peak).
6) Capacity factor = Gross generation/ (equipment capacity x number of hours in the certain period considered).
7) Availability factor = Hours of operation/ number of hours in the certain period considered.
8) This rate includes outage due to natural disasters.

3.2.3 Maintenance

The field survey for this evaluation found the power plant to be well maintained overall and thoroughly cleaned despite the fact that it uses coal that produces large amounts of coal dust. Also, as will be described below, the measures against coal dust and spontaneous combustion in the coal stockyard and the other environmental measures have been implemented, bringing great environmental improvements. However, some maintenance problems still arise due to the poor quality of the coal.

3.2.4 Used Coal

(1) Use of Semirara coal as a matter of national policy

According to the DOE Department Circular No. 95-05-004 (1995), 10% of NPC's coal consumption is to be domestic coal. Approximately 80% (in the first quarter of 1998) of domestic coal is Semirara coal (coal reserves on Semirara island near Calaca, see "Project Location" at the start of the report). Almost all the Semirara coal produced is supplied to the Calaca Power Plant. As Table 3-4 shows, nearly all the domestic coal used by NPC is burned at Calaca. Clearly it is a national policy that Calaca Power Plant is directed to use Semirara coal.

Table 3-4 Coal Consumption Volume of NPC・Calaca Power Plant

	1996		1997	
	Overall NPC	Calaca Power Plant (No.1 and 2)	Overall NPC	Calaca Power Plant (No.1 and 2)
Total coal consumption (t)	2,070,150	1,042,472	3,087,162	1,097,795
Domestic coal within the above (t)	706,741	601,725	744,698	596,428
Percentage of domestic coal (%)	34	58	24	54

(Source) NPC material

(2) The quality of Semirara coal

Semirara coal is lignite[11], which means that it is fine grained with high water and ash content. When it gets damp it becomes more viscous and sticks to the coal transport equipment. It also contains large amounts of alkali ($Na_2O.K_2O$) which can easily cause breakdowns inside the boiler. Problems such as these make this coal extremely difficult to handle as fuel for a power plant (Table 3-5. One more problem with the handling of this coal is that it is not sorted or washed[12] at the mine, meaning it is mixed with impurities such as stones and metal scraps and has sludge and coal dust stuck to it). As a result it was impossible for No.1 generator to run at its rated capacity on Semirara coal alone[13]. Mixing with imported coal was necessary. The No.2 generator was designed to be able to run on 100% Semirara coal, but the inconsistency of quality within the coal and its increased viscosity in the rainy season mean that mixing is still unavoidable.

There are two factors determining the mixing ratio between Semirara and imported coal. One is the alleviation of the handling problems described above and the other is that according to the terms of the ECC the sulfur content of the coal burned after mixing must not exceed 1% (Semirara coal has a higher sulfur content but under the terms of the contract with the supplier SCC, NPC does not buy coal with a sulfur content of more than 1.2%). NPC will have to deal with the first factor on a case to case basis, drawing on their experience. For the second they must test the sulfur content of their coal after mixing and ensure that it does not exceed 1%. This means that they will not be able to maintain a constant blend ratio of coals at the Calaca Power Plant.

Through the year the blend between Semirara and imported coals is 50:50 in No.1 generator and 90:10 in No.2 generator in dry season, changing to 70:30 in rainy season.

11 This is low-grade coal with low carbon, high volatility and low heat generation. The high proportion of volatiles makes spontaneous combustion easier, but it makes it harder to light with a burner (this is probably why auxiliary fuel for combustion is required).

12 Sorting is the process by which the excavated raw coal is separated into waste stone and coal at the mine and the coal is further graded by size. Washing involves using water to wash mud and coal powder off the coal.

13 Originally, No.1 generator was designed to make Semirara coal its main fuel, but the coal provided was far inferior to the type planned for, causing problems in the operation of the generation equipment and in the local environment.

Table 3-5 Comparison of the Properties of Semirara and Imported Coals (Analysis for coal as delivered, before drying)

	Unit	Semirara coal[1)]	(Performance Coal)	Imported coal[2)]
Calorific value	kcal/kg	2,695-4,745	(3760)	6,457
Fixed carbon	Weight %	17.4-33.4	(26.3)	49.0
Volatile matter	〃	23.5-34.6	(28.8)	30.3
Ash content	〃	5.0-32.1	(14.9)	13.2
Moisture content	〃	27.0-30.0	(30.0)	7.1
Alkali (Na_20,K_20)	〃	2.83-10.8	(5.7)	1.2
Sulfur content	〃	0.5-1.2	(0.5)	0.4

(Source) NPC material

(Note) 1) The properties of Semirara are not constant. "Performance coal" is set as the quality of Semirara coal that the generation equipment is designed to be able to use unmixed.

2) These are sample values for Australian coal, the main imported coal. Coal is also imported from Indonesia and China.

(3) Problems caused by Semirara coal

The low quality of Semirara coal described above caused environmental pollution in the past, but it still causes problems in the maintenance of the power plant's equipment and NPC is working to solve these.

① Coal stockyard

The spontaneous combustion and coal dust that were a problem in the coal stockyard in the past have been greatly improved by the installation of water sprinklers and a windbreak fence and by restrictions on the duration of storage and the stacking height. However, Semirara coal is lignite and it is extremely difficult to completely eliminate the problem of spontaneous combustion. Even now, small spontaneous combustion still breaks out. To counter this problem, NPC posted a 24-hour guard on the coal stockyard who can spot the thin vapor which appears immediately before ignition and put the fire out immediately.

② Coal unloader and conveyors

The coal unloaders, which unload coal out of the ships which deliver it, were changed from bucket-type to screw-type (one of which has already been installed) in the environmental project as a countermeasure against coal dust, but in the rainy season, the viscosity of Semirara coal increases, sometimes blocking the screws. Therefore the screw-type coal unloader has been partially altered and the bucket-type unloader can also be used in the rainy season when there is no problem with airborne dust. The conveyor belt and screens of the coal conveyors are prone to damage because Semirara coal includes stones and metal scraps. To counter this problem, NPC has started to sort and wash the coal (as will be described later) and have stepped up their maintenance and repair operations.

③ Ash pond

The ash left after coal burning is mixed with sea water and discarded into an ash pond, but as the ash content of Semirara coal is high, the capacity of the pool is insufficient and it may have to be expanded.

(4) Supply of Semirara coal

SCC, who are the supplier of Semirara coal, were established in 1977. They were a public corporation under DOE until 1997, when they were privatized. In 1995, SCC and NPC renewed their trading contract for Semirara coal after 15 years[14]. The contract stipulates that NPC will buy at least 900,000 tons of Semirara coal per year, all of it for use in Calaca Power Plant. If actual consumption falls short of that amount, the surplus can be stored at the Semirara coal field, once it has been paid for. Deliveries are to be made two or three times a week, as required for the operation of the power plant.

As described above, Semirara coal is mixed with stones and metal fragments and its ash content (including mud and coal dust) is high. In December 1998 SCC started sorting and washing the coal to remove these materials before shipping. According to NPC, handling of the coal by the coal unloader and conveyors has been much better. Although, washing can reduce the ash content, but it cannot remove the alkali content which damages the boilers. Therefore coal mixing will continue to be an unavoidable necessity.

3.3 Evaluation on Environment

3.3.1 Environmental Problems before this Project

The environmental problems which existed at the Calaca Coal-fired Thermal Power Plant before the implementation of this project, namely airborne coal dust and small-scale spontaneous combustion, are described in the JICA report "The Study for Calaca Coal-fired Thermal Power Plant (I) Upgrading Project" (January 1988)[15]. Such small-scale problems became serious due to the extreme overloading of the coal stockyard from the second half of 1989.

The EIS for the No.2 generator submitted to DENR by NPC in August 1987 included the results of atmospheric pollution monitoring of No.1 generator. According to those figures, No.1 generator was meeting ambient air quality standards, but the emission concentration of SOx was in excess of the standards. [Atmospheric monitoring included measurement of the emission concentration at the pollutant emission source (the chimney, in the case of the power plant) and the ambient concentration (or ground level concentration) measured where airborne pollutants land. The emission standard applies to the former and the environmental standard to the latter.]

However, the standards applied at the time included an exemption clause that "If the emission standard cannot be met due to economic and technical limitations then, the ambient air quality standard should prevail".

Therefore the emission concentration at the Calaca Power Plant was not seen as a problem. (The emission standard for SOx at the time was 87.5ppm which was very low compared to levels in developed countries[16] and it was practically impossible to comply with the standard. Therefore the standard was lifted to the more feasible level of 573.1ppm in March 1993. See Table 3-6.)

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14 This contract will remain in effect after NPC is privatized.

15 This study was originally intended to improve the working condition of the equipment, but it extended in part to include environmental measures.

16 Japan uses K values, which makes comparison difficult, but for example, the German standard is 140ppm and the US standard is 434ppm.

Table 3-6 Changes in SOx Emission Standards

	Emission standard	Conditions for exemption from compliance
1976	87.5 ppm	If it is impossible to clear emission standards for economic or technical reasons, priority is to be given to compliance with the environmental standard.
1993	573.1 ppm	— (No exemptions under any conditions).
1994	573.1ppm	Provided the ambient concentration measured by the stipulated method is within the standard, an exemption from compliance with emission standards is granted.

In September 1990 DENR conducted an inspection of the Calaca Power Plant. The results showed that both particulate matter and SOx emissions were in excess of standards (at 1,812mg/m^3 and 413ppm respectively) and in December of that year DENR ordered the suspension of the power plant's operation. NPC responded by asking DENR to repeat the inspection and an inspection of emission concentrations conducted in February 1991 found that the electrostatic precipitator which had been broken down at the time of the previous survey had been repaired, bringing particulate concentration within the standard. The SOx concentration was above the standard, but this was permitted under the exemption condition mentioned above.

The environmental survey commissioned from an expert in April 1991 found the following:

① Spontaneous combustion in the coal stockyard were frequent (some coal had already burnt inside the ship).
② Coal dust was scattering from the coal unloader and conveyors, and from the coal stockyard.
③ Percolation of sea water from the ash pond was causing salination[17] of well water.
④ High levels of noise were made several times a year (due to the action of safety valves).
⑤ Pollution of the sea surface by coal dust.

Otherwise, there was no major problem with the environmental concentrations and smoke and water discharges, other than SOx emissions beyond the emission standard.

3.3.2 Alleviation of Environmental Problems

NPC was to implement the measures listed in Table 3-7 to alleviate these environmental problems. The measures listed are from the Environmental Improvement Plan drawn up by NPC (the plan was put forward by NPC in May 1991 and submitted to DENR in November of that year). The measures satisfy the environmental conditions prescribed in ECC. The majority of the measures were implemented by NPC with its own funds (the planned cost was P47.5 million), but for some equipment and services which required procurement with foreign capital (the shaded area of Table 3-7) NPC petitioned the Japanese government for an ODA loan. The loan agreement for the "Calaca I Coal-fired Thermal Power Plant Environmental Improvement Prject" was concluded in March 1993 (approved loan amount was ¥6.112 billion).

Most of the environmental improvement measures were completed by February 1999, and completion is in sight for the portions covered by the ODA loan. Installation of the screw-type coal unloader (second set), upgrading of electrostatic precipitator for No.1 generator, installation of silencer and petrofitting of ash handling system are under way.

[17] NPC supplied drinking water to the people living near the power plant.

Table 3-7 Environmental Improvement Measures for the Calaca Power Plant

Objectives	Measures
Reduction of coal dust dispersal	Installation of screw-type coal unloader.
	Installation of water sprinklers on the coal transport equipment.
	Restoration of the anti-dust covers on the coal conveyors.
	Tree planting to block dust.
	Installation of a windbreak fence around the coal stockyard.
Prevention and extinguishing of spontaneous combustion	Restoration of water sprinkler equipment at the coal stockyard.
	Proper management of coal storage (limits on duration of coal storage, adoption of first-delivered/ first-used system, additional coal storage mounds).
	Compaction of coal piles by bulldozer.
	Use of a temperature monitoring system in the coal stockyard to improve prediction of spontaneous ignition.
Prevention of air pollution	**Limitation of sulfur content in fuel coal (less than 1%).**
	Monitoring of atmospheric emission and ambient concentrations.
	Construction of a higher chimney (150m) for No.2 generator.
	Upgrading of electrostatic precipitator for No.1 generator.
Prevention of ash dispersal	Retrofitting of economizer ash handling system
Preservation of discharged water quality	Provision of adequate capacity in the ash pond and construction of an embankment around it (to prevent sludge outflow).
	Restriction of temperature rise in coolant water to 3℃.
	Prevention of coal dust mixing with discharged water.
	Monitoring of groundwater, waste water from the ash pond and sea water.
Noise prevention	Installation of scilencer on No.1 generator.
	Noise measurement.
Enhanced environmental monitoring	Implementation of multipartite monitoring by a group comprising NPC, Calaca city, NGOs and DENR, and publication of monitoring results.
	Purchase of environmental monitoring equipment (atmospheric pollutant analysis devices, water quality detectors etc.).
	Study for consultancy services in the modification/upgrading of existing Unit 1, Coal and Ash Handling Equipment System.

Source: NPC documents, JBIC documents, ECC.

Notes: The shaded portions were financed by the loan named "Calaca I Coal-fired Thermal Power Plant Environmental Improvement Project". The project name refers to No.1 generator, but the equipment and devices procured are for the use of both No.1 and No.2 generators.

* More powerful electrostatic dust collector for No.1 generator: The design values for the electrostatic dust collector are only for Semirara coal. Australian coal is harder to capture its dust (the efficiency rate for No.2 generator is 99.85%, against 98.13% for No.1). The collection rate is to be raised to higher than 99.5% by improvement works in 1999.

3.3.3 Status of the Environment and Related Tasks

(1) Status

The site of this project, the municipality of Calaca in Batangas state is a clean region with atmosphere completely different from the air pollution, composed mainly of automobile exhaust, that Metro Manila suffers from.

Inspection on the site of power plant during the field survey for this evaluation[18] found that the

[18] For this report, field studies were conducted twice, in July and October 1998. Both field studies had the assistance of environmental experts in the fields of air and water quality. The "Third-party evaluation" was conducted by the air pollution expert who conducted the October field study.

environmental improvement measures were being put steadily into effect and there was no sign of airborne coal dust or spontaneous combustion. The survey also confirmed that there was no problem with water quality at the water outlet. The surrounding area was also inspected (the municipality of Calaca and Balayan) but no environmental pollution of air or water that could be due to the Calaca Power Plant was observed. Thus within the scope of the survey, the environmental problems indicated previously in Calaca Power Plant and environs appear to be greatly improved.

(2) The state of monitoring

Two systems of environmental monitoring are in effect at Calaca Power Plant. One system is implemented by power plant staff (there is an environmental monitoring department with seven staff, and a manager who has an environmental manager qualification from DENR). The department measures the atmosphere 20 times each month, water quality eight times and noise four times and submits quarterly reports to DENR. The other system is the multipartite monitoring which was a condition of ECC and involves NPC, Calaca, NGOs and DENR. It carries out similar measurements over 4~5 days twice a year, once in the rainy season and once in the dry season. Publication of the findings of the multipartite monitoring is mandatory. The results of detailed examination of the monitoring data from these two systems will be presented later in the relevant sections.

① Air quality

a) Monitoring methods and results

Atmospheric monitoring should measure both emission concentration and ambient concentration, but in Calaca Power Plant, continuous stack analyzer of both No.1 and No.2 generators are out of service and emission concentrations are not being measured. According to the Memorandum Circular No.29 from DENR in May 1994, existing power plants[19] which meet ambient air quality standards are exempted from compliance with the new emission standard (573.1ppm) (see Table 3-6). Therefore the power plant managers do not appear to fully recognize the importance of measuring emission concentrations.

On the other hand, eleven monitoring stations for ambient concentration have been set based on an EIA simulation of concentration distribution[20] (eleven points, see "Project Location" at the beginning of the report). The analyzed pollutants are SOx, NOx and TSP (Total Suspended Particulate Matter). According to recorded results between December 1996 and May 1998, particulates have briefly exceeded the standard[21], but other measurements have been within the standards (see Table 3-8), with most readings being low or ND (not detected).

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19 The plants which had already been built or designed by April 1993. This applies to Calaca Power Plant.

20 A simulation using a prediction model that takes pollutant discharge quantities and meteorological conditions as its parameters can find the concentration distribution of atmospheric pollution.

21 According to NPC's explanation, the value can be temporarily pushed up at a time by burning of sugar cane in the fields and dust from the roads. The environmental standard for particulates is set in two levels, TSP, which considers all particulate matter, and PM_{10} which only considers airborne particulates with diameters of 10 microns or less. At the Calaca Power Plant, only TSP is measured. PM_{10} considers the particulates that are harmful to humans. If PM10 is measured and the composition of the ash is analyzed the impact of pollutants released by the power plant can be defined.

The third-party evaluation predicted the short-term peak concentration (one hour value)[22] for ambient concentration at 0.12ppm for SOx (Table 3-8 "Predicted Peak Concentrations"). This made it clear that the Calaca Power Plant alone would not exceed ambient air quality standards for pollutants under any circumstances.

Table 3-8 Emission and Ambient Air Quality Standards/Predicted Peak Concentrations (One-hour Values)

	Units	Old standard	New standard (in force from March 1993)	Measured results [1] (minimum, average, maximum)	Predicted [2] peak concentration	Japanese standard
Environmental standard						
Sulfur dioxide (SO_2)	ppm	0.3	0.13	ND -0.005 -0.12	0.12	0.1
Nitrogen dioxide (NO_2)	ppm	Daily average value [3]	0.14	ND- 0.007 -0.07	0.11	Daily average value
Total suspended particulate matter (TSP)	mg/Nm^3	0.25	0.3	ND- 0.112 -1.54	0.036	—
Airborne particulate matter (PM10)	mg/Nm^3	—	0.2	—		0.2
Emission standard						
Sulfur dioxide (SO_2)	ppm	87.5	573.1		664・947	K value restriction
Nitrogen dioxide (NO_2)	ppm	974	797.3		740・740	200
Particulates (PM)	mg/Nm^3	300	300		240・240	100

Source: Environmental regulations, multipartite monitoring report etc.

Notes 1) Measurement values are hourly values between December 1996 and May 1998. ND means "Not detected".
2) The predicted peak emission concentration is for No.1・No.2.
3) The hourly values are average values over one day (the average of 24 hourly values), which makes comparison of standards within the table impossible.

b) Tasks

i) Monitoring system for emission and ambient concentrations

- Measurement of emission concentrations

Even though the power plant is exempted from compliance with the new emission standards under DENR Circular 29, it should still measure emission concentrations. Information on the volume, temperature and concentration of exhaust gases in the stack is necessary for maintenance of the boilers, electrostatic dust collectors and other equipment. It is also the most important information for devising measures against atmospheric pollution. In 1992, the construction of No.2 generator was permitted on the condition that Semirara coal and imported coal were being mixed in a fixed ratio in order to keep SOx emission concentration within the standard, the form of the coal and the mixing ratio are constantly changing. It can be assumed that the volume of SOx emitted is also varying widely as a result.

[22] The short-term peak concentration is "the theoretical maximum concentration that can arise based on certain conditions". It can predict the value of maximum concentration and the point when such value appears. For this prediction, the peak value of emission concentration and the climatic conditions (under which the maximum environmental concentration will occur) are adopted as calculation parameters.

This kind of measured data[23] is unavailable, which means that the best available way of knowing the maximum value of emission concentration is to make prediction as close as possible to the real conditions. When the peak SOx emission concentration was calculated based on the operational records[24] from January to September 1998, the figures obtained were 664ppm for No.1 generator and 947ppm for No.2 generator. These values are far in excess of the emission standard (573.1ppm) (however, these are only prediction of peak concentration. They do not mean that emissions are constantly at that level). The short-term peak value (one-hour value) of ambient concentration based on these values for maximum emission concentration is 0.12ppm, within the standard. However, this is a predicted peak value, which does not mean that such a high peak is reached frequently, but it is close to the environmental standard of 0.13ppm. Therefore if there was another contributing pollution source, the standard could be exceeded for brief periods. In the case of ambient concentrations, it is not acceptable for the impact from each individual source to stay within the standard. Considering the possibility of further industrial development in the area, the pollution from Calaca Power Plant as a single source needs to be reduced further.

Therefore, even if the continuous stack analyzer is unserviceable, NPC should analyze emissions manually to prepare emission specification data and take appropriate steps based on the findings to change the coal mix and reduce pollution.

- Implementation of continuous monitoring of environmental concentration

Due to their exemption under DENR circular 29 from compliance with emission standards, continuous monitoring equipment has been installed at two locations where the highest concentrations appear. Concentrations at these points must comply with environmental standards. DENR has installed these two devices (Refer to "Project Location" at the start of this report. However, both monitoring devices have broken down and are out of service). NPC has purchased one monitoring device and is calibrating it for installation. The third-party analysis predicted that the ground points of highest concentration would be nearly 3km downwind in the direction of the southwest and east winds, but the two DENR continuous automatic measurement devices were in different locations. They should be repaired and resettled to the predicted points of peak concentration to continue measurement.

- Environmental concentration monitoring at appropriate stations

In addition to the two points of highest concentration mentioned above, proper ambient concentration monitoring requires measurement at ten points in a broad concentration distribution that will reveal the impact of pollution over the whole of the surrounding area. As described in "(a) Monitoring methods and results", measurements were taken at eleven points for the Calaca Power Plant EIS, based on the results of a concentration simulation.

In the third-party evaluation, examination of the EIS concentration simulation revealed that the

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[23] According to the limited data gathered before the continuous stack analyzer broke down, No.1 generator was emitting 370~606ppm (over five days in January 1998) and No.2 was emitting 445~676ppm (over four days in June 1998). These figures exceed the emission standard of 573.1ppm but the data is too limited to give definitive peak values.

[24] Maximum sulfur content for mixed coal: 0.78% in No.1 generator and 0.99% in No.2.
Overall thermal efficiency: 36.43% (No.1), 32.51% (No.2).
Maximum output: 300MW
Residual sulfur in the coal (proportion not released to the atmosphere): 5%

meteorological data on which the simulation was based was inadequate (Refer to the Third Party Evaluation for details).

Therefore the concentration distribution predicted in the EIS is unlikely to be accurate, and the existing measurement points based on the prediction are probably also inappropriate i.e., they are not measuring at the points where the pollution impact of the power plant is most likely to occur[25]. (However, as noted above, whatever point is measured, the environmental standards are not exceeded.)

The climate data should be remeasured and used as the basis of a repeat of the concentration simulation so that the monitoring measurement points can be relocated on the basis of an accurate concentration distribution.

- Climate measurements

Grasping the concentration distribution will require at least one year of meteorological data (wind direction, wind speed and atmospheric stability). Therefore NPC should buy gauges for measuring wind direction, wind speed, solar radiation and net radiation in order to measure atmospheric stability[26].

If a monitoring system for the emission source and the ambient air quality is set up as described above, it would be possible to prove or disprove the causal relationship between the power plant and any complaints arising against it in the future, on the basis of the accumulated data. The policy of the Calaca municipality is to industrialize the coastal area in the future, which will create multiple pollution sources. At that time it will be extremely important for NPC to know exactly what pollution concentration can be attributed to the power plant.

ii) Spontaneous combustion

As noted in section 3.2.4, NPC says that small-scale spontaneous combustion still occur. NPC is now taking various measures but it must strengthen its countermeasures further (control of the duration of coal storage[27] etc.).

② Water quality

The results of water quality measurement do not show any major problems. The measurement points were eight points in Balayan Bay and eight in rivers (the Cawong, Dacanlao and Bolboc Rivers), seven around the power plant water discharge and four for underground water. Samples were analyzed for color, temperature increase (the regulation is not more than 3 ° of rise), chromium, oil, pH,

[25] As shown in Figures 4~6 of the Third-party Evaluation Report, the area subject to high concentrations is small and the measured concentrations away from the optimum measurement points fell rapidly.

[26] Atmospheric stability can also be measured by the difference in air temperature between 10m and 100m above ground. The Calaca Power Plant is equipped with a 100m meteorological pole and the data for the EIS was measured from the pole, but it is now inoperable. In a climate such as that of the Philippines, which has many typhoons, a pole 100m high can easily be broken. Solar radiation and radiation balance gauges should be bought to allow measurement of atmospheric stability on the ground.

[27] Lignite such as Semirara coal becomes increasingly prone to spontaneous combustion the longer it is stored.

phosphorus chloride, suspended solids and other properties. The results of the last three multipartite monitoring have all been within standard. In this survey, the appropriateness of measurement and analysis methods was confirmed.

However, even though BOD and COD[28] are regulated, they have not yet been measured. Measurement of these indicators must be started. (Equipment for measuring BOD is scheduled to be bought under the environmental project).

③ Noise

Noise is measured in eight locations in Municipality of Calaca three times (morning, noon and night) in a day. The last three multipartite monitoring studies found that the noise standard[29] was exceeded at intersections and on city streets, but it is impossible to separate the power plant noise from traffic and street noise. Therefore to isolate the noise generated by the power plant, JBIC evaluation group asked NPC to set monitoring points at intervals of 10m away from the power plant over the ash pond, where there is no noise from houses and streets. The results of measurements at these points found the noise level to be within the standard level at all times. Other than ordinary noise, exceptionally loud noises occur a few times a year when boiler pressure is checked. The installation of silencer for No.1 generator under the environmental project will reduce this noise to a level within standard (No.2 generator was fitted with silencer from the start).

3.4 Evaluation on Public Acceptance Measures

The construction of No.2 generator encountered strong resistance from local residents. As a result, gaining the consent of the residents was made a precondition for construction, together with environmental improvements. After that, in September 1992, the mayor of Calaca signed the MOA and in January 1993 all 40 village heads in Calaca announced their consent to the construction of No.2 generator. Thus all the elements were in place to clear the residents' consent condition. The resettlement of the residents of San Rafael was completed in 1994. NPC is now continuing with its support for social and economic development in the surrounding communities, which include the resettled residents. They are also pursuing various activities to improve the residents' perception of the power plant.

3.4.1 Resettlement of Residents

The residents were resettled a total of three times between 1980 and 1994 (Refer to "Project Location" at the start of this report for details of the resettlement destination). The first resettlement took place in 1980 when the whole of the village (approximately 350 households) were resettled so that the land could be acquired. NPC suggested a site well away from the power plant as the resettlement site, but the residents wanted "to continue the existence of the Barangay of San Rafael and to be somewhere where they could make a living from fishing". Therefore a 30ha plot adjacent to the power plant to the southwest was selected.

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[28] BOD is biological oxygen demand, COD is chemical oxygen demand. Both are used as indicators of organic pollution.

[29] Daytime: 75dbA, morning and evening: 75dbA, night: 65dbA

When No.1 generator went into operation, the above-mentioned coal dust problem began. The resettlement site was exactly downwind from the power plant, leading the San Rafael residents to ask NPC in December 1986 for another resettlement. NPC began considering measures for another resettlement. An agreement[30] was later reached between NPC and the San Rafael residents over resettlement compensation, the resettlement site and other matters. From the end of 1989, 316 households were gradually moved to other barangays[31] in Calaca in the second resettlement. However, 19 households[32] including the village head refused resettlement to other villages in a bid to preserve San Rafael. A solution to the problem of the remaining villagers was made a condition for granting the ECC (see p8). In February 1993 NPC bought a resettlement site of 5,000m^2 adjacent to the power plant on the East (within the barangay of San Rafael), and the resettlement of the remaining barangays to this site was completed in 1994, which was the third resettlement[33]. NPC also set up livelihood programs in each region for the resettled residents and funded these programs with P500,000. The programs have their limitations[34], but the proceeds cover a portion of the residents' living expenses.

The third-party evaluation on public acceptance included interviews with 92 households to examine changes in the residents' lives between before and after resettlement (comparing 1992 and 1998). Most of the households had seen the incomes of the household heads and other family members rise[35] and 85% responded they were content with their current life.

On their form of employment, 55% of respondents said they were self employed in 1992, but this fell to 36% by 1998. Those in employment rose from 42% to 51%. Most of the residents of San Rafael were originally fishermen or farmers, but some had to change the way they make their livings after resettlement. Also, 42% said they had been employed by NPC at some stage, but the majority of those had only been term employees[36] for part of the year, rather than receiving regular employment.

3.4.2 Community Development Projects

(1) Community Development Projects

NPC Community Development Projects include programs based on the MOA and programs based on DOE Energy Regulations No.1-94 (Table 3-9. There are also projects based on demands from Balayan, a city adjacent to Calaca). The total amount expended on aid to date is nearly P80 million.

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30 Compensation was paid, based on executive order 1035, for homes and farm land (sharecroppers were paid the equivalent value of 5 years' crops). Resettlement expenses were paid under presidential order 6839. The resettled residents used most of the money to buy land and build houses at their resettlement destination.

31 The main resettlement destinations were Barangay Comastilisan (145 households), Quisumbing (60 households), and Pantai (22 households).

32 Seven of these households were original residents who wanted to stay in San Rafael. The other twelve households were unbonafide residents who moved in after the resettlement.

33 A cement factory is now being built immediately to the south of the settlement destination and the Village of San Rafael is once again entering into resettlement negotiations with the cement company. The village has now expanded from 19 households to 69, but the number of households is too low to support its continuation as an independent village. Therefore San Rafael is likely to be merged with the village of Dakanrao to the north.

34 Livelihood programs such as sewing and hog fatting were set up, but they were group rather than individual jobs. As a result, the members were not enthusiastic, demand for the products was low, and the pigs suffered from chronic diseases. Some members did not earn enough to repay their loans.

35 In 1992 only 20% of respondents replied that their annual income was P4,000. By 1998 that figure had risen to 68%. However, considering inflation, the real growth rate was 40%.

36 Under this form of employment, workers work for three months and are laid off for 1.5 months. NPC has adopted this system because the number of jobs they can offer cannot meet demand.

Table 3-9 Record of Community Development Projects by NPC (Cumulative)

(Units: thousands of Pesos)

	Calaca	Balayan	Total
Projects based on the MOA (1992 to completion in 1995)	38,447		38,447
Construction of municipality hall, public market, public halls and other community facilities.	18,317		18,317
Electrification of 12 villages.	7,530		7,530
Paving and lighting of major roads.	4,000		4,000
Small-scale infrastructure improvements requested by each barangay. (62 locations)	3,000		3,000
Medical missions (annually between 1992 and 1995).	2,600		2,600
Construction of water supply system.	2,500		2,500
Project loans for four livelihood programs for resettled residents.	500		500
Projects for the municipality of Balayan (1994 to completion in 1997)		6,784	6,784
Projects loans for 19 livelihood programs.		1,230	1,230
Small-scale infrastructure improvements (23 locations)		5,554	5,554
Projects based on DOE Energy Regulations No.1-94 (from 1994 to the present (October 1998)).	28,156	4,950	33,106
Electrification (46 locations).	12,420	570	12,990
Livelihood programs and development aid. 1)	3,285	1,179	4,464
Aid for planting, water supply and health improvement. 2)	12,451	3,201	15,652
Total aid	66,603	11,734	78,337

Source: NPC documents

Note 1) Infrastructure improvements were made at ten locations.

2) Water supply facilities were built in 17 villages in Calaca, and health centers were built in 14 villages in Balayan.

The MOA referred to here is the "Memorandum of Agreement on the Construction of No.2 Generator" agreed by NPC, the municipality of Calaca, DENR and NEDA. It stipulated the following two points:

1) NPC would operate the power plant appropriately in accordance with environmental standards.

2) NPC would implement projects to improve the economic and social condition of the residents of Calaca.

The content of the projects under the second point was specified and NPC spent P38 million to implement these programs.

DOE Energy Regulations No.1-94 (which came into effect in June 1994) are regulations imposed by the DOE. According to the law, power plants throughout the country must set aside one Centavo (0.01 Pesos) per KWh of the total electricity sales for the financial benefits of host communities. The areas where the money is to be spent are those cities in which power plants are located. The power plant site extends beyond Calaca, with 15% of its area (a portion of the ash pond) lying in Balayan. Therefore aid under the DOE regulations is applied to both municipalities[37]. The regulations specify that 50% is to be applied to "Reforestation, Watershed Management Health and/or Environmental Enhancement Fund", 25% to “Electrification Fund” and 25% to "Development and Livelihood Fund".

[37] Balayan is adjacent to Calaca on the west. Its population was 66,936 people in 1998. The barangay in Balayan which includes part of the power plant site is Baclaran.

The process for devising community project is direct application to the DOE where the administrative unit concerned is the municipality. When the unit concerned is a Barangay, the Barangay makes an application for a project to the municipal council and those projects which are selected are forwarded to the DOE. Priority is given to those areas nearest to the power plant, with set amounts being allocated to the barangay of San Rafael, Dacanlao and Baclaran. As Table 3-9 shows, P33 million was provided under Energy Regulations No.1-94 by October 1998. Electrification projects were implemented in 46 locations and all the allocated money was used. Any funds unused in a year are carried over to the next year, leaving a balance which stands at around P40 million.

(2) Job creation

Under the MOA, residents of Calaca are guaranteed priority access to jobs with NPC. Table 3-10 shows the employment situation.

Table 3-10 Numbers Employed by the Calaca Power Plant (As of August 1997)

	Number employed	Proportion from Calaca
NPC employees (in full-time employment)	386*	161 (42%)
Managers	43	4 (9%)
Engineers and specialists	192	62 (32%)
Laborers	151	95 (63%)
Term employees	116	107 (92%)
Employees of other companies used by NPC	286	230 (80%)
Total	788	498 (63%)

Source: NPC documents.

Note: Up to 486, as of October 1998.

Calaca residents account for 42% of NPC employees (in full-time employment), with over half of those being resettled residents of San Rafael. Term employees (see footnote 36) are mainly resettled residents. Calaca residents take 63% of the jobs created by the power plant. NPC is also working to build up human resources in various ways, including providing on-the job training (OJT) to graduates of Calaca's vocational training school.

3.4.3 Activities to Gain the Understanding of the Residents

NPC has been working as described above for public acceptance and there are no longer any groups of residents in opposition to the power plant. NPC's community relation office is now located in the power plant and anyone going there to complain can receive individual attention from the staff there who can take action or provide explanation. In addition, NPC conducts the following activities to gain the understanding of the residents.

One of the most important activities is multipartite monitoring, which is conducted by a group comprising members from NPC, Municipality of Calaca, NGOs and DENR. Besides the environment (air and water quality), the community itself is monitored twice annually. Community monitoring includes visits to residents who have made complaints and observation of current community development projects. The findings are collated into a report which is released to the public. This

system makes sure people from outside NPC participate in the monitoring of the environment and community, which is very important for helping the residents come to terms with the power plant.

NPC's overall approach is to make the community action offices of each power plant work to promote understanding between residents and power plants through publication of information, publicity activities and participation in community activities. Each power plant presents a specific community relations plan to NPC head office and staff are evaluated according to how well the plan is realized. Community relation activities at Calaca Power Plant includes explanation of the plant operation at a science center, publishing multipartite monitoring results, running tours of the power plant and other information and promotion activities. NPC also work to build stronger links to the community through participation in local festivals and other events.

Thus NPC has been pursuing a variety of activities for the residents. Interviews with residents for the "Third-party Evaluation on Public Acceptance" found that many residents rated NPC highly for electrification, job creation and community development programs. Some residents still feel that NPC is polluting the environment and the existence of multipartite monitoring is not widely known. NPC submits copies of the multipartite monitoring reports to Calaca municipality, NGOs, DENR and NEDA and considers it to have been published. Multipartite monitoring is conducted as a way of helping the residents to understand the environmental issues, but the nature of the reports is highly technical. Findings should be presented to the residents in a form that would be much easier to understand[38]. In parallel with environmental improvement, NPC should work to improve freedom of information to allay residents' concerns over their environment.

3.5 Project Effects and Impacts

3.5.1 Quantitative Effects

(1) Contribution to stabilizing the balance of electricity supply and demand

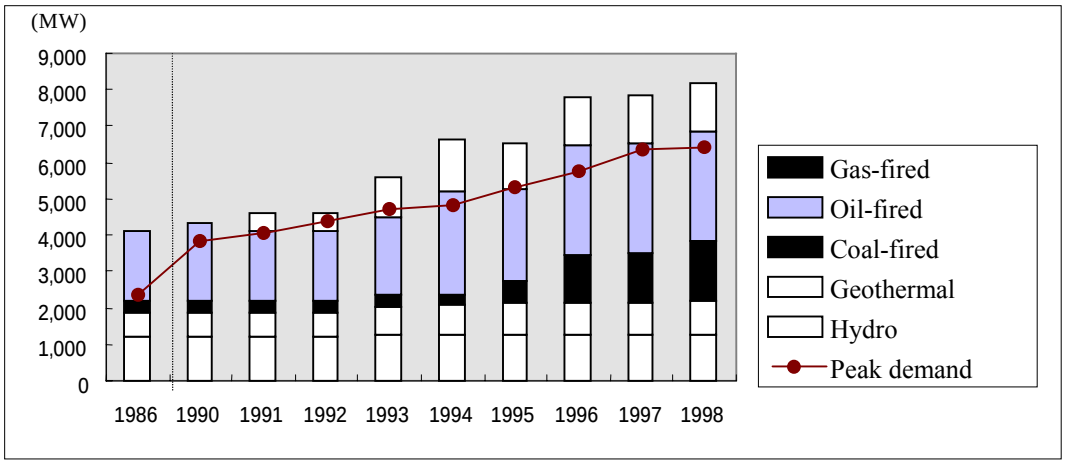
Figure 3-1 shows the movements of generating equipment capacity and peak demand in the Luzon Grid at the time of the appraisal for the construction project (1986). Demand grew faster than predicted at the time of the appraisal, and the Aquino administration made practically no progress until 1992 in developing new power sources. All power plants have planned and forced outage, which means the equipment is not always generating at its full capacity. Therefore the balance of supply and demand was becoming strained and capacity began to be inadequate from the end of the '80s, as seen in Figure 3-2. In the early '90s in particular, power outages became very frequent in the whole of the Luzon Grid, which includes the Metro Manila.

As Figure 3-1 shows, Calaca Power Plant's No.1 generator was the only coal-fired power plant in operation between 1986 and November 1995, when No.2 generator went on line. If No.2 generator had gone into service in 1992 as scheduled and supplied 1,026 GWh, as it did in its actual first year of operation (1996), the power shortage which arose in 1992 (a shortfall of 1,008 GWh) would have been averted. The delay in the construction of No.2 generator, which was urgently needed, certainly worsened the power shortage in the Luzon Grid. The shortage was alleviated at the end of 1993 by the development of oil and gas-fired (gas turbine) power plants, but the price of electricity from these

[38] For example, explanatory materials such as bar graphs could be posted on notice boards in the municipality hall showing that environmental concentrations are within standards.

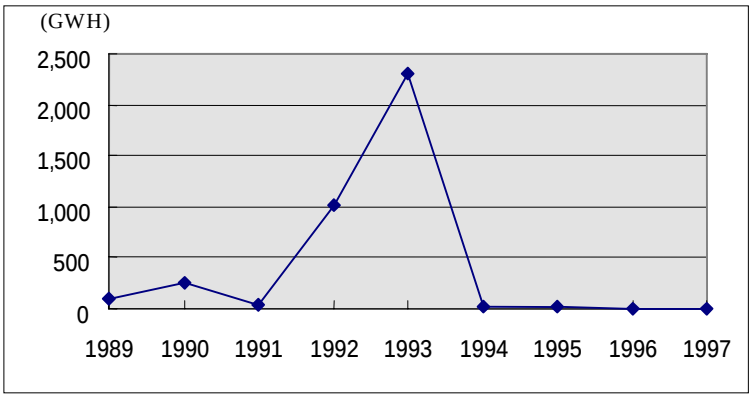
power plants is high, particularly for gas (approximately three times the price of coal-fired generation). Therefore these power plant types are basically unsuitable for base-load generation. When No.2 generator came on line in 1995, it was very significant as it was the first base-load power source to come on line since the power crisis. It has made an important contribution to stabilizing the balance of supply and demand in the Luzon Grid.

Figure 3-1 Movements in Generation Equipment Capacity and Peak Demand in the Luzon Grid



Source: NPC documents
Note: Data for 1987~1989 is unavailable.

Figure 3-2 Movements in the Power Supply Shortfall



Source: NPC documents

(2) FIRR (Financial Internal Rate of Return)

The results of the FIRR calculation are as shown in Appendix 2. They put the FIRR for the construction project at 14.4%, 0.5% down on the 14.9% predicted in the initial appraisal. This was the case because the construction costs rose and the cost of the environmental project was added, more than doubling the total investment cost from P5.874 billion to P13.267 billion. However, despite the fact that the equipment usage rate is set at 58.6% (recorded in January ~ September 1998) rather than the 70% anticipated in the initial appraisal, the revenue from sales of electricity (wholesaling to

distribution companies) has increased due to a doubling of the unit price. The increased revenue means that the recorded FIRR is only slightly less than anticipated.

(3) Foreign exchange savings

One effect of constructing No.2 generator which was anticipated at the time of the appraisal for the construction project was "foreign exchange savings from the use of domestic coal in place of imported oil". Therefore we have calculated the actual foreign exchange savings, as shown in Table 3-11.

Table 3-11 Foreign Exchange Savings Due to the Use of Domestic Coal in the No. 2 Generator

	Total electricity generation	Oil volume required 2)	Cost of oil 3)	Imported coal cost 4)	Cost of supplementary fuel oil 5)	Foreign currency cost 6)	Saving 3)-6)	Saving rate
	GWH	Ml	Thousands of $	Thousands of $	Thousands of $	Thousands of $	Thousands of $	%
1996	1,173	290	37,654	10,812	3,596	14,408	23,246	62%
1997	770	190	24,715	3,765	5,911	9,676	15,039	61%
1998 and beyond 1)	1,540	380	49,450	8,443	3,596	12,039	37,411	76%

Notes 1) Calculated assuming capacity factor of 58.6% and a 20% share of imported coal.
2) Oil volume required: Volume of heavy oil required = 247 liter/ MWH (thermal efficiency 35%, average heat generation 9,900kcal/l).
3) Calculated at $0.13/l, being the 1996 FOB price of $0.12/liter (from the Philippine Statistical Yearbook), plus shipping cost.
4) Figures for 1998 and beyond are calculated from recorded results for 1997.
5) 1998 and beyond take the 1996 value ($3.596 million). In 1997 the amount of oil used was higher because it was used instead of coal due to frequent boiler breakdowns.

It is important to note that the use of domestic coal does not reduce the import cost to zero because there are still import costs for coal for mixing and oil as supplementary fuel. ("savings rate" in Table 3-11 shows the ratio of net foreign exchange saving yielded by the use of domestic coal.)

Thus some imported fuel is still being used, but in the two years after No.2 generator went into service (1996~1997) it saved approximately $40 million of foreign currency. The falling value of the Peso since 1997 means that from 1998 on, imports will be a greater burden for the Philippines and this project's effect in saving foreign currency will be very significant.

3.5.2 Qualitative Effects

(1) Job creation

The creation of jobs at Calaca Power Plant and Semirara Mine was anticipated as another effect of the implementation of this project. In fact, job creation at the power plant was as noted above in section 3.4.2, and 1,000 laborers are employed at Semirara Mine.

(2) Negative effects of using domestic coal

The poor quality of Semirara coal cause a variety of environmental and operational problems.

Approximately half of the cost of the additional project and one third of the cost of the environmental project (the portion for improving the electrostatic precipitator on No.1 generator) were incurred by specification adaptations necessitated by the use of Semirara coal. Thus the use of domestic Semirara coal serves to promote the use of domestic energy sources and save foreign exchange, but it demands various economic and social costs in return. The Philippine government must consider these costs fully before it promotes the use of Semirara coal in future.

(3) Changed perception of consideration for the environment and residents

The time taken in this project to take measures for the environmental protection and public acceptance before the construction caused delays which exacerbated the power shortage in the Luzon Grid. However, this experience has prompted NPC to take measures for environmental protection and public acceptance more seriously. NPC head office now has departments to manage and promote environmental measures, resident resettlement and community development projects of each power plant. According to those in charge of NPC at that time, resistance to the construction of No.2 generator came immediately after the changeover of power from President Marcos to President Aquino. Until that time, priority had been placed on development, and little attention was given to the environment or the people. The process for the construction of No.2 generator coincided with this change of the times and gave NPC valuable experience for later measures for the environment and public acceptance.

This project also had the effect of making the Japanese government and JBIC more keenly aware of the importance of "working to encourage the partner country's efforts to protect their environment and people".

This project was an important lesson for both the Philippine and Japanese side on the difficult question of how to balance development and the environment.

4. Lessons Learned

(1) Measures for the environmental protection and public acceptance in projects should come from the executing agency's awareness of the importance of these issues, leading them to devise measures accordingly (Importance of ownership of environmental protection and public acceptance measures.). It is also important, if necessary, for JBIC to pay attention to these matters and monitor the implementation of measures, as well as encouraging the executing agency.

(The Philippine government and NPC strengthened environmental protection and public acceptance measures after the experience of this project. At present, environmental and social measures are taken for all the development projects in the Philippines.)

(2) When equipment and facilities are expanded or improved, the operation status and the environment and social impact of the facilities as a whole, including the old parts, should be reviewed where necessary. Then if necessary, the environmental protection and public acceptance measures involved in JBIC projects should be examined.

This project (the addition of No.2 generator) was planned since the start of construction of No.1 generator. The feasibility study considered two generators and the site for No.2 was acquired before construction of No.1 even started. However, little consideration was given to social and environmental measures after No.1 generator began operating. JBIC had no internal guidelines for environmental considerations, which contributed to the failure to make a detailed investigation of the operational status of No.1 generator and its environmental and social impact, and to include remedial measures as part of the project.

Therefore when a project expands or improves equipment and facilities, the operational status of the entire completed project (even if not financed by JBIC) and its social and environmental impact should be reviewed where necessary. The result of reviews may be taken into consideration for the formation of the environmental and social measures of JBIC projects.

Reviews including original facilities should be conducted by the executing agency at the stage of project formulation for the expansion and improvement of facilities. JBIC should also ensure that the executing agency is fully aware of the importance of such reviews.

Appendix Project History of Calaca Power Plant

1979	September	Feasibility studies for No.1 and No.2 generators conducted.
1980		First resident resettlement
1981	September	Construction of No.1 generator starts.
1984	September	Operation of No.1 generator starts.
1986	October	Philippine government petitions Japanese government for a loan to add No.2 generator.
		JBIC appraisal for the No.2 generator project.
	November	Prior notification on the loan to President Aquino on her visit to Japan.
		JICA study to improve the operational status of No.1 generator (preliminary study).
	December	San Rafael residents demand a second resettlement from NPC.
1987	Feb. – Aug.	Full scale implementation of the above-mentioned JICA study.
	June	NPC conducts EIA for No.2 generator.
	August	NPC submits EIS to DENR.
	September	Loan agreement for “Calaca II Coal-fired Thermal Power Plant Project”.
1989	Mid 1989~	Environmental pollution due to overstocking of the coal (continues until the mid-1990s).
	November	Calaca municipal council resolves to demand suspension of operation from NPC.
		Resettlement of 316 households begins (second resettlement of residents).
1990	September	Inspection by DENR.
	December	DENR issues a suspension order, but NPC asks for a repeat inspection.
1991	February	Repeat inspection by DENR.
	April	Questions raised in the Diet (in Japan).
		NPC helds public hearing with Calaca residents.
		Environmental survey of Calaca by JBIC.
	May	Environmental Improvement Plan drawn up by Calaca Power Plant.
	July	JBIC receives request from NPC for concurrence of the contract for the No.2 generator.
		MOA agreed between NEDA, DENR and NPC.
	August	JBIC gives notice that it withholds the contract concurrence.
	September	Philippine government petitions Japanese government for a loan for environmental improvements to No.1 generator and an additional loan for No.2 generator.
	April	DENR issues ECC for No.2 generator.
1992	August	DENR accepts NPC position that no desulfurization equipment is required.
	September	New mayor of Calaca agrees to the MOA.
	October	38 out of 40 barangay captains sign documents indicating their agreement to the MOA.
		A survey team from the Japanese government visits Calaca. Atmospheric survey of Calaca also conducted.
	January	All 40 barangay captains sign documents indicated their agreement to the MOA.
1993		Japanese government receives a letter from NPC and DOE stating that adequate measures have been devised.
	March	Agreement between the mayor of Calaca and NPC on the relocation of residents remaining in San Rafael.
		SO_2 emission standard raised from 87.5ppm to 573.1ppm.
		JBIC concurs the No.2 generator construction contract.
		Loan agreement for "Calaca I Coal-fired Thermal Power Plant Environmental Improvement Project" signed.
	April	Construction begins for the No.2 Generator.
1994	March	Resettlement of remaining households in San Rafael begins (third resettlement).
	May	DENR Circular No.29 gives exemption from compliance with new emission standards.
	June	DOE Energy Regulations 1-94 come into effect.
1994	December	Loan agreement for “Calaca II Coal-fired Thermal Power Plant Project Additional Financing”.
1995	November	No.2 generator completed and starts operation.

Third-Party Evaluation on Air Quality Status

Issues on Air Quality related with JBIC Calaca II Coal-Fired Thermal Power Plant Project

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(as of evaluation)

1. Introduction

In Calaca Coal-Fired Thermal Power Plant in Luzon, the Philippines, Unit I started operation with an output of 300 MW in September, 1984, followed by Unit II of the same output in November, 1995. Currently, this station continues operation with a capacity of 600 MW. This plant may be characterized by its principal fuel, that is, Semirara Coal (lignite) produced in the nearby Semirara Island. Since operation start of Unit I, environmental pollution problems occurred possibly due to the use of this low-grade coal. Construction of Unit II was realized at length about ten years later because of various measures and discussions made on these problems. As Unit I is financed by the Export - Import Bank of Japan and Unit II is financed by ODA loan, Japan has also extended cooperation to NPC (National Power Corporation) of the Philippines concerning various measures related to pollution control. This cooperation is still continued at present.

This time, in response to the request from JBIC, the author has conducted the study on local air pollution problems and on the future measures including the environmental monitoring. The field investigation concerning the power plant facilities and surrounding environment was made from October 18 to 24, 1998, with the cooperation of the members of JBIC and NPC staff.

2. History of Air Pollution Problems and Countermeasures

Unit I has been a source of various pollution problems since its start of operation, but various reviews and investigations were made in each stage. As described above, this plant was constructed on the prerequisite that the locally-produced low-grade coal or Semirara Coal would be used. Being difficult to use because of its properties, it caused many problems, resulting in frequent shutdowns of the plant. In two years after operation start, the initial plan had to be changed to start mixing Semirara Coal with imported coal from Australia.

From the beginning, such internal problems were recognized as pollution problems, such as foul smell or flying coal dust in surrounding areas. In response to claims from these areas, the Department of Environment and Natural Resources (DENR) of the Philippine Government conducted environmental inspection. After all, the order was issued to stop operation of Unit I, because the inspection results showed that the particulate matter and the SOx concentration were above the emission standards of the country. Through the re-inspection, due to the repair of the electrostatic precipitator, the power station met the standard for concentration of dust and soot, but was unable to meet the standard for sulfur oxides. The emission standard provides an exemption “If the emission standard cannot be met due to economic and technical limitations, then the ambient air quality standard should prevail.” Based upon this provision, Unit I was exempted from the obligation to meet the emission standard for sulfur oxides.

On the other hand, the Philippines planned addition of Unit II under financing of Japan while proceeding with environmental measures for Unit I in 1987, EIA (Environmental Impact Assessment, whose report is called EIS) was conducted concerning new construction of Unit II. Public hearing was also held for the local residents in 1991. In those days, the environmental measures for Unit I were not complete and spontaneous combustion of coals occurred frequently in the coal yard, resulting in foul smell and smoke as well as scattering of coal dust. These were considerably highlighted as social problems both in Philippines and Japan, and questions were presented to the Japanese Diet, and Japanese NGO (Non-Governmental Organization) groups visited the site. The

measures on the Japanese side included the environmental investigation under contract with JBIC in 1991 and 1992, involving investigation and forecast of the air pollution concentration.

Concerning construction of Unit II, ECC (Environmental Compliance Certificate) was finally issued by DENR in 1992. In 1993, JBIC gave a green light for the Japanese loan assistance for the environmental improvement project of Unit I and construction of Unit II.

As such, Unit II was completed and started operation in November 1995, and the environmental improvement project related to Unit I is still under way.

3. Compliance with the Emission Regulation

In the Republic of the Philippines, ambient air quality and emission standards are established in compliance with DAO No.14. Revised and current standards up to 1994 are shown in Tables 1 and 2.

Table 1 Ambient air quality standard (Article 62, DAO14)

Item	Mass concentration μg/Nm^3	Volumetric concentration ppm	Averaging time	Measurement method
Sulfur dioxide (SO_2)	470 340 180 80	0.18 0.13 0.07 0.03	0.5 hours 1 hour 1 day Year	Pararosaniline method (flame photometer)
Nitrogen dioxide (NO_2)	375 260 150	0.20 0.14 0.08	0.5 hours 1 hour 1 day	・Gas Bubbler Griess-Saltza method ・Chemiluminescence method
Total Suspended Particulate Matter (TSP)	300 230 90		1 hour 1 day Year	High volume sampling (weighing)
Carbon monoxide (CO)	35,000 10,000	30.0 9.0	1 hour 8 hours	NDIR method

Table 2 Emission standard (Article 62, DAO14)

Particle matters	(PM)	300mg/Nm^3		
Sulfur oxides	(SO_2)	1,500mg/Ncm^3	(573.06ppm)	Barium-thorin titration method
Nitrogen oxides	(NO_2)	1,500mg/Nm^3	(797.28ppm)	Phenol-disulfonic acid method
Carbon monoxide	(CO)	500mg/Nm^3	(436.61ppm)	Method using an Orsat analyzer

According to the ambient air quality standard of Japan, the sulfur oxides is set to 0.10 ppm per hour and 0.04 ppm per 24 hours. For the nitrogen dioxides, the 24-hour value is 0.04 - 0.06 ppm. For the particulate matters (in the case of Japan, PM_{10}, the particles less than 10 μ), the one-hour value is 200 μg/Nm^3 while the 24-hour value is 100 μg/Nm^3. The Philippines also has the standard for

PM10, aside from total suspended particulate matter in which the one-hour value is 200 μg/Nm^3. Accordingly, the Japanese standard is more stringent in terms of sulfur oxides and nitrogen oxides, but on equal level with the Philippine standard in terms of suspended particulate matter.

With regard to the emission standard, direct comparison with the Japanese case is not possible because Japan regulates sulfur oxides not by concentration, but by quantity (K-value regulation). As far as the facility of this scale is concerned, the value of the Philippines is equivalent to the regulation value of local small cities in Japan. The regulation value for nitrogen oxides is 200 ppm for coal-fired boiler (gas flow at 700,000 Nm^3/h or more) in Japan, which is about 1/4 of the case of the Philippines. The particulate matters (soot and dust) in Japan are set at 200 mg/Nm^3 for the facility of the same scale, which means that the allowable emission level is about 2/3 of the Philippine standard.

The Philippine emission standard provides an article, in which existing thermal power plants (including Calaca Unit II) and geothermal power plants are exempted from the obligation of compliance with the emission standard if the ambient air quality standard is complied with. Monitoring of the ambient concentration, however, is a duty and the countermeasure must be taken immediately when DENR certifies that the ambient air quality standard is exceeded. As the mixed ratio of Semirara Coal and imported coal varies from time to time, the sulfur oxides concentration discharged from the stack of power plant may exceed the emission standard. This emission regulation is not mandatory, if the case meets the ambient air quality standard. Therefore, the environmental monitoring plays an important role. On the other hand, this fact has lead to negligence of the stack emission monitoring.

Atmospheric environmental monitoring is implemented in two schemes. The first scheme is to set up 11 monitoring stations beforehand around the premises of the power station. Depending on the wind direction of the day of measurement, two upwind stations and three downwind stations will be selected for measurement of four items (SO_2, NO_2, TSP, and wind direction) for about 20 days a month, 1 - 2 hours per day. On the same date, the 24-hour values are sampled at three points. In addition to the above periodical monitoring by NPC, monitoring is also made semiannually for about one to two hours a day by a multipartite monitoring group formed by NPC, Calaca Municipality, DENR, and NGO. When the author visited the site, it was during the multipartite monitoring. The author visited the monitoring sites and noticed that in all points, a group of several people were seriously engaged in sampling and chemical analysis was executed with utmost care. Measurements are reported every quarterly (former Scheme) or every six months (latter Scheme), and their results are presented to DENR. Another method uses an automatic air pollution measuring machine mounted on a large vehicle (leased temporarily from the NPC headquarters), measuring SO_2, NO, and NO_2 as well as the wind direction, wind speed, air temperature, and temperature for 24 hours continuously. This monitoring method is employed for two to three days during the multipartite monitoring twice a year.

These two types of monitoring is characterized by the short period or short term measurement. It is dubious therefore whether such temporal monitoring can grasp the local atmospheric environment correctly, in particular, whether implementation of such monitoring can be used effectively as a reason to exempt compliance with the emission standard. Reasons are described below.

① The Way of Air Quality Monitoring

There are two types of air monitoring, the regional monitoring and the target monitoring. Generally speaking, the former intends to grasp the space effect of combined concentrations from multiple emission sources, and in this case, monitoring stations are located to avoid as much as possible the direct influence from emission of specific pollutants, while the target monitoring is to try to grasp the effect of specific emission sources (targets), selecting monitoring stations likely to be affected significantly by specified emission sources.

Monitoring conducted around the Calaca Thermal Power Plant is of target monitoring type. In this case, monitoring is made to check the effect of exhaust gas discharged from two high-rising stacks of the plant. The data on position and height of emission sources, exhaust gas rate etc are already known. Given such emission source information and local meteorological conditions, the distribution of ambient concentrations can be roughly estimated and the points with highest concentration for a short time are identified approximately by the use of a diffusion model mentioned later. As a rule, in the case of target monitoring, the related area is covered by network, estimating the trends of appearing concentrations. Considering the fact the Calaca Thermal Power Plant had implemented concentration prediction as reported by EIS (Environment Impact Statement) for the construction of Calaca Thermal Power Plant Unit II, including the impact assessment of its operation, the distribution of estimated concentrations should have been used effectively at that time in order to set up a monitoring network.

The ambient air quality standard is provided with due consideration of the effects on the health. As shown in Table 1, the reference concentration is set for a certain evaluation period (0.5 hours, 1 hour, 24 hours, etc.) according to each pollutant matter. Since these values are the concentrations which should not be exceeded, evaluation is not made normally by means of the accidentally measured values, but by the one-hour or 24 hour concentration that is the highest throughout the year (in Japan, this is the 98% value determined, excluding the top 2% values).

Since monitoring in Calaca is on a short-time or short-term basis as described above, evaluation concerning the ambient air quality standard should be considered as based not on the long-term average concentration, but primarily on the one-hour value. In the case of a single emission source, the one-hour concentration varies greatly depending on meteorological conditions, and since the area where the high concentration appears due to the emission gas from high stacks is limited (see the concentration distribution maps 4 - 6 described later), it is extremely difficult to detect and measure the high concentration at appropriate times. With the one-hour concentration, the concentration in the high-concentration portion decreases substantially when measuring points are deviated even slightly from the main stream in the wind direction. In the case of Calaca, three monitoring stations are provided within the range between 1.5 and 6 km on the downwind side. However, this widely dispersed monitoring network and short-period sampling offer less possibility of encountering with the high concentration due to stack emission gases.

The monitoring results so far include many ND (not detected) cases for SO_2, and even in rare cases which record high concentrations, they are still substantially lower than the standard. These values are considered as representing background concentration values. If assessment priority is given to monitoring of long-period average concentrations, the regional concentration distribution will become smooth, so that in such case, the use of even a coarse monitoring network can easily identify high-concentration areas. Considering that there is a single emission source in Calaca area, the absolute

values of the average concentrations in long-term are very small, so they could not be considered highly problematic. Accordingly, monitoring here should put a stress on appearance of short-term high concentrations.

As the current practice of monitoring by the use of manpower is difficult to perform continuous measurement over a long period, there is no way but to use a continuous ambient analyzer. For this continuous monitoring, the number of monitoring stations may not be numerous, but importance should be rather placed on the target monitoring by an automatic continuous monitoring machine which is made continuously throughout the year, covering valid monitoring spots with high concentration. In addition to this continuous monitoring at fixed points, it is preferable to implement on-going network monitoring.

② Ambient concentration and ambient air quality standard

As described previously, the ambient air quality standard has been set up to protect the health and welfare of residents and is not designed for providing a standard for evaluation of the effect from a specific emission source (surface concentration). When I surveyed the site, we confirmed that there is a diesel power generation facility near the thermal power plant (which will soon be taken away), but with no major emission source. A few possible emission sources may be vehicle emission gases from jeepneys and incineration of sugar cane garbage after harvesting. A single state-owned thermal power plant cannot monopolize the whole concentration within the ambient air quality standard.

Contrary to this, if the environmental measurements may exceed the ambient air quality standard, that can not be attributed totally to the power plant. Current monitoring does not produce any particularly disputable concentration, but the high concentration of SO_2 nearly equivalent to the ambient air quality standard is also reported some time. (Judging from the wind direction, such high concentration is considered not attributable to the thermal power station.) Since future development of the surrounding areas can not be restricted, it is essential to establish independent environmental targets lower than the ambient air quality standard now and to make efforts to reduce the emission rate.

NPC is performing adjustment of the coal-mixing ratio to reduce the emission rate of SO_2. According to the consumption record of 1998, the ratio of Semirara Coal and imported coal is 50:50 for Unit I. In the case of Unit II, the ratio of Semirara Coal ranges from 70 - 90% according to the season. As a result, the S content of the coal used for Plant I was 0.57% on average and 0.84% for Unit II. Accordingly, there is a high possibility that Unit II exceeds the existing emission standard of 1,500 mg/Nm^3. Consequently, as long as the local coal is to be used mainly, if the emission regulation value is provided voluntarily in the future, it is necessary to take appropriate countermeasures such as the use of good quality coals as well as with flue gas desulfurization, etc.

4. Estimation of Air Pollution Concentrations

There are two types of air pollution sources in Calaca Thermal Power Plant. The first is smoke and soot from spontaneous combustion in the coal yard and coal fine dust brought about through diffusion, and the second one is emission gas coming from the high-rise stacks, Unit I (120m) and Unit II (150 m).

The pollution of the first case has been improved greatly owing to measures taken subsequently. Yet there remains a problem because small-scale spontaneous combustion occurs rarely even at present. Spontaneous combustion is difficult to predict because its scale and timing vary and the generation rate of pollutants is not constant. As the emission source of occurrence is a coal yard, it may be a ground emission source. Therefore, the nearer the location is to the coal yard, the higher the surface concentration is. Residents living in the neighborhood are more sensitive to this kind of pollution including foul odor. More efforts must be continued towards the extermination of spontaneous combustion. Besides, to prevent dispersion of coal dust, a very effective windbreak fence was provided, which has a beneficial effect on solving local pollution problems.

On the other hand, the high rise stacks continue emitting gases. With their buoyancy and discharge speed, the emission gases elevate highly in the sky, displaced and dispersed, resulting in high concentrations of pollutants in the lee remote areas. This type of emission source may be considered as a source easily exerting adverse effects over a wide area. Concerning atmospheric dispersion of the stack exhaust gas, there are investigations and researches under way among developed countries, and the technology for estimating ambient concentration has been developed. Prediction of concentration generally involves the technology called a concentration simulation which is utilized for EIS for the construction of Calaca Thermal Power Plant and for subsequent investigations on the air environment by the specialists commissioned by JBIC.

Concentration simulation employs an atmospheric diffusion model. This model uses combination of the two models, the atmospheric diffusion model derived from the transfer/dispersion theory of the smoke in air, and the model of estimating the effective height of stack which deals with the inertia of emission gas and the atmospheric ascendance due to buoyancy. The most important variables for concentration simulation are the conditions relating to the emitting specification of emission gas and to the atmospheric diffusion field (meteorological conditions). The emitting parameters of emission gas include the stack height, emission gas amount, emission gas temperature, emission speed, emission gas concentration. From the atmospheric dispersion field, the following local meteorological observation data over the period of one year are necessary, such as wind direction, wind speed, and atmospheric stability.

(1) Forecast of concentration when Unit II was planned

Forecast of concentration of air pollution was implemented under the environmental impact assessment for the construction of Unit II. Initially, in 1987, NPC made forecasts which were reported in EIS for Unit II, and these data seem to have been utilized at the local public hearings in 1991. In those days, environmental problems by Unit I already had arisen and caused a movement against Calaca Thermal Power plant. In 1991, the Overseas Economic Cooperation Fund, Japan (JBIC) entrusted some Japanese experts in environmental problems with the implementation of environmental investigation for the local site in question, and as part of these activities, forecast of concentrations was made (Investigation I). Subsequently, in 1992, JBIC reported the results of another commissioned investigation (Investigation II).

Examining the calculation details for determining concentrations in long term which are reported in EIS, it was found that of the variables used in the diffusion model, the most important one, the occurrence distribution data relating to the atmospheric stability are not correct. Table 3 shows the stability frequency presented in EIS (June, 1987).

Table 3 Stability Frequency Versus Wind Speed Class

BCFTPP DATA

BCFPTT Ⅱ EIS: June 1987
(Meteorology / Air Quality)

	* Stability Class, %					
WS – Class, m/sec	A	B	C	D	E	F
0.4 - 1.7			1.25	5.2	0.5	
1.8 - 3.5				5.95	8.82	
3.6 - 5.7		0.62		16.4	9.6	
5.8 - 8.4	1.2	1.6	3.5	20.6	4.3	
8.5 - 10.6		3.2	3.5	8.2	1.2	
> 10.7		0.9		1.1		

Available: 2880 Hr. Missing = 965 Hr. Calm = 6 H

Data process: 1915 Hr.

As noted under the table, the data of hours used is less than 2,000 hours. The concentration, when considering its original purpose, should be determined in the time span of one year, that is, 8,760 hours. The listed data which is only 1/4 of the required amount is not enough to calculate the concentration representing a one year period. Another problem is the content of the stability frequency itself. Here, the normal plume type is used, therefore, the atmospheric stability concerned is Pasquill's stability class. Namely, the stability is categorized into seven classes from A for extremely unstable, D for neutral, and further to G for extremely stable.

The stability is an index to show the degree of atmospheric turbulence governing dispersion of the smoke. Such turbulence is caused by forced and free convection. The former is an air vortex forced by the wind speed while the latter is turbulence caused by the warmed air which rises in the form of bubbles (by buoyancy). The strong wind stirs the atmosphere well and the stability is D (neutral). When the wind is weak and the solar radiation is strong, the buoyancy becomes active and the stability becomes A (extremely unstable). When thermal radiation from the ground is strong without solar radiation, the atmospheric turbulence becomes extremely weak. In this case, the stability is F or G (extremely stable).

Accordingly, the atmospheric stability can be classified in terms of the wind speed, solar radiation (daytime) or net radiation (night-time). At the Calaca Thermal Power Plant, no observation was made for solar radiation and net radiation . Instead, the vertical temperature difference with a 100m meteorological tower is used. Generally, the temperature is higher at 10 m above ground than at 100 m above ground. The stability is classified according to the difference of temperature. During extremely unstable periods, the surface wind is weak and the temperature around the ground surface (10 m above ground) is high. When the wind is strong or the solar radiation is weak even in daytime, the class is neutral (D) and the temperature difference becomes about 1℃ every 100 m. On the contrary, when the temperature in the high sky is higher than on the ground, the temperature is inverted, and the condition for the extremely stable (G) appears.

Upon reviewing the occurrence trend of atmospheric stability types used for the calculation from the

viewpoint of above-described findings, we felt that this was very strange. Class A (extremely unstable) has the frequency of only 1.2 %, but does not appear when the wind is weak. Surprisingly, this appears at a strong wind with approximately 10 m/s. Although at periods of extreme unstability, the wind should be weak, and the wind velocity on the ground should be close to that in the high sky, the frequency of high wind is extremely large.

Request was made for NPC to present the observation data with the tower. Since no measurement is made at present, the data used here is the observation values at the time of EIS. We were told that the only data available are as shown below and there were no other data.

Air temperature	(altitude 10m)	January to December, 1986 (one year)
	(altitude 100m)	A part of a period from January to December, 1986 (for more than one month)
Wind direction	(altitude 10m)	January to December, 1986 (one year)
	(altitude 100m)	Only January, 1986 (for less than one month, with omission of data)
Wind speed	(altitude 10m)	January to December, 1986 (one year)
	(altitude 100m)	January to December, 1986 (for one year, but frequent omission of data in January)

Concerning the vertical air temperature difference to estimate the atmospheric stability class, the available data is few, covering only more than one month from January to February as above described. We checked the data available for air temperature difference, and most of data show that the air temperature in the high sky is higher than on the ground, exhibiting a continuous temperature inversion, and even at the time of a strong wind, no neutral stability is recorded.

We judged that the data was not very useful for our purpose. These meteorological data was taken more than 10 years ago, and since then, no monitoring has been made. We had to give up our further investigation on meteorological data. Accordingly, calculation of the annual average concentration of EIS is not reliable. The meteorological tower of 100 m is seldom used even in Japan. Though the considerable amount of expenses may have been used for installation of the tower, it is not used effectively.

In addition to inconsistency of meteorological data, EIS contains many problems, such as those concerning the equation for estimating the effective height of a stack. As we know JBIC conducted the forecast calculation separately in its two investigations, this section reviews the JBIC investigations.

First, the emission data used in Investigation 1 is shown in Table 4. The data were those used in EIS of NPC, but were processed based upon the operational situation of Unit I. Concerning the S content of the coal used, EIS assumed 0.78% for Unit I and 1.0% for Unit II. In Investigation 1, the emission rate of sulfur oxides is estimated from the S content of 0.54% for both Units I and II by assuming a proportion of mixed fuel with 60% of Semirara Coal (S content, 0.56%) and 40% of imported Australian coal (S content, 0.51%)

Table 4 Emission data of source

Item	Unit	Unit I	Unit II	Total
Output	MW	300	300	600
Emission gas amount (wet)	$10^3Nm^3/h$	1,143.2	1,347.6	2,490.8
Emission gas temperature	℃	141	145	-
Emission gas speed	m/s	30.82	20.0	-
Stack height	m	120	150	-
Sulfur oxides emission amount	Nm^3/h	697.79	697.79	1395.58
Nitrogen oxides emission amount	Nm^3/h	429.53	429.53	859.06
Dust emission amount	kg/h	240	240	480

The diffusion model used for calculation consists of a normal plume equation and Bosanquet's effective stack height estimation equation, with Biggs coefficient for the smoke spreading width. Calculation covers the annual average concentration of sulfur oxides ($SO_{2)}$, nitrogen oxides (NOx), and particulate matter (TSP), and the hourly average concentration at the atmospheric stability D(neutral) and at wind velocity of 6 m/s. Since calculation here is mainly for estimation of the annual mean concentration, emission data of Table 4 are provided under average conditions without considering seasonal and hourly fluctuation. On the other hand, the atmospheric diffusion field used in EIS was obtained through continuous observation of the wind direction, wind velocity, and air temperature at 10 m and 100 m in altitude, which were recorded by the 100 m meteorological tower in the plant yard. The calculation result shows SO_2 for both Units I and II, 0.02 ppm for the one-hour value and 0.0018 ppm[1]) for the annual average, considerably lower than the value given in EIS.

In Investigation 2 conducted in 1992, the prediction method used in the environmental assessment for construction of thermal power plants in Japan was resorted to for review, instead of the method in EIS. Though the method developed by the Central Research Institute of Electric Power Industry (Japan) is used partially, the Ambient Concentration Prediction Manual of the Ministry of International Trade and Industry (Japan) is generally complied with. Only the hourly concentration is predicted here. For the emission data, those given in Table 4 for Investigation 1 were used. Concerning prediction of the one-hour concentration, the effective stack height estimation equation of Bosanquet, which is also used for the Air Pollution Control Law in Japan, is employed. The Sutton equation is used for atmospheric diffusion. The average diffusion field conditions with the wind speed of 6 m/s and the stability D are used for prediction. Namely, the stress is placed not on prediction of high concentration, but on prediction of hourly average concentration.

In addition, high-concentration prediction was made for the planned Unit II in terms of hourly concentration, and compared with the EIS prediction. The SO_2 concentration at A (extremely unstable) and wind speed of 4 m/s is predicted at 0.063 ppm in EIS, while 0.065 ppm at A (extremely unstable) and AB (between A and B) in Investigation 2. As the S content of fuel is assumed to be 0.54%, the prediction of Investigation 2 is slightly lower than the prediction of EIS. In the case of the combined pollution by Units I and II, however the prediction of SO_2 is close to the current ambient air quality standard (0.13 ppm). When the background concentration is added, the ambient

[1] Note that this annual average is based on the stability of EIS and the prediction result can not be relied on.

concentration after construction of the Unit II may exceed the standard level.

(2) Current concentration prediction

So far, we have discussed the prediction of the air pollution concentration which was carried out prior to the construction of Unit II. From now on, our concern is how to grasp the present situation of air quality after Unit II started its operation, because such data can provide us with important information for the evaluation of the existing monitoring method and countermeasures for emission sources.

As described above, the ambient concentration simulation includes the short-term high concentration (one-hour concentration) and long-term concentration (annual average concentration). Judging from the accuracy of concentration simulation, the latter provides much higher accuracy. Namely, the approach to the existing concentration from viewpoint of long-term average concentration is a technically stable method. As repeated previously, however, the case of the Calaca Power Plant lacks the atmospheric stability data to be used for long-term concentration simulation. The NPC data cannot be used at all even when modified in any way possible. Therefore, we have to resign ourselves from simulation of the long-term concentration. The result of this simulation can be checked by the use of the measured value. This long-term simulation technology is widely utilized in the air pollution administration of Japan. On the other hand, the short-term high-concentration simulation needs setting-up of certain meteorological conditions (diffusion field) for calculation. In the event of a concentration simulation for environmental impact assessment, the prediction is made stringently from the safety standpoint, enabling us to use considerably severe assumptive conditions. Therefore, the following logic may hold good; if any problematic concentration is not predicted under such stringent conditions, desired safety can be ensured.

The simulation which the author is now developing in this report is to reproduce actual concentrations. For the short-term concentration simulation, the normal plume model and Concawe's effective stack height estimation model are used. These are the air pollution prediction methods recommended by the Environment Agency of Japan. Diffusion parameters used in the normal plume are to be determined according to the Pasquill stability using the P-G (Pasquill - Gifford) chart. Considering fluctuation of the effective stack height due to change in the wind speed, initial diffusion widths σ zo and σ yo were set at every 20 cm to be added at each σ y and σ y. With regard to σ y, the one-hour value of σ y was expanded by 1.82 times according to the 1/5th power rule by setting the values in the P-G chart to the three-minute value.

Since Unit II was not yet operating when the previous predictive calculation was made, temporarily set emission gas data was used. This time, we need to use actual values from the operational data, because Unit II is operating. Besides, the data including pollutant emission amount in the previous prediction was only average data, since it was the prediction of long-term average concentration without any consideration of seasonal and hourly fluctuation.

① Comparison with the actual record

Focusing on the SO_2 emission amount, the S content of fuel coal was checked in terms of actual usage. As described before, the average S content of the coal used was 0.57% for Unit I and 0.84% for Unit II in 1997. There are also data to indicate the maximum 0.78% for Unit I and the maximum 1.0% for Unit II. From these operational records, the values of S content of 0.54% for both plants as set in

Investigation 2 were rather optimistic when viewed from prediction of the environmental impact effects. SO_2 concentration calculated from SO_2 emission amount of Table 4 in Investigation 1 results in 610 ppm for Unit I and 518 mm for Unit II. The monitoring frequency of emission gas concentration in the stack is low due to failure of the measuring instrument. From this record, we know the concentration is 606 - 370 ppm (January, 1998) and 525 - 325 ppm (February, 1998) for Unit I and 676 - 445 ppm (June, 1998) for Unit II. These measurements are difficult to evaluate because the measurement frequency is low and the proportion of mixed fuel between imported and domestic coals differ from dry season to rainy season. These values are slightly lower when viewed from the S content of the operation record. The previous (Investigation 2) prediction used 610 ppm as an annual average, and this is considered reasonable as an average concentration.

On the other hand, the NOx value of 429.53 x $10^3 Nm^3/h$ was set in Table 4 for both Units I and II. By dividing this value by the emission gas amount, the concentration is set at 375 ppm for Unit I and 319 ppm for Unit II. This setting seems to be lower even for the annual average concentration because the actual measurement was 702 - 300 ppm (January, 1998) for Unit I and 740 - 350 mm (February, 1998) for Unit II. The similar measurement is reported for Unit II, in which NO_2 is 581 - 490 ppm and NO is 451 - 143 ppm, indicating that the ratio of NO_2 to NO is abnormal. NOx in the emission source consists mostly (95% or more) of NO which is oxidized to NO_2 after being discharged into the atmosphere. The above value shows abnormally high NO_2 concentration, and thus cannot be relied on. All in all, it may be concluded that there is no emission data available for Unit II.

The NOx emission amount in concentration is based on the EIS data of NPC. EIS notes "NOx are particularly formed at temperature exceeding 1500℃. Measurements of furnace temperature last March 16, 1985 and November 20, 1985 gave maximum values of 1401℃ and 1560℃, respectively. Thus, the formation of NOx at Unit I is minimal. The Unit I EIS using the worst possible fuel as basis, estimated NOx concentration of $1250mg/Nm^3$." This corresponds to the NOx concentration of 429.53×10^3 Nm^3/h used for emission from Units I and II in two previous investigations. These results are therefore not based on the actual measurement. Considering the premise given in EIS, the actual measurement values should be relied on for Unit I.

On the other hand, measurement of TSP was made twice for Unit I, March, 1985 and June, 1986, during the rainy season for each case. For the output of about 300,000 kW, there is no other data than the value of 124 mg/Nm^3 on average for five days as reported in EIS. Concerning Unit II, no measurement was made at all because of the failure of the measurement instrument.

In spite of efforts to verify the air pollutant emission amount from the operation record of Unit I and II, there is no systematically collected data because of low frequency of measurement. Moreover, even if there are any specific measurement data available on some items, associated data such as consumption of fuel coals and emission gas amount are not collected in relation to one another.

② Emission data of short-term high-concentration

Though insufficient as described above, the data available was used as a basis to provide emission characteristics data of short-term high concentration. The air environment is influenced not by the concentration of pollutants in the emission gas, but by the emission amount of pollutants per unit time. This is called the emission intensity. The emission amount is determined by multiplying the

concentration of pollutants in the exhaust gas by the emission gas amount. Even if the exhaust gas concentration is high, the effect on the environment is small if the exhaust gas amount is low. Even if the concentration is relatively low, the environmental effect is large if the gas amount is high. Therefore, it is necessary to provide the exhaust gas amount, prior to setting up the concentration of pollutants.

For Unit I, two measurements are reported in EIS. At 300,000 kW output, the exhaust gas amount was 1,143.2 x 10^3Nm^3/h and the exhaust gas temperature 141℃, which will be used for the simulation this time. For Unit II, there is no official report of measurement. The emission gas amount that the author knew through hearing directly from the engineer of the plant was 1,148 x 10^3Nm^3/h at the outlet of the electrostatic precipitator, 1,046 x 10^3Nm^3/h for dry gas (dry gas: the gas amount excluding vapor volume), which is nearly equivalent to the value of Unit I. Originally, Unit II is specified to use the higher ratio of low-grade coal, therefore, operated with poorer thermal efficiency. Accordingly, if the output is the same, Unit II have to use 20% larger amount of coal than Unit I, which leads to increase in the air consumption. Consequently, the design value, gas amount of 1,347.6 Nm^3/h and the exhaust gas temperature of 145℃ of NPC are used for Unit II. These figures are the same as those used previously with Unit I and II.

Now, the SO_2 emission concentration is determined from the current plant operation state, it appears that SO_2 requires the most attention. As described above, however, the measurement examples are limited and the measured concentration ranges wide. Therefore, the SO_2 emission amount per hour was estimated through the calculation based on the conditions described below.

Unit I, Coal calorific value, 5,281 Kcal/kg (average for the actual data from January to September, 1998)
S content 0.78%, Gross thermal efficiency 36.43%

Unit II, Coal calorific value, 4,509 Kcal/kg (average for the actual data from January to September, 1998)
S content 1.0%, Gross thermal efficiency 32.51%

For calculation, the total calorific value necessary for power generation of full capacity (300,000KW) was determined with due consideration on the total thermal efficiency, which was then divided by the fuel calorific value to determine the fuel consumption. Now the consumption is multiplied by the S content (maximum values of February and May, 1998) of coal to calculate the SO_2 generation amount from the burnt S content. This is the total emission amount of SO_2.

Assuming that the S content of coal is totally discharged as SO_2 into the atmosphere, the SO_2 emission amount is 2,092 kg/h for Unit I or 732.2 Nm^3/h in terms of volume. When this is divided by the emission gas amount of 1,143.2 x 10^3Nm^3/h, the result of 1,830 mg/Nm^3 is obtained, and equivalent to 640 ppm when converted into volumetric concentration under the standard conditions. According to the Philippines standard, SO_2 of 1 mg/Nm is equal to 0.382 ppm, which is 1.091 times the conversion factor in the standard state. Calculation with this factor produces 699 ppm. This value seems to be derived when corrected volumetrically at an assumptive atmospheric temperature of 25℃. When considering its effect on the ambient concentration, it is likely to need to use this conversion amount, so this value is taken into account in determining a contribution concentration. This value may be approximated to the highest value of measurements with Unit I. Similar calculation for Unit II produces the SO_2 emission amount of 3,520 mg/Nm^3 or 1,232 Nm^3/h. By dividing this value by the

emission gas amount of 1,347.6 x 10^3 Nm^3/h, 2.613 mg/Nm^3 is given which is equivalent to 914 ppm under the standard conditions. This value is far above the measurement mentioned above.

According to EIS, 26.38% of S content in burned coal remains in the incineration ash. If this is a fact, this is equivalent to about 3/4 of the above concentration. However, the practical experience with coal-fired thermal power plants in Japan shows that 95% of S content in coal is converted to SO_2. Out of remaining 5%, SO_3 accounts for 1 - 2%, fly ash or soot residue account for about 2%, and slug residue for 1% or less. Namely, the sulfur amount remaining without being discharged is 3% or less. The EIS values are difficult to understand when viewed from our experience. Firm and reliable re-investigation is necessary.

It is assumed here that the residue ratio is 5% by considering that the ash content is high in the low quality coal used and the pararosaniline ambient measurement method can not measure SO_3. The SO_2 emission amount to be used for high-concentration prediction was therefore set to 695.6 Nm^3/h for Unit I and 1,170.4 Nm^3/h for Unit II.

For NOx, the maximum measurement of 740 ppm was used here because the measurement with Unit I exceeded the previous set value. The same concentration was set for Unit II because there is no available data.

Since the measurement of TSP is 124 mg/Nm^3 as an average for five days, it is evident that the hourly high-concentration emission amount will exceed this value. According to EIS, NPC alleges that the concentration to be discharged will have the sufficient allowance to avoid exceeding of 300 mg/Nm^3. Therefore, 240 mg/Nm^3 will be set as the emission concentration, the same value as the previous investigation (Table 4).

Emission data finalized after reviews above described are shown in Table 5. Though it may not be necessary to repeat the above description, these data are set values to predict occurrence of high concentration corresponding to the one-hour ambient air quality standard. Never misunderstand that such discharge is normally made in the site. Needless to say, the estimation results of ambient concentration using such emission data are predicted values and not the concentration that occurs frequently.

Table 5 Emission data used for prediction of the short-term high concentration

Item	Unit	Unit I	Unit II	Total
Output	MW	300	300	600
Actual stack height	m	120	150	-
Exhaust gas amount (wet)	$10^3Nm^3/h$	1,143.2	1,347.6	2,490.8
Exhaust gas temperature	℃	141	145	-
SO_2 emission amount	Nm^3/h	695.6	1,170.4	1,866.0
NOx emission amount	Nm^3/h	846.0	997.2	1843.2
PM emission amount	kg/h	274.4	323.4	597.8

(Note 1) For the SO_2 emission amount, the contribution concentration is represented by the volumetric concentration. Accordingly, the listed value is multiplied by 1.091 using the Philippines conversion factor.

(Note 2) For NOx, the actual concentration (ppm) will be used as it is because conversion according to the Philippines method is considered completed already.

③ Calculation result of contribution concentrations

Now that the emission data for short-term high concentration prediction is established, the contribution concentration of flue gas from the Calaca Power Plant is calculated. The equation used for this calculation consists of the normal plume equation plus the initial dispersion width of 20 m, as described above. Though calculation can be made for various meteorological conditions, it is necessary to extract the conditions where the short-term high concentration tends to appear readily.

First, the atmospheric stability is extracted from the Pasquill's class. When the smoke source is at an elevated position, the stability A (extremely unstable) exerts the highest concentration on the ground. EIS and previous investigation also reviewed the class A for prediction at high concentration, but these are the most severe conditions set temporarily in the assessment. Though the meteorological observation may indicate that the class A appears with considerable frequency, it is practically difficult to consider that the exhaust gas from an elevated smoke source (such as this facility) is dispersed with the diffusion width of class A for the range from the high altitude in the sky to the surface.

In Japan and other developed countries, many experiments and researches have been made on the exhaust gas diffusion from high-rising stacks. Near the ground level, the upper layers at 100 m or above from the ground is ranked as Class D (neutral) even when the ground area is ranked as Class A. Even in the most unstable case, the class remains C. EIS reports on the other hand that the mixed layer altitude in the field is estimated to be 1,600 m on average for a period from January to March, which is higher by 60% than the case of Japan. This may be due to a fact that the site is in the low latitude where the heating effects of sunshine reaches high above in the air. Since the elevation of mixed layer is determined by the development of air layer with relatively active convection, the diffusion field in the air is shifted to the unstable side. On the basis of considerations up to now, it was decided to use Class B as a diffusion field of the high emission source in estimating the concentrations. Since the ground concentration differs depending on the wind speed when Class is B, the ambient concentration is calculated for each wind speed. It was found that the ambient concentration was the highest at the wind speed of 2 m/s for the source concerned. This is because the effective stack height may change depending on the wind speed.

Figs. 1 through 3 show the downwind axial concentration of SO_2, NOx, and TSP. All of these substances are discharged from the same stack, showing the similar concentration pattern, and only the absolute value of concentration differs. In the figure, the horizontal axis shows the downwind distance (km) while the vertical axis shows the concentration expressed in ppb or $\mu g/m^3$.

First, SO_2 of Fig. 1 is reviewed. Three curves are drawn in this figure, of which the lowest concentration curve is for emission from Unit I, followed by the one for Unit II and the highest value for combined concentration from Unit I and II. The highest concentration of combined concentration is 120.5 ppb (about 0.12 ppm), and its appearance point is 3.1 km on the downwind side. The Philippines' ambient air quality standard is shown in Table 1, in which the one-hour value is 0.13 ppm, which means compliance with the standard as far as the contribution concentration from the plant is concerned. When the background concentration is added, the concentration barely measures up to the standard and, in some cases, may exceed the standard if regional development is accelerated in the future.

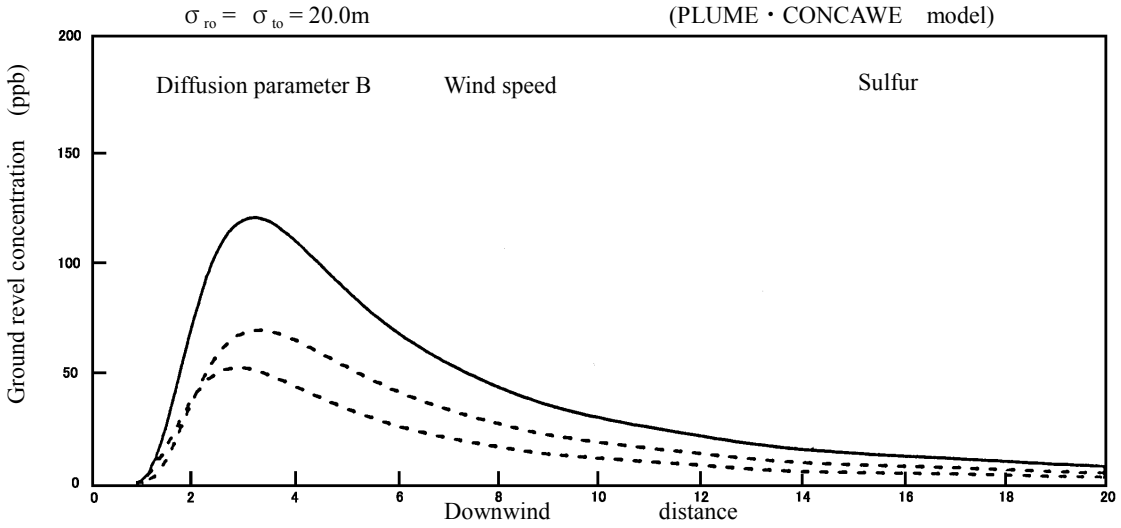
For NOX of Fig. 2, the emission concentration was set the same for both Unit I and II. Accordingly, Unit I with low actual stack height and less emission gas amount shows higher contribution

concentration. The combined concentration is 111 ppb (about 0.1111 ppm), which is lower than the NO_2 concentration (0.14 ppm) of the ambient air quality standard. As the calculated concentration is NOx (NO + NO_2), NO_2 itself will fall considerably below the standard.

TSP have the maximum concentration of 35.6 μg/m^3, which is far below the standard 300 μg/m^3. Since it is estimated that the background value will be considerably high in the dry season, it will be necessary to pay attention to combination with this background value.

Figs. 4 through 6 show the contour in which concentrations calculated every 200 meshes are plotted on the 1 km mesh. A central black point is where the highest concentration appeared while a cross mark shows the source location. Numerical values attached to the iso-concentration curves are the concentration values expressed in ppb or μg/m^3. As is known from the map, the area of high concentration is small and the distance-based slope of concentration is sharp around this area. The SO_2 figure shows that the concentration decreases by 20 ppb at a distance of 500 mm in a direction vertical to the wind direction. This shows the difficulty of grasping the high concentration through the present way of monitoring in the Calaca Power Plant.

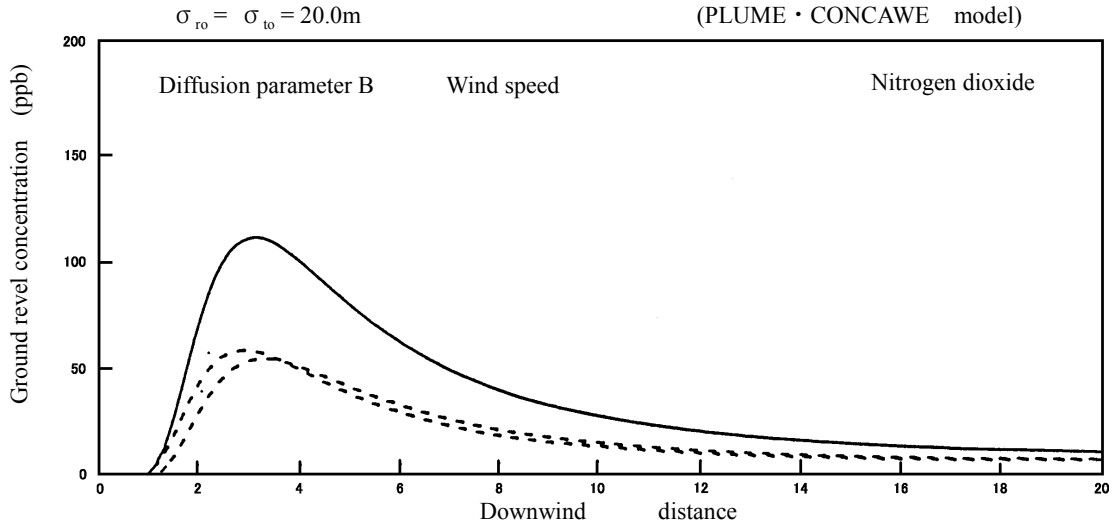
Fig.1 Ambient concentration distribution of sulfur dioxide (one-hour value)



Parameter = 8 2.0 (m/s) IXSW = 0 IYSW = 0

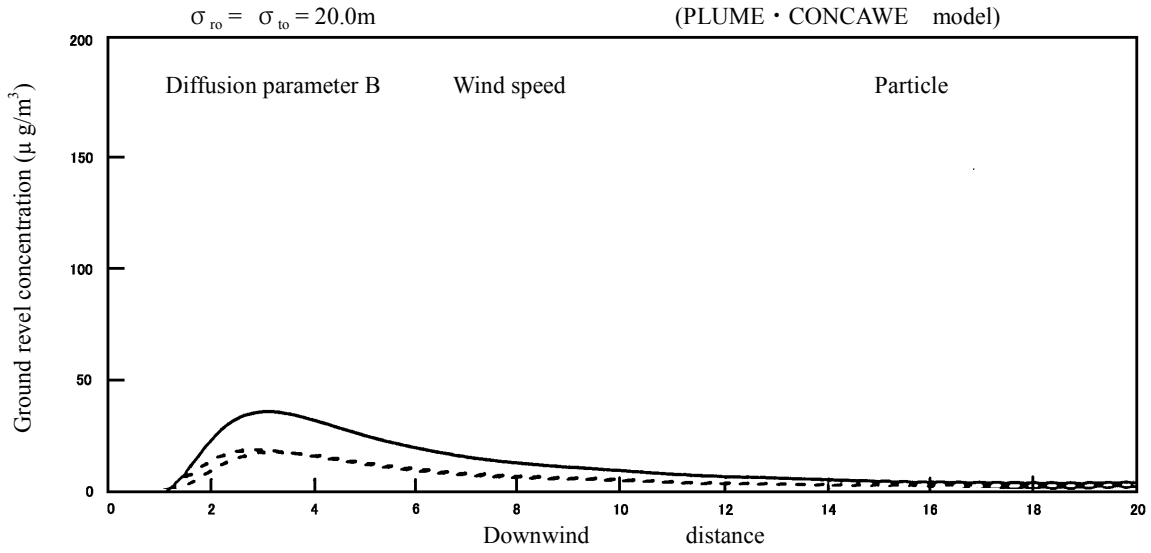
	Actual stack height	Emission gas quantity	Emission gas temperature	Emission gas speed	Hourly emission	Effective Actual stack height	Xmax	Cmax
	(m)	(103Nm^3)	℃	m/s	Nm^3/h	(m)	(km)	(ppb)
Plant I	120.	1143.2	141.	613.2	758.2	486.7	2.8	52.1
Plant II	150.	1347.6	145.	729.8	1276.9	554.4	3.2	69.3
Total	120.	1143.2	141.	613.2	758.2	486.7	2.8	52.1
	150.	1347.6	145.	729.8	1276.9	554.4	3.2	69.3
					2035.1		3.1	120.5

Fig.2 Ambient concentration distribution of nitrogen oxides (one-hour value)



	Actual stack height	Emission gas quantity	Emission gas temperature	Emission gas speed	Hourly emission	Effective Actual stack height	Xmax	Cmax
	(m)	(103Nm^3)	℃	m/s	Nm^3/h	(m)	(km)	(ppb)
Plant I	120.	1143.2	141.	613.2	846.0	486.7	2.8	58.1
Plant II	150.	1347.6	145.	729.8	997.2	554.4	3.2	54.1
Total	120.	1143.2	141.	613.2	846.0	486.7	2.8	58.1
	150.	1347.6	145.	729.8	997.2	554.4	3.2	54.1
					1843.2		3.0	111.4

Fig.3 Ambient concentration distribution of TSP (one-hour value)



	Actual stack height	Emission gas quantity	Emission gas temperature	Emission gas speed	Hourly emission	Effective Actual stack height	Xmax	Cmax
	(m)	(103Nm^3)	℃	m/s	Nm^3/h	(m)	(km)	(μg/m^3)
Plant I	120.	1143.2	141.	613.2	274.4	486.7	2.8	18.8
Plant II	150.	1347.6	145.	729.8	323.4	554.4	3.2	17.5
Total	120.	1143.2	141.	613.2	274.4	486.7	2.8	18.8
	150.	1347.6	145.	729.8	323.4	554.4	3.2	17.5
					597.8		3.0	36.1

Fig.4 Prediction result of sulfur dioxide ambient concentration (one-hour value)

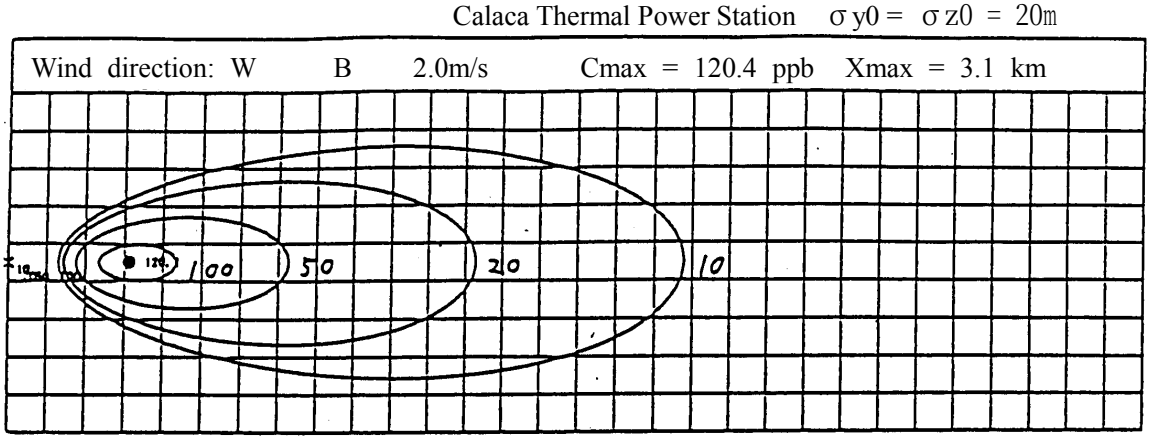


Fig.5 Prediction result of nitrogen oxide ambient concentration (one-hour value)

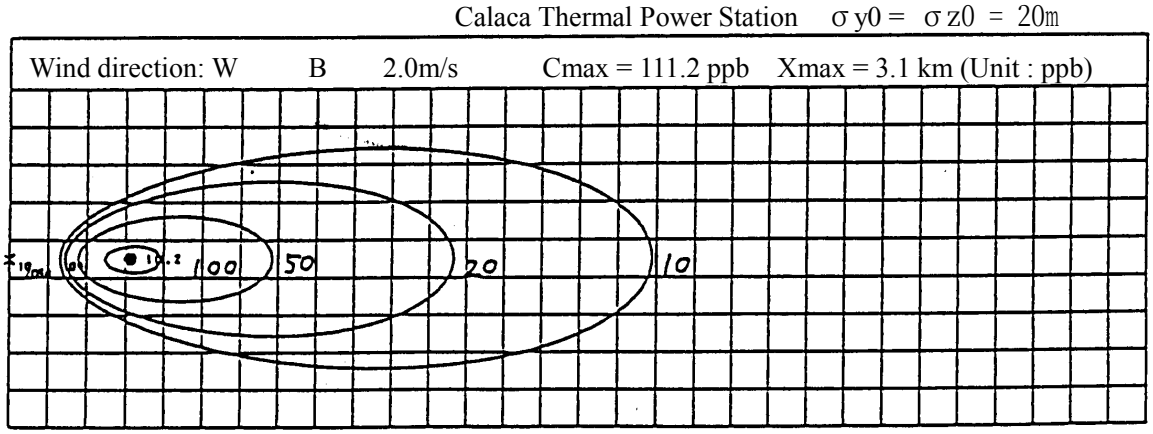
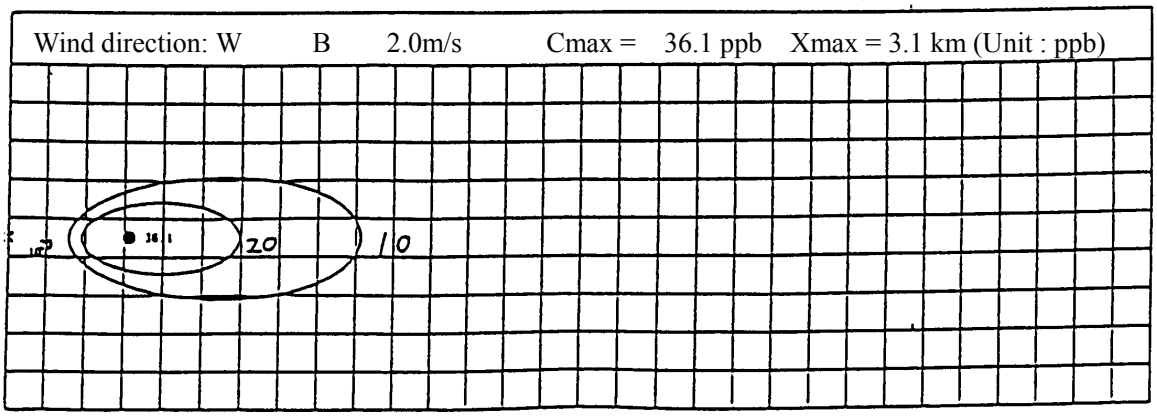


Fig. 6 Prediction result of TSP ambient concentration (one-hour value)



5. Summary

The field investigation was made in October, 1998, concerning air pollution problems related to new construction of Unit II in Luzon, the Philippines. This investigation covers the predictions of atmospheric environment and related countermeasures that were implemented by NPC prior to the construction of Unit II. Though thorough analysis could not be made because of insufficiency of data concerning air pollution including emission data, the following conclusions could be drawn.

(1) Measurement of Emission Sources

It appears that the local people still feel an anxiety about the situation after Unit II was constructed, reflecting the environmental problems arising after the operation of Unit I had begun. It is certain that a wide range of countermeasures have been taken against emission sources during the construction of Plant II.

Principal sources of air pollution in Unit II includes low smoke source (coal yard) and elevated smoke source (high-rising stack). The former consists of dust and foul smell from spontaneous combustion in the coal yard while the latter is the wide-ranging environmental pollution caused by the sulfur oxides, nitrogen oxides, and particulate matters (smoke and soot) in emission gas incessantly discharged from the 150m stack.

In the former case, because of over-stocking of coal and the insufficient monitoring system on spontaneous combustion, large-scale spontaneous combustion prevailed. To cope with it, various countermeasures have been implemented subsequently. Especially for the prevention of coal dust flying, the wind break fence of 20m height was installed, therefore the problem of dust flying can be controlled considerably. With regard to the problem of spontaneous combustion, however, there still remains some concerns due to the quality of Semirara coal, requiring further enhancement of countermeasures in the future.

Concerning exhaust gas from the high-rising stack, it is said that the S content of coal is controlled below 1% through mixed burning of Semirara coal and imported coal. However, because of incomplete investigation on the pollutant emission amount itself, this control is not sufficient. As this facility is exempt from the obligation to meet the national emission standard, there is no legal requirement to implement emission measurement. However, this is a source which emits large amount of pollutants continually, with a significant effect on the local environment. Moreover, the used coal does not have homogeneous S content, which may fluctuate the amount of pollutants largely. Accordingly, it is essential to establish the exhaust gas measurement and monitoring system as early as possible to obtain pollutant emission data.

With regard to the current pollutants emission amount, the emission amount of sulfur dioxide gas may possibly rise above the national emission standard. It is desirable that the independent emission target is set in the future to reduce its amount. For this purpose, it may be necessary to make efforts for selection and improvement of the coal used by understanding properly the relationship between the fuel coal and emission gas concentration.

(2) Current Situation of Air Quality

Review of the details of prediction by EIS for Unit II revealed that there was no consistency in the

measurements of atmospheric stability which is a basic element of ambient concentration forecast. The forecasted values are therefore not reliable.

This time, attempts were made to reproduce the ambient concentration after starting the operation of Unit II. Since the atmospheric stability data cannot be used, it was impossible to estimate the long-term average concentration (annual average). We had to estimate the short-term high concentration (one-hour value) and compare it with the ambient air quality standard for evaluation of the environmental effects. Since environmental effects of emissions should not be made for Unit I and II separately, the combined concentration of these two plants was used. Pollutants used for evaluation were SO_2, NOx, and TSP.

Though the SO_2 emission amount may exceed the emission standard, its contribution concentration (one-hour value) to the environment of high concentration was 0.12 ppm which is below the ambient air quality standard of 0.13 ppm. Though this contribution concentration does not appear frequently, there arises a possibility in the course of regional development that the effects of sources other than the power plants may be added to cause exceeding of the one-hour value above the standard.

In the case of Japan, the SO_2 ambient air quality standard places a stress on the long-term average concentration. At present (1996), 99.9% of 1,612 stations provided in 709 local communities all over the country showed compliance with the long-term evaluation standard. With regard to the short-term evaluation (0.1 ppm in Japan, which is more strict than in the Philippines), 99.6% of stations showed compliance while 50 stations proved failure of compliance. Among these 50 stations, there are those in Kagoshima, etc. which are exposed to the effect of volcano and those which have proved compliance with the long-term standard and failed compliance with the short-term standard. In the case of Calaca City, air pollution is not caused by multiple sources, and the source can be identified. This environment will be the one which can comply with the standard in the long-term evaluation, but may prove unacceptable in the short-term evaluation.

Concerning nitrogen oxides, nitrogen oxides (NOx) containing both NO and NO_2 were predicted to be 0.11 ppm under high-concentration conditions. The ambient air quality standard is represented by NO_2 to be 0.14 ppm, there remains sufficient margin from the standard value. Nitrogen oxides present less problem in Calaca Municipality, because this pollutant is highlighted in the urban area crowded with vehicles.

The high-concentration predicted value of particulate matters is 35.6 $\mu g/m^3$, which is far below the ambient air quality standard of 300 $\mu g/m^3$. Accordingly, this value is low as a contribution concentration of the power plant. When the effects of dust generated by vehicle running on unpaved road or the wind in the dry season, incineration of sugar canes after harvesting, etc. are added, due attention must be paid on their combination with the background concentration.

(3) Air Quality Monitoring

Calaca Thermal Power Plant is excluded from the scope of facilities subjected to the national emission standard and exempted from compliance with the standard. Instead, the plant has to comply with the ambient air quality standard. Accordingly, the target monitoring with this Calaca plant as a specific source must be employed for monitoring. Being different from the regional monitoring which tries to grasp the general environment, the target monitoring minimizes the effects of sources other than the specific one and must perform measurement at the place and time where the

effects of such specific source are the largest.

The current monitoring at Calaca Power Plant is conducted mainly by setting 11 monitoring stations within 6.5 km around the source and by executing the measurement at 2 upwind and 3 downwind stations according to the wind direction of the day. But measurement is made mostly only for a short period, about 20 days a month and 1 - 2 hours per day. Though the measurement results up to now indicate the compliance with the ambient air quality standard, it is highly dubious whether such sporadic sampling is enough to meet the intended purpose. The area where the high concentration corresponding to the short-term (one hour) ambient air quality standard appears within the short period is extremely narrow, and the concentration decreases rapidly when the point is deviated even slightly from the wind direction axis.

Future monitoring should involve the use of continuous ambient analyzer installed at fixed stations for major measurement and should be continued throughout the year. In addition to this, the current way of monitoring should be conducted. With the continuous ambient analyzer, daily, monthly and annual average concentrations can be obtained. Therefore, it is possible to grasp the short-term concentration fluctuation, which can offer relative information on the ambient concentration of other monitoring points. **It is desirable to set the fixed points for continuous measurement at around 3 km on the downwind side in southwestern and eastern winds by considering the prevailing wind in dry and rainy seasons while referring to the short-period high concentration prediction conducted this time.** Besides, grasping the behavior of smoke with less monitoring stations requires correspondence between the actual concentration measurement and meteorological conditions. **It is recommended therefore to take meteorological data by installing a pyranometer (for measuring solar radiation) and net pyrradiometer (for measuring net radiation) in the plant yard.** With such data, the atmospheric stability can be classified. Above recommendation is made because we have the impression that field investigation at the 100m tower is difficult to maintain.

Establishing the monitoring system recommended in this report will benefit both Calaca Power Plant and residents in the surrounding area. Should any claim be presented in the future, the accumulated data may be used to certify the causal connection. If the meteorological observation data including the atmospheric stability are developed and accumulated, the annual average concentration distribution can be grasped correctly. Accordingly, it is recommended to understand the concentration distribution over the wide area to review the appropriateness of current arrangement of monitoring stations. On the other hand, if the ambient concentration is measured throughout the year, it can clarify the relationship between the annual average concentration and 98% value of 24-hour average concentration. Using this relationship, the long-term evaluation of ambient concentration can be conducted over a wide area, which will cope with the changes in the ambient air quality caused by the future countermeasures and future regional development.

Third-Party Evaluation on Public Acceptance Measures

"A Socio-Economic Assessment of Communities around the Batangas Coal Fired Thermal Power Plant (BCFTPP) in Calaca, Batangas"

~ Prof. Mario P. Leviste* ~

** Executive Director, Management Training Development Centre,*
De La Salle Lipa University Philippines
(as of evaluation)

EXECUTIVE SUMMARY

The Proponent was commissioned by the Japan Bank for International Cooperation (JBIC) of Japan to assess the status of fulfillment of the socio-economic provisions under Environmental Compliance Certificate (ECC), the Memorandum of Agreement, Supplemental Memorandum of Agreement Nos. 1 & 2, the Department of Energy- Energy Regulation 1-94 and other commitments made to the Municipal Government of Calaca, of the National Power Corporation Batangas Coal-Fired Power Plant (NPC BCFTPP) in Calaca, Batangas.

This report is divided into three parts; namely: The Evaluation of the Relocation Package, The Evaluation of the Community Development Programs and The Evaluation of the Environment and Health of the Community. The basis of this report are the three survey runs done, from October to November 1998, for two (2) types of survey; The Relocatee Survey, which has 92 relocatees as respondents, and the Community Appreciation Survey, which has 176 residents of barangays in the area of Calaca and Balayan near the NPC BCFTPP. Primary and other secondary data were also gathered from various sources and resource persons like the NPC, LGUs (municipal and barangay), NGOs and Regional Health Units of Calaca and Balayan.

On the Evaluation of the Relocation Package, in order to better analyze the program, the proponent decided to divide it into three (3) phases; namely, Pre-relocation, Actual Relocation and Post-Relocation. After analyzing the data and information gathered, the proponent was led to the conclusion that the Pre-relocation and Actual relocation phases carried out by the NPC for the residents of the affected barangays were fully and satisfactorily implemented. It was the Post-relocation phase that encountered numerous problems. The important provisions in this phase included employment and livelihood programs for the relocatees, and basic services like electrification, infrastructure and water. It was established that the general living conditions of the people greatly improved, but the employment and livelihood opportunities were very limited in scope and did not match the skills of the people as well as the resources available in the area[1]. The proponent also noted that most projects funded by the NPC were not attributed by the people to the NPC. The recommendation of the proponent is to form a multi-partite committee, comprised of members from the NPC, LGU, NGO and NEDA that will assess the reasons behind the inadequacies of the programs implemented. Aside from this, it is also suggested that proper coordination be done in devising projects that will suit the skills, interests, capabilities and available resources of the people

in the area. Proper communication channels are also needed to be established to pave the way for the effective implementation of the projects.

[1] [JBIC's view: JBIC appreciates NPC's efforts at employment generation and livelihood programs. Further improvement can be expected by strengthening information dissemination.]

In the Evaluation of the Community Development Projects, the proponent determined that the NPC has, to date, spent a substantial amount of P78,337,000 for the accomplishment of the provisions and guidelines stated in the Memorandum of Agreement, Supplemental Memorandum of Agreement Nos. 1 & 2, the Department of Energy – Energy Regulation 1-94 and other commitments made to the Municipal Government of Calaca. These investments came in the form of infrastructure projects, community livelihood and employment projects, environmental and health projects and provision of basic services like electrification and water. Majority of the respondents feel that the NPC has made limited contributions leading to the improvement of their standards of living. Although there have been an increase in total household income because of other family members finding employment, there has also been an increase in unemployment in family heads. This is not due to the relocation and cannot be directly attributed to the NPC. Limited employment opportunities for non-skilled laborers as well as limited livelihood opportunities implemented only in certain areas, led to more problems based on the high expectations of the community members on the NPC[2]. On the other hand, the NPC has limited capacity in meeting these high expectations.

[2][JBIC's view: As mentioned above, JBIC appreciates NPC's efforts at employment generation.]

The proponent suggests using specific frameworks to evaluate the inconsistencies of the community development projects and their implementation. Utilizing the multi-partite committee in order to better coordinate the efforts to provide a more suitable means of gaining employment for the people. Communicating the plans' objectives to the people so as to motivate them towards active participation and cooperation is very valuable. More important is the controlling and checking of the results of these projects so as to avoid failures and to determine if the key targets are met.

Aside from the two socio-economic areas, the survey also showed that the people in the community are very much concerned about the adverse effects of the NPC BCFTPP operations on the environment and health. The NPC has invested millions of pesos in order to control the supposed adverse effects of the plant's operations on the environment, which contributed to much improvement

in environment. These interventions address specific pollution concerns and therefore significantly reduce polluting potential.

Some problems experienced by the people are still attributed to NPC. The consistent increase in Upper Respiratory Tract Infection cases, the air particles, the emission of smoke by the smokestacks of the plant, the hot water discharge and the occasional noise and vibrations coming from the plant are perceived by the people as threats to their health, environment and general quality of life. These concerns will have to be verified and further researched. Furthermore, the cause-and-effect relation between such concerns and NPC's operation still has to be established.

It is important to note that whether or not the plant causes the problems, the prevalent perception of the people is that the NPC is the main cause. Much worse, the people feel that the NPC is not exerting all efforts to protect them and their families. It is, therefore, important for NPC to disseminate information to local people how much efforts they have done for environmental improvement, and to hear about people's anxiety and clarify the facts.

A substantial part of the funds of the NPC for community development went into the constructing of health centers and pollution control edifices and structures, as well as sponsoring medical missions. It is apparent that most of the people in the community credit the local government units (LGU) and the non-governmental organizations (NGOs) for such thrusts and activities. This was made clear when the survey teams interviewed the people in the communities surrounding the plant, and in addition to this, the infrastructure developments were attributed to the LGUs where in reality, these were funded by the NPC.

It is therefore suggested that the NPC carry out plans leading towards social marketing which is the incorporation and application of social and environmental concerns into an organization's marketing strategy in order to improve society. Social marketing techniques include activities like providing or funding health services, employment generation for people in the nearby communities, recycling of wastes and pollution control. But this time, it is imperative that the NPC communicates its plans and implementation actions directly to the people through effective channels of communication. The implementation of the Communications and Public Relations Plan of the NPC is seen by the proponent as a good start. It is, therefore, important to harness this project fully to benefit the NPC and reach the people effectively.

It is also important that the people in the community get involved in the protection of their health and environment. Education and training for the people about the prevention of diseases as well as providing them with ways of helping protect the environment are also necessary.

This paper was developed with one objective in mind and that is to assist the NPC BCFTPP in gaining total public acceptance through its socio-economic programs. It is apparent that there are different groups that depend of the plant's operations and these groups can be regarded as the NPC's stakeholders. All of these groups apply pressure on the NPC because they form part of the internal and external environment of the firm.

In closing it is clear that the NPC BCFTPP guided by the provisions of ECC, the Memorandum of Agreement, Supplemental Memorandum of Agreement Nos. 1 & 2, Department of Energy – Energy Regulation 1-94 and other commitments made to the Municipal Government of Calaca has exerted exhaustive efforts to comply with all requirements. There have been problems encountered that can be studied and rectified in the future in order to prevent the same occurrences and help improve the situation. It is very important that the NPC stance be pro-active rather than reactive with regard to the needs and requirements in the environment in which it operates. All these are needed to pave the way to a better relationship between the NPC and the public that it serves.

1. Evaluation of the Relocation Package

The first socio-economic condition under the Environmental Compliance Certificate (ECC) dated April 1992 was for the National Power Corporation BCFTPP to implement the proper compensation and resettlement of legitimate Barangay San Rafael residents.

In order to better evaluate the NPC Relocation Package, the proponent decided to breakdown the relocation procedures into three (3) phases, namely:

a) PRE-RELOCATION

This includes:

- the coordination of the NPC with the local government units (LGUs) both at the municipal and barangay level regarding the Relocation Plan;
- the consultation procedures conducted with the families that will be relocated, this consultation tackled issues on the fair compensation for the land, property, 5-year crops (if they are not land owners) as well as the place where they will be relocated;
- the verification of results of the consultation.

b) ACTUAL RELOCATION

This includes:

- the payment of compensation for the land, property, 5 year crops(payable only to non land owners), and disturbance payment of P50,000;
- the actual resettlement of affected families to areas of their choice.

c) POST-RELOCATION

This includes:

- the provision of livelihood programs to relocated families
- the provision of job or employment opportunities and assistance by the NPC to the relocatees.

- the provision of basic services and infrastructure projects for the barangays of Calaca and Balayan, not limited to the relocatees.

1.1. Facts Regarding the Relocation Package

1.1.1. Pre-Relocation Process

NPC coordinated with the municipal and barangay officials regarding the relocation plan. This was prior to the construction of Calaca I in 1980. Consultation procedures and interviews for the families that will be affected were commenced. The barangay officials assisted the NPC in gathering the members of the community for the consultation process.

During the consultation phase, in accordance with EO1035, compensation for the relocatees was determined based on the values of their, houses, farm lands and their expected 5-year crops depending on their status as land owners. In accordance with RA 6389, each relocatee family also received disturbance compensation in the amount of P50,000. Having satisfactorily accomplished the consultation procedures, the NPC proceeded to implement the next phase of the project which is the actual relocation.

1.1.2. Actual Relocation Process

1.1.2.1. First Relocation (1980 – Prior to construction of Calaca I)

Approximately 350 families in Bgy. San Rafael were relocated to a 30 hectare resettlement area mainly due to NPC's acquisition of their land for the power plant. These affected families were given just compensation for their land, property, and 5-year expected for rice crops (for non-landowners). NPC wanted to resettle the families farther away from the plant, but the people insisted to stay in a portion of the plant complex in order to retain the identity of the barangay and also to be near Balayan Bay which is the source of livelihood of one-third of the affected family heads being fishermen, while the rest are either farmers or laborers. In 1984, Calaca I started operations. By December 1986, Bgy. San Rafael residents petitioned NPC to re-relocate them to a place farther from the plant allegedly due to pollution. NPC conducted exhaustive studies in order to find a better

resettlement area for the affected families, prepared the relocation scheme then, carried out the second relocation.

1.1.2.2. Second Relocation (Last Quarter of 1989)

NPC started the second re-relocation of 316 of the 335 families to areas of their choice outside of San Rafael to places like Bgy. Camastilisan, Quisumbing and others. There were still families that stayed behind to retain the identity of Bgy. San Rafael.

1.1.2.3. Third Relocation (1994)

Between March and July 1994, an additional nineteen (19) families were re-relocated to a half hectare lot lying on the San Rafael boundary purchased by the NPC based on the families' request.

1.1.3. Post-Relocation

1.1.3.1. Provision of Livelihood Programs

NPC tried to facilitate the relocatees in the organization of livelihood programs in each barangay. The livelihood projects initiated were Hog Raising, Rag/Ready-to-Wear Garment Sewing, Buy and Sell Program, and the provision of 4 Tricycles for transport services. However, these were only implemented and organized in Bgy. Camastilisan under the San Rafael Homeowners Association (SAHARA). According to an NPC officer, the projects were not very popular because, first, it takes time for the people to organize a project since it is a group task, and second, it is a loan and although it is not charged with interest, the people would have to pay the principal amount.

The livelihood programs in the long-run were partially successful, more specifically for the Hog raising and Rag sewing ventures. Hog raising was later hit by the Foot and Mouth disease. Rag sewing started out good, then lost its biggest market, the NPC. Earlier on, NPC purchased the rags produced by the community project, but due to limited production on the part of the relocatees, their products' prices went up and NPC found an alternative supplier. This led the relocatees to abandon such projects.

1.1.3.2. Provision of Jobs and Employment to Relocatees

A majority of relocatees' primary source of income is farming and fishing. The difficulty experienced here was that these relocatees are basically non-skilled to be employed in the BCFTPP. Approximately 87 employees were employed as regulars as of July 30, 1998.

Stevedoring became the best option for employment for these non-skilled relocatees. Due to an abundance of such type of labor, the NPC hired them on the basis of three-months duty, one and a half months off-duty, to give chances to others who would also like to work as stevedores. It is important to note that in an interview conducted on July 29, 1998, the relocatees voiced out their preference to revert to their old way of life prior to the relocation, which is fishing and farming.

1.2. Interview

The proponent conducted the Relocatee Survey three times in order to fully conform to the provisions of the JBIC.

1.2.1. Methodology

1.2.1.1. Criteria for Choosing Respondents

Three main relocation areas were selected as the interview sites:

Barangay San Rafael – comprised of 19 relocated families

Barangay Camastilisan – comprised of 145 relocated families (est.)

Barangay Quisumbing – comprised of 60 relocated families (est.)

Giving a total of 224 relocated families as the total population for the survey.

The survey team tried to cover as many respondents as possible to have a better perspective of their situation, but interviews were limited to those present at that time. As a result, 92 relocated families, 41% of the total families from the above three (3) barangays, were interviewed. Approximately thirty (30) families from each barangay.

1.2.1.2. Interview Methodology

Semi-structured interview was adopted. Since there was no baseline data before the relocation, the living situation before the relocation was based on a respondent's recollection of that time.

1.2.1.3. Methodology in Analyzing Data

The results of the survey were tabulated and validated in order to present the facts gathered from the respondents.

1.2.1.4. Results of the Interviews

SURVEY RESULT

No. of Respondents = 92

1. Relocation Process

Did NPC conduct an interview in your barangay?		RESPONSE	%
	Yes	68	73.91
	No	16	17.39
	NR	8	8.7
		92	100.00

Reason for relocation		RESP.	%
	Environmental condition	65	70.65
	Land acquisition	57	61.96
	Salty Water System	1	1.09
	Total	92	100.00

Reason for delay of relocation		RESP.	%
	Unreciprocated demands	20	21.74
	Additional demands	19	20.65
	No delays	19	20.65
	Availability of lot	2	2.17
	No Response	32	34.78
		92	100.00

2. Family Structure

NO. OF FAMILY MEMBERS	RESPONSE		
RANGE	1992*	1998	% increase
1 – 3	9	17	88.89
4 – 5	30	32	6.67
6 – 7	31	23	(25.81)
8 – 9	5	8	60.00
9 –10	4	2	(50.00)
10 – 11	3	4	33.33
12 – 13	2	5	150.00
NO RESPONSE	8	1	
TOTAL	92	92	

* Based on people's recollection of the time in 1992.

Educational Background	Under Graduate	% Under Graduate	Graduate	% Graduate	Total	% Total
Secondary	27	27.55	35	91.38	62	122.690
Primary	40	40.82	25	107.98	65	140.81
Tertiary	28	28.57	21	79.15	49	103.9
Vocational	5	5.1	14	24.59	19	34.19
Special Skills	0	0.0	3	3.06	3	4.58
Total	100		98			
Total Number of family members = 198						

Reason for Change of Family Structure	RESPONSE	%
Marriage	37	40.22
Fertility	20	21.74
Merging	17	18.48
Mortality	5	5.43
No response	13	14.13
	92	100.00

3. Employment and Income Level

a. Head of the Family

HEAD OF THE FAMILY			
Employment	RESPONSE		**% increase**
	Before NPC*	**Present**	
Self-employed	43	28	(22.22)
Employed	33	30	20.00
Not Employed	2	10	25.00
No Response	14	15	7.14
	92	83	

* Based on people's recollection of their situation before the second or third relocation.

REASON FOR CHANGE OF JOBS	RESPONSE	%
Income Factor	29	31.52
Health	8	8.7
Disability	7	7.61
Resigned	4	4.35
Terminated	4	4.35
Location	2	2.17
Distance	1	1.09
Reassigned	1	1.09
No Response	36	39.12
	92	100.00

HEAD OF THE FAMILY			
INCOME LEVEL	**1992**	**1998**	**% INCREASE**
0 – 1000	23	8	(65.22)
1001 – 2000	19	12	(36.84)
2001 – 3000	22	6	(72.73)
3001 – 4000	5	14	180.00
4001 – 5000	6	9	50.00
5001 – 6000	2	7	250.00
6001 – 7000	1	2	100.00
7001 – 8000	1	8	700.00
NO RESPONSE	13	26	
	2084	2090	

Was there job opportunity given by the NPC?		Response	%
	Yes	42	107.69
	No	38	97.44
	NR	12	30.77
		92	235.90

Job descriptions:		Response
	Helper	6
	Stevedore	19
	NPC (mechanics, etc.)	6

Job level of satisfaction		Response	%
	Very Good	18	19.57
	Good	14	15.22
	Excellent	9	9.78
	Fair	6	6.52
	Poor	3	3.26
	No response	42	45.65
		92	100.00

b. Other Family Members

Employment	**Response**		
	Before NPC	**Present**	**%**
Self-employed	13	10	(23.08)
Services	13	27	107.69
Manufacturing	6	8	33.33
Not applicable	10	9	(10.00)

REASON FOR CHANGE OF JOBS		
	RESPONSE	%
Income Factor	14	15.22
Terminated	3	3.26
Health	1	1.09
Location	1	1.09
Resigned		-
Reassigned		-
Disability		-
Distance		-

INCOME LEVEL	Before NPC	Present	1998
0 – 1000	9	3	(66.67)
1001 – 2000	5	7	40.00
2001 – 3000	5	3	(40.00)
3001 – 4000		6	
4001 – 5000		9	
5001 – 6000		9	
6001 – 7000		4	
7001 – 8000		3	
8001 – 13000		4	

c. Total Family Income

INCOME LEVEL	Before NPC	Present	%
0 – 1000	12		(100.00)
1001 – 2000	13	3	(76.92)
2001 – 3000	11	2	(81.82)
3001 – 4000	4	13	225.00
4001 – 5000	2	10	400.00
5001 – 6000	1	6	500.00
6001 – 7000	1	2	100.00
7001 – 8000	1	6	500.00
8001 – 13000	5	14	180.00
No response	42	36	(14.29)
	92	92	

4. Land

Land Property :		Response	%
	Owned	80	86.96
	Donated	2	2.17
	Owned by relatives	2	2.17
	Lease	1	1.09
	No response	7	7.61
	TOTAL	92	100.00

AREA (in square meters)	Response	%
0		
1 – 40	4	4.35
41 – 50	3	3.26
51 – 60	4	4.35
61 – 70	0	-
71 – 80	2	2.17
81 – 90	2	2.17
91 – 100	13	14.13
101-200	21	22.83
201-300	22	23.91
301-400	10	10.87
400-	7	7.61
No Response	4	4.35
Total	92	100.00

5. Living and Housing Condition

Water Supply		Response	%
	Water pump	32	34.78
	Deep well	25	27.17
	Artesian well	21	22.83
	Water works system	7	7.61
	No response	7	7.61
	Total	92	100.00

Comfort Rooms		Response	%
	Private	36	39.13
	Conventional	6	6.52
	Public	5	5.43
	No Response	45	48.91
	Total	92	99.99

Electrification		Response	%
	Electric Lights	61	66.30
	No response	28	30.43
	Oil/Lights	2	2.17
	Motor Supply	1	1.09
		92	100.00

Transportation		Response	%
	Tricycle	62	67.39
	Private vehicle	12	13.04
	Jeepney	4	4.35
	Bicycle	1	1.09

House Amenities	Response	%
Television	77	83.70
Gas Range	64	69.57
Karaoke	51	55.43
Washing Machine	33	35.87
Refrigerator	8	8.70
Radio	1	1.09

Recreation	Response	%
Watching TV	73	79.35
Playing Cards	15	16.30
Cock fighting	10	10.87
Watching Movie	7	7.61
Videoke Bars	1	1.09
Pub Houses	1	1.09
Drinking sessions	1	1.09

6. Participation in Relocation Planning

Participation in Relocation Planning		RESPONSE	%
a. Community Level			
	YES	74	80.43
	NO	4	4.35
	No Response	14	15.22
		92	100.00
b. Family			
	YES	52	56.52
	NO	9	9.78
	No Response	31	33.70
		92	100.00
c. Individual			
	YES	41	44.57
	NO	21	22.83
	No Response	30	32.61
		92	100.00

7. Compensation

Is NPC committed for the just compensation of your land property?	RESPONSE	%
YES	68	73.91
NO	9	9.78
NO Response	15	16.30
	92	100.00

Did NPC pay what was agreed upon?	RESPONSE	%
YES	62	67.39
NO	17	18.48
No response	13	14.13
	92	100.00

Did NPC give provisions regarding the agreement on the Relocation Package?		RESPONSE	%
	Yes	67	72.83
	No	21	22.83
	No Response	4	4.35
		92	100.010

Were the provisions and guidelines of the Relocation Package clear to you?		RESPONSE	%
	Yes	50	54.35
	No	35	38.04
	No Response	7	7.61
		92	100.00

Was the NPC able to accomplish all its commitments?		RESPONSE	%
	Yes	62	67.39
	No	26	28.26
	No Response	4	4.35
		92	100.00

8. The money received were invested in the following:

	RESPONSE	%
House and Lot	71	57.26
House amenities	25	20.16
Education	10	8.06
Health	3	2.42
Business	1	0.81
Others	5	4.03

9. Were there any livelihood projects offered?

Were there any livelihood projects offered?	RESPONSE	%
YES	34	36.96
NO	54	58.70
No Response	4	4.35
	92	100.00

If yes :

a. LIVELIHOOD PROJECT :

	RESPONSE
Hog Fattening / Breeding	18
Rag / RTW Sewing	8
Recipient : Tricycle	1
Services	1
Manufacturing	

b. SECTOR THAT SUPPORTS / SUPPORTED THE SAID PROGRAM ?

	RESPONSE
NPC	25
LGU	2
NGO	1
All of these	
Others	

10. Social Relationship

	Before NPC	Present	% change	Before NPC	Present	% change	Before NPC	Present	% change
	+	+		=	=		-	-	
a. Community ties	44	24	(45.45)	10	14	40.00	27	14	(48.15)
b. Environment & sanitation	44	25	(43.18)	11	19	72.73	22	14	(36.36)
c. Peace and order	45	24	(46.67)	10	16	60.00	28	12	(57.14)
d. Political aspect	36	22	(38.89)	17	16	(5.88)	26	21	(19.23)
e. Drug addiction	33	17	(48.48)	3	9	200.00	30	27	(10.00)

11. Satisfaction

Are you satisfied with your present situation?		RESPONSE	%
	Yes	78	84.78
	No	7	7.61
	No response	7	7.61
		92	100.00

ACTION TAKEN

Legend :
0 = no response
1 = ocular inspection
2 = planning stage
3 = implementing stage

DEMAND	ACTION TAKEN			
	3	**2**	**1**	**0**
Electrification	24	7	3	7
Foot Bridge	2	0	0	25
Medical Mission	9	5	2	21
Land Posts	6	4	1	20
Perimeter Fence	5	1	2	26
Roofing	3	1	1	25
Health Center	15	9	3	14
Drainage System	1	6	3	30
Artesian Well	4	0	3	21
Artificial Reef	0	0	2	22
Basketball Court	2	3	1	22
Multi-purpose Center	3	6	0	22
Trash can	0	1	2	28

	Level of Satisfaction				
Electrification	1	2	3	4	5
Foot Bridge	7	3	5	12	3
Medical Mission	8	2	2	11	1
Land Posts	9	2	5	3	4
Perimeter Fence	8	0	3	4	1
Roofing	9	2	1	2	2
Health Center	8	0	1	2	1
Drainage System	6	3	7	3	5
Artesian Well	22	2	3	0	0
Artificial Reef	10	1	1	0	4
Basketball Court	10	0	1	0	0
Multi-purpose Center	9	1	1	1	0
Trash can	9	0	2	1	0
	15	0	0	0	1

12. Do you have any recommendation or specific demand from NPC?
(Multiple answers are possible.)

Recipient Barangay	Quisumbing	San Rafael	Camastilisan	Baclaran	Cawong
No of Respondents					
Public Market		1			
Barangay Hall	3	2	3		
Recreational Facilities		1			
Funds for Livelihood projects	1		1	4	
Garbage Disposal			2		
Medical Mission			3		
Basketball Court	4				
Lights on Posts			4		
Electrification	1	1	3	2	
Employment Opportunity	12		3		1
Regular NPC Job		1	1	1	4
Drainage System	3	2	12	4	
Assistance in Land Titling Processing			5		
Waiting Shed			1		
Health Center	9	2			2
Water System	6	1	1	1	6
Public Toilet	3				
Footbridge	12		1		1
Rip-rap	3				
Road Construction and Rehabilitation	2	2	1	1	
Multi-Purpose Hall	3		1		1
Trash Cans					
Minimize emission of Carbon	2				
Chapel		1			

1.3. Findings based on the Survey and Analysis

1.3.1. A majority of relocatees (74%) responded that they were directly interviewed by the NPC. It is accepted that all relocatees have been consulted based on the compensation that they received. The other relocatees must have forgotten that they were directly consulted and some respondents answered that they were either informed indirectly of the Relocation Package through their barangay officials or their neighbors.

1.3.2. The two major reasons cited for the relocation were land acquisition and environmental conditions.

1.3.3. Regarding Relocation Planning participation on the side of the relocatees, 80% responded that they participated at the community or barangay level, 57% at the family level and 45% on the individual level.Most of the planning consultation was delegated to barangay officials for them to directly and efficiently coordinate with the people.

1.3.4. On the issue of just compensation for land, property, crops and disturbance compensation, 74% answered they were fairly compensated, while 10% responded that they were not. Some respondents answered that they were paid on a staggered basis and that the amount they received were no longer enough to buy building materials for their new homes because the prices of such materials already went up by the time they received their compensation.

1.3.5. About 72% of the respondents confirmed that they were informed of the provisions and agreements of NPC's Relocation Package. Fifty four percent (54%) answered that the provisions and guidelines were clear to them, while 67% responded that the NPC accomplished all its commitments to individual relocatees as stated in the Relocation Package.The main reason behind these findings that not all respondents answered affirmatively regarding being informed is that most of them received the Relocation package information from their barangay officials, and not all provisions were made clear to them at that time.

1.3.6. The income level of the relocatee family heads increased ranging from P3,000 to 8,000 per year, these figures were derived without inflation factored in. In addition to this, family members also helped augment the family income through other forms of employment.

1.3.7. Around 46% of relocatee respondents confirmed that the NPC provided employment opportunities for them. Most of the relocatees were non-skilled or semi-skilled and a majority found work as stevedores in the NPC port. Eighty seven (87) relocatees were hired as regulars in the plant.

1.3.8. Living conditions of relocatees generally improved with regard to basic services being provided or funded by NPC like electricity and water , there was also an improvement in the means of transportation.

1.3.9. On the issue of community level livelihood projects being offered to relocatees, only 37% answered in the affirmative. This is due to the limited facilitation or provision of livelihood projects. Based on an NPC officer's own report, Bgy. Camastilisan was the only relocatee barangay that benefited from the livelihood projects. Other constraints mentioned were the difficulty of coordinating the projects with the relocatees and the loan repayment provision of the livelihood agreement that made the projects not very popular with the relocatees. There is also a lack of proper information dissemination about the projects and the guidelines. It is also important to note that the livelihood projects offered did not fully conform with the needs, interests, capabilities and available resources of the people. Lack of marketing assistance for the finished products also became a major reason for relocatees to abandon the project. Not all relocatees attributed NPC-sponsored livelihood projects to the NPC, although projects were facilitated through the assistance of NPC officers. The LGUs and NGOs were credited for these projects suggesting that there was improper communication on this end.

1.3.10. In general, 85% of the respondents are satisfied with their present situation. This statement is based on the fact that the relocatees find their present living conditions acceptable in terms of the basic services that they are benefiting from like water, electrification, and improved income levels. Their major concern though, are the environmental problems that they feel they are being subjected to.

1.4. Conclusions based on Findings

1.4.1. The Pre-relocation and Actual Relocation phases of the Relocation Program of the NPC achieved their set objectives based on the Memorandum of Agreement (MOA).

1.4.2. The Post-relocation phase was where the major problems were encountered due to lack of coordination and insufficient planning in carrying out the programs for livelihood projects and income generating activities. It is the proponent's view that before any relocation is commenced, all three phases of relocation must be well thought out and planned. Most specially the post-relocation stage, wherein livelihood programs and employment opportunities must be made available. The relocatees must have a source of income to keep them satisfied and happy in their new environment.

1.4.3. The fact that the relocatees were primarily fishermen and farmers, therefore making them non-skilled, presented major constraints on the provision of jobs and employment. This situation relegated them to manual labor like stevedoring which is not enough to support the financial needs of their families because they could not work regularly, the gaps of three month duty, and one and a half month off-duty set-up put strains on their earning capacity.

1.4.4. The livelihood projects implemented were not effectively suited to the needs, capabilities, interests and available resources of the relocatees. The background of the relocatees must have been taken into consideration, coming from fishing and farming communities, better projects more suitable to their experiences and former way of life must be developed.

1.4.5. The majority of relocatees are satisfied with their improved living conditions pertaining to basic services provided to them like electrification, artesian wells, and the different infrastructure projects made possible through the efforts of the NPC.

1.5. Recommendations

Based on the data gathered as well as the analysis made on the Relocation Package of the NPC, the following are the recommended courses of action. It is too late to conduct a "post-

relocation" package, but within a limited time frame, NPC can help relocatees for some skill-building, utilizing DOE-ER 1-94 fund.

1.5.1. Strengthen the multi-partite committee comprised of representatives from the NPC, LGUs (both municipal and barangay level) and the NGOs to study the problems encountered in the development and implementation of livelihood programs within two (2) months.

1.5.2. This multi-partite committee must coordinate with the heads of the relocated families or their representatives so as to better determine income generating projects that would be suited to their needs, interests, capabilities and available resources within two (2) months.

1.5.3. Provide training and seminars for the unemployed non-skilled and semi-skilled relocatees in order to provide more opportunities for them to gain employment in fields that they can get involved in. For example, there is a great demand now for cut-flowers and other alternative high-profit crops that farmers can get into which are relatively less capital intensive.

1.5.4. For most of the older and unemployed relocatees, they feel that it is too late for them to learn new means of generating income and would like to return to their accustomed way of life as farmers and fishermen. The NPC could provide financial assistance in the form of loans to get these relocatees started. The provisions of the loans should be properly explained to them, for instance, that it would be paid after six (6) months without interest. The financial aid could be used to buy seedlings, fertilizers, basic farming or fishing equipment, boats and other materials needed by the relocatees. Although this is not a provision of the MOA to provide financial assistance to farmers and fishermen, it is important to note that livelihood or employment opportunities must be developed for the relocatees. This is what they are good at, and this is what they already know how to do, might as well support them in order to provide a better future for their families.

1.5.5. Enhance the existing Communications and Public Relations Plan of the NPC. This is in order to develop better communication channels with regard to coordinating projects and dissemination of pertinent information on NPC-sponsored projects and activities for community development. This is to effectively inform and update the people of the moves that the NPC is taking to give them a better life.

2. EVALUATION OF THE COMMUNITY DEVELOPMENT PROGRAMS

The second socio-economic condition under the Environmental Compliance Certificate (issued April 1992) for NPC's Batangas Coal Fired Thermal Power Plant (BCFTPP) is to implement provisions in Memorandum of Agreement (MOA and Supplemental MOAs) signed by the NPC, DENR and Calaca Municipality on the livelihood training and support program, social infrastructures, delivery of basic services, employment prioritization and others. Furthermore, in 1994, DOE Energy Regulations 1-94 took effect, which set aside one centavo per kilowatt-hour (KWH) of the total electricity sales for the financial benefits of host communities, such as electrification, livelihood fund, infrastructures and others, which will be referred to in this report as "Community Development Programs."

2.1. Memorandum of Agreement

2.1.1. MOA by and among the Department of Environment and Natural Resources (DENR), Municipality of Calaca, Batangas (LGU), National Power Corporation (NAPOCOR), and the National Economic and Development Authority (NEDA), defining their respective commitments toward the promotion of national and local development with concomitant concern for the protection of the environment and upliftment of social and economic conditions of the people. The MOA has already been signed by the DENR, NEDA, and NAPOCOR. Supplemental Agreements to this MOA were entered into by NPC and Calaca LGU through the new mayor dated September 14, 1992 and March 18, 1993. Napocor honored and implemented all its commitments in the original MOA.

Among the projects carried out under the MOA are:

a) Environmental Improvements for Calaca Complex

b) Setting up of the Environmental Guarantee Fund

c) Environmental Monitoring for Air, Water, Ecology and Socio-Economic Aspects

d) Assistance for Livelihood Projects

e) Infrastructure Support as requested by Barangay Captains

f) Priority for Calaca II employment for Calaca residents

g) NPC's assistance for attracting industries in Calaca

h) Payment of Municipal License and Permits of Contractors

i) On-the-job training of graduates of PUP-Calaca Vocational School in NPC BCFTPP

2.1.2. MOA by and between NAPOCOR and the Barangay Captains of Calaca, Batangas regarding the NAPOCOR socio-economic assistance to the people of Calaca and the concurrence of the said elected officials to the implementation of Calaca II. Out of forty (40) barangay captains, thirty three (33) signed the MOA.

2.1.3. MOA by and between NAPOCOR and the National Electrification Administration (NEA), on the electrification of twelve (12) barangays in Calaca, Batangas. As of March 31, 1993, 321 woodpoles have been delivered, 202 of which have been erected.

2.1.4. MOA by and among the Municipality of Calaca, Batangas, the Department of Public Works and Highways (DPWH) and NAPOCOR, for the installation of potable water supply system for upland barangays particularly Bgy. Tamayo.

The project was completed on May 28, 1992 and turned over to the barangay, June 4, 1992.

2.2. Infrastructure Projects

Included in the request of Calaca leaders from NAPOCOR during the meeting of July 10, 1991 is the assistance in the implementation of infrastructure projects aimed at improving the economic well-being of the local residents. Since then NAPOCOR has carried out infrastructure projects, and by 1993, there was 100% completion of all 1992 projects.

The following infrastructure projects were undertaken:

a) Footbridge construction for the following barangays:

- Poblacion II
- Calantas-Coral ni Lopez

- Bagong Tubig
- Timbain
- Munting Coral
- Laganap-Pantay
- Lumbang na Matanda
- Cahil-Balimbing
- Niyugan
- Coral ni Bacal
- Cawong-Pantay
- Dacanlao-Calumpit
- Taklang Anak

b) Lighting facilities along the coastal areas for Banca mooring for four barangays.

c) Roofing sheets for Bgy. Lumbang na Matanda and Baclas school and Calantas PNP Detachment

d) Waiting shed for Bgy. Quisumbing, Cahil, Laganap-Pantay, Sinisian and Putting Bato East.

e) Construction of school fence for Bgy. Dacanlao, Dila, Calauangan and Putting Kahoy.

f) Roof sheet for Bgy. Tamayo waiting shed

g) Sinisian Barangay Hall and Camastilisan Lighting Facilities construction

h) Bridge repair at Barangay Lumbang na Bato and Salong

i) Construction of School Room and Multi-purpose Center for Bgy. Dacanlao and Lumbang na Calzada, respectively.

2.3. Other Commitments

The following projects were undertaken as other commitments of NAPOCOR to the Calaca Local Government Unit (LGU) under the Community Development Assistance Program:

a) Seedlings for Calaca LGU (6,250 pcs.)

b) Artificial coral reef for four (4) barangays

c) Twenty (20) pcs. of empty drums which are made to 40 pcs. garbage receptacles

d) Junk engines for the local vocational school

e) Free medical/dental mission for six (6) barangays intiated August 1991 (continuing program)

f) Doctors rendering medical services for two (2) barangays initiated August 1991 (continuing program)

g) Payment of Real Estate Tax

h) Assistance in livelihood projects (implementing guidelines for the Community Development Programs have been approved in August 1992 by the NAPOCOR President.

i) Tenant farmers request for additional financial assistance based on 5x average harvest, checks for tenant farmers have been released

j) System in-place for Priority Calaca II Employment for Calaca residents

k) System in-place for NAPOCOR assistance to attract industries to Calaca

l) System in-place for payment of Municipal License and Permits to contractor

m) Program under development for OJT of Graduating PUP-Calaca students

n) The NPC-Municipality of Calaca Scholarship Programs for deserving high school graduates/students from four (4) high schools in the area of Calaca

2.4. Supplemental Agreement No. 1

The following projects were undertaken as Supplemental Agreement No. 1 dated September 14, 1992, between NAPOCOR and the Calaca Local Government Unit (LGU) under the new mayor's development program:

a) Construction of a public market in an amount not exceeding P15 million

b) Provision of materials for the installation of centralized water supply system to Poblacion in the amount not exceeding P2.5 million

c) Installation of individual water supply system for thirteen (13) barangays in an amount not exceeding P3.5 million

d) Construction of covered sports and social court at the town plaza to serve as venue for the youth in an amount not exceeding P2.7 million

e) Concreting of Poblacion main road to Marasigan street with a length of 1.92 kms. in an amount not exceeding P4 million

f) Rehabilitation of Calaca Municipal Hall to check deterioration of structures and provide additional space in an amount not exceeding P2.7 million

g) Livelihood projects in an amount not exceeding P0.5 million for the initial projects and additional amount not exceeding P1.5 million for the subsequent projects

h) Materials for the construction of community hospital in an amount not exceeding P5 million

i) Materials for the construction of vocational school in an amount not exceeding P1.5 million

j) Installation of manually controlled electronic pollution indicator at the Calaca Municipal Building

k) Provision of two (2) sets of cellular phones to the Municipal Government of Calaca

l) Provision of four (4) sets of personal computer and printer to the Municipal Government of Calaca

2.5. Supplemental Agreement No. 2

The following projects were undertaken as Supplemental Agreement No.2 dated March 18, 1993, between NAPOCOR and the Calaca Local Government Unit (LGU) under the new mayor's development program:

a) Cost of construction of the entrance wall of the "Monument of Friendship and Cooperation" between the Municipality of Calaca, Batangas and NAPOCOR in an amount not exceeding P700,000

b) Cost of materials for the completion of the Calaca Multi-purpose Building in the amount not exceeding P1 million.

2.6. DOE Energy Regulations 1-94

The DOE Energy Regulations 1-94 mandates the Batangas Coal-Fired Thermal Power Plant (BCFTPP) as well as other power plants covered by this law to set aside one (1) centavo per kilowatt-hour (KWH) of the total electricity sale for the financial benefits of its host communities. This regulation took effect last June 1994.

The circular mandates that 50% of the financial benefits be set aside for the Reforestation, Watershed Management, Health and/or Environment Enhancement Fund, while 25% shall be set aside for the Electrification Fund. The remaining 25% shall be set aside for the Development and Livelihood Fund.

The Development and Livelihood Fund shall be divided as follows:

30%	-	host region
25%	-	host province
25%	-	host municipality
15%	-	host barangay
5%	-	official relocation site

2.7. Interview to Calaca and Balayan Residents

2.7.1. Methodology

Random interviews were conducted with the residents of barangays in Calaca and Balayan, Batangas. There were around 17 barangays covered, with approximately 10 respondents coming from each barangay. The study had a sample composed of 176 respondents from the barangays in Calaca and Balayan.

2.7.2. Results of Interviews

SURVEY RESULT

No. of Respondents = 176

1. Average Family Size

NO. OF FAMILY MEMBERS	RESPONSE		
Average	**1992***	**PRESENT**	% increase
2	44	23	(47.73)
4	41	51	24.39
6	56	58	3.57
8	16	20	25.00
10	11	15	36.36
12	4	7	75.00
No response	4	2	(50.00)
Total	176	176	

* Based on people's recollection of their situation in 1992

REASON FOR CHANGE OF FAMILY SIZE		
	RESPONSE	%
Married	91	51.70
Fertility	35	19.89
Merging	19	10.80
Mortality	10	5.68
Migration	1	0.57
No Response	20	11.36
	176	100.00

2. Educational Background

	Undergraduate	%	Graduate	%
Primary	266	25.85	88	8.55
Secondary	154	14.97	201	19.53
Vocational	48	4.66	34	3.30
Tertiary	74	7.19	164	15.94
TOTAL	542	52.67	487	47.33
% was based on total No. of graduate & undergraduate listed = 1029				

3. Employment and Income Level

a. Head of the Family

HEAD OF THE FAMILY			
Employment	RESPONSE		
	1992	**PRESENT**	**%**
Self-employed	73	79	8.22
Services	19	28	47.37
Manufacturing	7	13	85.71
Fisherman	6	5	(16.67)
No work	9	27	200.00
No Response	62	24	(61.29)
Total	2168	176	

INCOME LEVEL HEAD OF THE FAMILY	**1992**	**PRESENT**	**%**
0 – 1000	27	22	(18.52)
1001 – 2000	30	17	(43.33)
2001 – 3000	23	20	(13.04)
3001 – 4000	17	16	(5.88)
4001 – 5000	15	19	26.67
5001 – 6000	9	16	77.78
6001 – 7000	11	10	(9.09)
7001 – 8000	16	28	75.00
8001 - up	9	9	-
No Response	19	19	-
Total	2168	176	

Was there job opportunity given by the NPC?		Response	%
	Yes	28	15.91
	No	132	75.00
	No Response	16	9.09
		176	100.00

Job descriptions:		Response	%
	Helper	9	5.11
	Stevedore	4	2.27
	NPC (mechanics,etc.)	13	7.39
	No Response	2	1.14
	Total	28	15.91

Job level of satisfaction			%
	Poor	0	0
	Unsatisfactory	2	7.14
	Satisfactory	8	28.57
	Very Satisfactory	8	28.57
	Excellent	7	25.00
	No response	3	10.71
	Total	28	100.00

b. Other Family Members

Employment	Response		
	1992	PRESENT	%
Self-employed	82	79	(3.66)
Services	24	26	8.33
Manufacturing	8	13	62.50
Not applicable	6	9	50.00
No Response	56	49	(12.50)
	2168	176	

INCOME LEVEL	1992	PRESENT	% INCREASE
0 – 1000	24	8	(66.67)
1001 – 2000	22	13	(40.91)
2001 – 3000	19	14	(26.32)
3001 – 4000	14	12	(14.29)
4001 – 5000	20	17	(15.00)
5001 – 6000	7	5	(28.57)
6001 – 7000	7	8	14.29
7001 – 8000	5	10	100.00
8001 – UP	9	21	133.33

c. Total Family Income

INCOME LEVEL	1992	PRESENT	% INCREASE
0 – 1000	20	6	(70.00)
1001 – 2000	18	11	(38.89)
2001 – 3000	17	9	(47.06)
3001 – 4000	16	17	6.25
4001 – 5000	9	12	33.33
5001 – 6000	12	12	-
6001 – 7000	17	12	(29.41)
7001 – 8000	19	14	(26.32)
8001 – UP	28	69	146.43

4. Family Expenses:

Range	1992	PRESENT	% INCREASE
0 – 1000	24	12	(50)
1001 – 2000	22	10	(55)
2001 – 3000	16	28	75
3001 – 4000	6	19	217
4001 – 5000	4	10	150
5001 – 6000	9	21	133
6001 – 7000	3	3	0
7001 – 8000	13	6	(54)
8001 – UP	23	47	104
No Response	56	20	(64)
	2168	176	

5. Land

Land Property		Response	%
	Owned	104	59.09
	Lease	7	3.98
	Donated	12	6.82
	Government Owned	5	2.84
	Own by relatives	24	13.64
	Tenants	1	0.57
	No Response	23	13.07
		176	

AREA (in square meters)	1992	PRESENT	%
0	3	1	(66.67)
1 – 40	10	14	40.00
41 – 50	8	8	-
51 – 60	10	11	10.00
61 – 70	8	9	12.50
71 – 80	12	11	(8.33)
81 – 90	10	15	50.00
91 – 100	12	12	-
101-200	16	19	18.75
201-300	14	17	21.43
301-400	4	7	75.00
401 - 500	8	11	37.50
501 – UP	13	12	(7.69)
No Response	48	29	(39.58)
	2168	176	

6. Housing Condition

Water Supply		1992	PRESENT	
	Artesian well	86	77	(10.47)
	Deep well	37	7	(81.08)
	Water pump	23	27	17.39
	Water works system	16	57	256.25

Comfort Rooms		1992	PRESENT	%
	Public	7	6	(14.29)
	Private	143	157	9.79
	Conventional	10	3	(70.00)

Electrification		1992	PRESENT	
	Oil/Lights	64	1	(98.44)
	Electric Lights	100	164	64.00
	Motor Supply	1	2	100.00

Transportation Available in the Area		1992	PRESENT	%
	Tricycle	107	74	(30.84)
	Bicycle	111	132	18.92
	Jeepney	121	150	23.97
	Private vehicle	66	115	74.24

House Amenities	1992	PRESENT	%
Television	90	146	62.22
Washing Machine	13	73	461.54
Karaoke	14	85	507.14
Gas Range	39	87	123.08
Refrigerator	41	105	156.10
Radio	91	121	32.97

Recreation	1992	PRESENT	%
Watching TV	99	130	31.31
Playing Cards	37	51	37.84
Cock fighting	26	30	15.38
Watching Movie	32	49	53.13
Videoke Bars	5	35	600.00
Pub Houses	4	13	225.00
Drinking sessions	41	64	56.10

7. Participation in Project Planning

Participation in NPC Project Planning		RESPONSE	%
a. Community Level			
	Yes	31	17.61
	No	108	61.36
	No response	37	21.02
	Total	176	100.00
b. Family			
	Yes	8	4.55
	No	132	75.00
	No response	36	20.45
	Total	176	100.00
			-
c. Individual	Yes	8	4.55
	No	133	75.57
	No response	35	19.89
	Total	176	100.00

8. NPC Supported Projects

NPC supported project present in the area?	Level of satisfaction				
	1	2	3	4	5
Electrification	2	5	35	57	26
Foot Bridge	22	11	6	9	3
Medical Mission	25	13	9	11	13
Land Posts	25	6	6	15	5
Perimeter Fence	19	2	6	7	2
Roofing	21	3	6	2	
Health Center	23	16	18	13	7
Drainage System	26	16	6	5	3
Artesian Well	32	8	4	7	1
Artificial Reef	18	2	4	3	1
Basketball Court	28	6	9	10	4
Multi-purpose Center	25	8	8	7	8
Trash can	21	7	12	120	6

Level of Satisfaction: 1 – poor 2 - unsatisfactory 3 – satisfactory 4 – very satisfactory 5 - excellent

9. Livelihood Projects

Were there any livelihood projects initiated or implemented through the help of NPC?	RESPONSE	%
YES	24	13.64
NO	123	69.89
No Response	29	16.48
Total	176	100.00

If yes :

a. LIVELIHOOD PROJECT :

	RESPONSE	%
Hog Fattening / Breeding	5*	21
Rag / RTW Sewing	6*	25
Recipient : Tricycle	3*	13
Services	8*	33
Manufacturing	5*	21
	0	

b. SECTOR THAT SUPPORTS THE SAID PROGRAM ?

	RESPONSE	%
NPC	11*	46
LGU	10*	42
NGO	6*	25

*Based on 24 respondents who answered yes for the livelihood offered by NPC

10. Social Relationship

	92	98	% increase	92	98	% increase	92	98	% increase
	+	+		=	=		-	-	
a. Community ties	75	81		44	39		10	9	
b. Environment & sanitation	76	75		45	38		12	14	
c. Peace and order	90	86		41	38		3	5	
d. Political aspect	74	81		49	39		10	11	
e. Drug addiction	58	68		37	28		29	25	

11. Satisfaction

Are you satisfied with your present situation?		RESPONSE	%
	Yes	99	56.25
	No	32	18.18
	No Response	45	25.57
		176	100.00

12. Perception towards NPC

Was NPC able to accomplish all its commitments?		RESPONSE	%
	Yes	45	25.57
	No	83	47.16
	No response	48	27.27
	Total	176	100.00

Is there any POSITIVE effect caused NPC?	
Job opportunity	40
Electricity	29
Water	1
Barangay development	7
Higher standard of living	7
Better services	20
No response	72

Is there any NEGATIVE effect caused by NPC?	
Air Pollution	77
Water Pollution	41
Noise	10
Health (sickness)	8
Effect on plants (environmental effect)	9
Poor Electric services	3
Nepotism	2
No response	26

Do you have any specific request or recommendation from NPC?	
Better electric service	9
More livelihood projects	15
More job opportunities	45
Barangay development	11
Drainage	1
Light posts	1
Consider the health of the people	1
Nepotism	2
Free Electricity	4
Anti pollution devices	9
No more additional Power Plants (no additional phase)	1
Transfer of NPC to MERALCO	1
No response	76

13. What changes, issues, problems and opportunities do you expect from NPC in the next five years ?

a. Changes :

Job	20
Services	15
Reclamation	1
Unaware	6
Barangay development	12
Fishing aid	2
Additional NPC Phase	5
Air Pollution	4
Higher Salary rate	1
Livelihood	2
Devices for anti-pollution	6
Water pollution	1
Health condition	2
No response	99

b. Issues

Air Pollution	28
Water Pollution	17
Electricity	7
Noise Pollution	2
Health	1
Unaware	1
Employment	2
Privatization	7
Additional NPC Phase 3	2
Livelihood development project	3
Nepotism	7
No response	99

c. Problems

Water Pollution	42
Air pollution	53
Poor Health	5
Unaware	1
Environment	4
Relocation	2
Electric Service	1
Employment	5
Electricity	1
Nepotism	1
Safety	2
No response	59

d. Opportunities

Job	87
Services	3
Unaware	1
Development	2
Scholarship	1
Livelihood	8
No response	74

2.8. Findings Based on Survey

2.8.1. The NPC has contributed a substantial amount of P78,337,000 as of October 1998 for the accomplishment of the provision of the MOA, Supplemental MOAs, DOE-ER 1-94 and other commitments to the municipal governments of Calaca and Balayan.

2.8.2. The NPC has set up systems to implement and monitor its public acceptance programs as directed by the government agencies like the DOE and DENR/EMB through multi-partite monitoring groups.

2.8.3. There was a 75% increase in the income level of family heads surveyed, and the significant income changes recorded ranged between P5,000 to P8,000.

2.8.4. Employment in manufacturing increased by 86%, and the rate of unemployment of family heads was recorded to have increased 200%.

2.8.5. On the issue of NPC offering jobs to the members of the community, 75% of respondents answered negatively, while 16% answered positively.

2.8.6. Income level of other family members increased significantly, wherein 63% gained employment in manufacturing. These manufacturing activities are in factories not related to the operation of NPC BCFTPP.

2.8.7. The respondents' total family income went up by 146%.

2.8.8. General living conditions of respondents were reported to have greatly improved in terms of basic services like electrification, water supply and availability of transportation.

2.8.9. On the issue of the respondents' participating in NPC project planning for community development on the community, family and individual level, majority of them answered negatively.

2.8.10. Most of the respondents answered that they were not fully satisfied with NPC supported projects that are present in their communities.

2.8.11. Respondent awareness with regard to NPC assisted livelihood projects was minimal, with 14% of the respondents answering that they did not have any knowledge of such projects and these respondents came from San Rafael through their organization called SAHARA.

2.8.12. On the positive effects of the NPC on the community, respondents significantly cited factors like the availability of job opportunities through industries that the power plant attracted to operate in their communities, electrification, and availability of better community services like water and infrastructure.

2.8.13. On the negative effects of the NPC on the community, the major concern of majority of the respondents was on air, water and noise pollution due to vibrations during the power plant's machine start-ups.

2.9. Conclusions based on Survey Findings and Analysis

2.9.1. Majority of the respondents are not aware that most of the improvements in their barangay or community were funded or initiated and implemented by the NPC based on the MOA, Supplemental MOA and DOE 1-94. The reason behind this is that the people perceive and attribute improvements like in infrastructure and water to the LGUs, NGO and organizations like Batelec. These organizations' participation in the development projects left a marked impression on the people.

2.9.2. The increase in income levels of the family heads and other family members in the community contributed largely to the significant improvements in their standard of living.Due to the increase in the number of unemployed family heads, the other family members sought employment in order to help augment the family income.

2.9.3. Job opportunities offered by NPC were limited in scope wherein not all barangays were covered and most of the people in the community were basically non-skilled laborers who could not qualify to work in the power plant. According to the documents furnished by NPC that showed the geographical distribution of personnel hired by the power plant as of July 30, 1998, 175 were hired from Calaca, 117 employees come from within Batangas and 128 employees are from Manila and nearby suburbs. This breakdown does explicitly show employees hired from the barangays of Balayan which also form part of the area of the NPC BCFTPP.

2.9.4. There was lack of proper information dissemination as evidenced by the insufficient awareness of the people about NPC-sponsored community development projects and employment opportunities.

2.9.5. At present, the major concerns of the people on their health due to air, water and noise pollution were perceived to be caused by the NPC BCFTPP operations.

2.9.6. Better living conditions brought about by basic services like electrification, efficient water supply and infrastructure developments are the positive effects of the NPC to the community.

2.9.7. There is a need for the NPC to develop more appropriate livelihood opportunities to assist the members of the community to be independent and self-reliant. These income generating projects must be based on the skills, capabilities, interests and available resources of the people. There have been projects launched in certain barangays in Balayan, and the proponent believes that this is a good start and more of such projects must be carried out to reach more community members.

Basing the analysis on the Stairway of Development, shown and explained in detail below, the NPC and the multi-partite committee have to devise a system that would fully maximize the skills and know-how of the people in order to empower them through meaningful and effective development projects. There are four (4) major components of this model, namely: awareness, participation, skills & capability and access & control of resources which are needed for successful development. As mentioned earlier, limited awareness is prevalent in the people, which leads to poor or lack of participation. When an objective is not fully explained to the people, they could not be expected to support nor effectively cooperate in the attainment of the said objective. Another limitation noted by the proponent is in Skills and Capability expansion stage of the program implementation. Aside from its limited scope in terms of participants, there was also a mismatch between the skills training provided and the interests of and resources available to the people. Hence, the inadequacy resulting from the community development programs.

It should further be noted that this is very unfortunate since the NPC has invested huge amounts of money in order to assist the people in uplifting their standards of living through development and empowerment and yet the perception of the people is that the NPC is not doing its best to improve their lives. This must be corrected to give credit where credit is due.

STAIRWAY MODEL FOR DEVELOPMENT

A Model For Development

The Stairway Model for Development is a framework that establishes the steps needed to liberate a community from relative mediocrity to a successful, self-determined and empowered positive contributors to national development. All components (awareness, participation, skills & capability and access & control of resources) are needed for successful development. Champions responsible for each level are identified, given the mandate and support of the group. Positive indicators are listed on the rise before each landing while the wedges or obstacles to development are partially listed in the right hand side of the reader.

There are at least four levels in the move towards true empowerment and development. These are:

AWARENESS : There is no demand for an unknown product. Most people who take things for granted simply do not appreciate things. Nature is one such item. It provides for us so consistently that we often take it for granted. Training is another. Learning skills for gainful employment requires awareness and the desire to succeed. Dealing with adult learners requires special attention to their needs.

PARTICIPATION : There can be non-conscious participation where there is no awareness of the situation. To a large extent, learners must be first made aware of the basic knowledge inherent in them. Practical home grown situations and cases make the best examples for applied learning. This must be needed by the consumer of labor, service or product. Without awareness there in no interest. Without participation, there is no learning.

SKILLS & CAPABILITY BUILDING : Many people wish to participate in projects that have social significance, environmental projects are no different. Saving the coastline, its waters and land is always a good endeavor which no one will argue against. Everybody likes it, but it is rarely anybody's top priority. Any management situation will require specific skills that would make a

potential environmentalist a good and efficient one. Thus, it is necessary to develop their skills and capabilities. This means that conceptual, human and technical skills must have a level of competence in order to be effective in communicating situations. planning strategies and deciphering data. Again, it is important that the skill to be learned is what the industry or consumer needs.

ACCESS & CONTROL OF RESOURCES: Even the best trained people will have little use for their newly found skills if the equipment that is required to maximize the use of these skills are not available. Furthermore, prolonged under utilization of skills that were newly learned will result in significant deterioration of these skills. What you don't use, you lose. Participants in the training must not be deprived of the chance of using their newly developed skills. Trainers will have to resist the natural tendency to solve the problems for their students. They must be there to guide and facilitate but minimize direct interventions,

When all 4 levels (Awareness, Participation, Skill and Capability Building, and Access & Control of Resources) have been attained, development evolves and places the participant in an empowered state living and learning. This should be the vision of NPC with regard to the relocatees. Their plight must be better than the situation that they left.

2.10. Recommendations

2.10.1. Proper coordination must be done among the NPC, LGU (both at the municipal and barangay level), and NGOs through the multi-partite committee. This committee is not only for monitoring the progress of community development programs, but more importantly, to ascertain the needs and wants of the people in the communities of Calaca and Balayan so as to come up with comprehensive and suitable development projects.

2.10.2. Develop skills training programs and seminars to assist the non-skilled community members to secure employment or get involved in livelihood programs based on their capabilities. This could be done after an analysis of the flaws of the former system based on the Stairway of Development framework. The support of the multi-partite committee will play a major role in this aspect.

2.10.3. Set-up effective channels of communication through proper coordination with the various agencies, LGUs, NGOs and the NPC. A major stumbling block in the implementation of projects is lack of communication. The respondent survey results, without a doubt, show that they are not properly informed of the existence of projects, or on the other hand, they are not interested to participate because they feel that the projects are not suitable to them. Proper information dissemination is a key to the effectual implementation of development projects.

2.10.4. Focus on development projects that community members consider to be of high value like education, pollution control, health programs, meaningful employment and livelihood projects. It is the proponent's suggestion that in terms of education, the NPC can offer scholarships to deserving youth of the community. The NPC Centrum has been set-up and is on-going but on a very limited scale. Since rural Filipinos consider education to be of utmost importance, the NPC must capitalize on this.

Based on the results of the survey, a major concern in the communities of Calaca and Balayan is pollution control and provision of health programs and facilities. The people need more concrete solutions to the noise, air and water pollution that they feel they are subjected to by the NPC BCFTPP operations. Aside from medical missions and pollution control devices, an information campaign can also be used to better educate the people about how to prevent sickness and disease from spreading. The better services provided by the NPC in terms of clean drinking water and electrification are welcome improvements, but there is still a need for effective ways of disease prevention. A dialogue with the people may also be helpful for the NPC to calm the people's fears and determine better ways to assist the community members. This would lead to better public acceptance of the power plant's operations.

2.10.5. Develop a team that would monitor the projects, check the use of funds/financial assistance and assess the results of the project implementation from an objective standpoint. This is to ascertain that the goals and key targets of each project are met.

3. Evaluation of the Environment and Health

3.1. Factual Contents

In order to pave the way for the total public acceptance of the NPC BCFTPP operations in the municipalities of Calaca and Balayan in Batangas, a comprehensive program to protect and monitor the environment as well as safeguard the health of the people is imperative.

In the 1990s, prior to the construction and operation of Calaca II, the NPC, DENR/EMB, NGOs, the local government units of Calaca and Balayan and the NEDA agreed to the creation of a multi-sectoral group to monitor the operations of Calaca I and its effects extensively, particularly on the environment and health of the people living in the area. The monitoring covered Air Quality in several barangays in hourly/24 hour duration for SO2/SPM (Suspended Particulate Matter), ground water quality for National Standard for Drinking Water (NSDW) compliance, fish catch, mortality/morbidity rates, pulmonary function tests, and interview of resettlers in Quisumbing.

Since early 1991, NPC has developed its own environmental control program that has been implemented in the plant. The following environmental pollution items were treated in depth:

a) Coal Dust Emission

b) Odor due to Spontaneous Combustion

c) Sea Water Intrusion

d) Management of Coal Storage

e) Sulfur Dioxides

f) Particulate Emissions

g) Noise

h) Upgrading of environmental monitoring system and its proper operation

According to the Status Report No. EIP 060 dated 2 March 1998, the following projects have been undertaken:

a) Installation of Continuous Screw-type Unloader

b) Installation of Windbreak Fence

c) Upgrading of Eletrostatic Precipitator

d) Reinforcement of Environmental Monitoring System

e) Portable Temperature Monitoring System for Coal Stockpiles

f) Study the modification/Upgrading of existing Unit I, Coal and Ash Handling Equipment/System

g) Coal Dust Suppression System (Installation of Water Spray System)

h) Retrofit of Economizer Ash Handling System

i) Installation of Silencer

In spite of all these environmental protection measures and devices set up by the NPC, there is still a prevailing sentiment among the people of Calaca and Balayan that the NPC is not doing its best to protect the environment and their health.

Based on data gathered, both primary and secondary, as well as interviews done with the respondents and other local residents, there have been numerous allegations of environmental violations resulting the NPC BCFTPP operations. The proponent started gathering statistical reports from the Rural Health Units in the area to further investigate said allegations.

3.2. Methodology

Both the positive and negative effects of the NPC BCFTPP operations on the lives of the people were asked in the survey. It was clear that the major concern of the people was on environment and health. The proponent decided to do an ocular inspection of the supposed environmental hazards posed by the NPC BCFTPP operations in Calaca and Balayan. Pictures were taken in the process. Most notably, the residents in the area cited the following:

a) The Twin Smokestacks

b) The Hot Water Discharge

c) The Noise and Vibrations emanating from the Plant

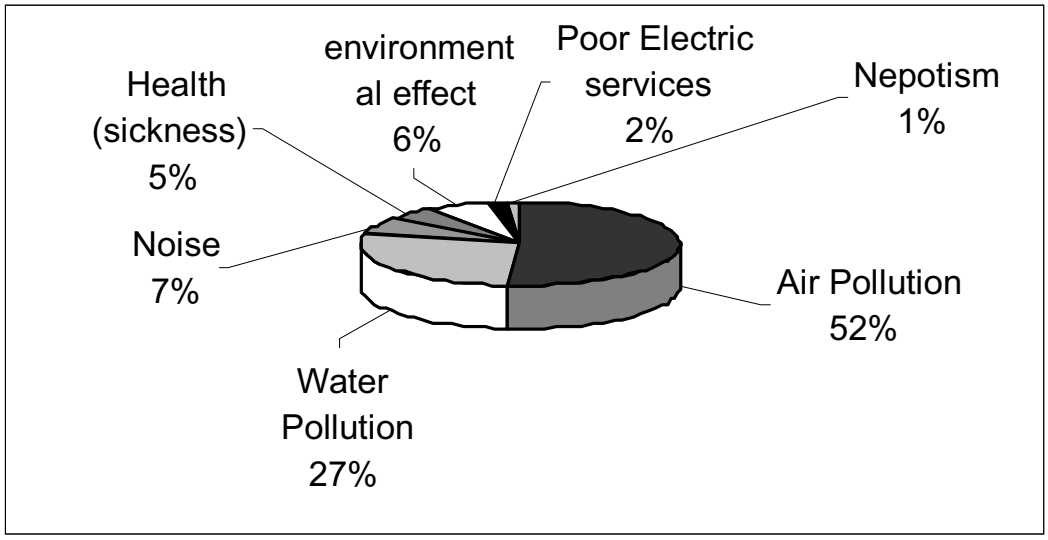
d) The Airborne Coal Particulates coming from the Plant

Although the multipartite monitoring report shows that the quality of air, water and noise meet the standard, it is a serious problem if people perceive that the pollution still exists.

The proponent also gathered data from the regional health units in the area. The records of the Regional Health Unit II (RHU II) of Balayan composed of seventeen (17) barangays were reviewed. The RHU II is responsible for monitoring the health condition of people residing in the area of the NPC BCFTPP, it showed that the leading sickness that afflicts the people in the vicinity is Upper Respiratory Tract Infection (URTI). Although there is no verification made for those data, and the specific reason for the increase is not found yet, this is quite alarming in the sense that the people may attribute this to the plant's operations and its effluents. The poster seen below is publicly displayed at the Rural Health Unit office and it shows that Upper Respiratory Tract Infection has the highest rate of incidence in the area. It is important to conduct a further study to clarify the reason for the high incidence of URTI. Such study will contribute to the improvement of health in the community.

3.3. Findings and Analysis

3.3.1. The following pie-chart shows the answers by the respondents to the question "Is there any NEGATIVE effect caused by NPC?" It is notably clear that the majority of respondents cited air pollution, followed by water pollution and noise pollution.



3.3.2. As to the negative effect brought about by the plant's operations, 97% responded that the NPC caused pollution and other negative environment related effects. This is a very important fact to consider on the part of NPC. Regardless of whether or not the plant is causing pollution and sickness in the area, the people's perception and belief is going to hinder NPC's total acceptance by the public.

3.3.3. As a provider of a basic service which is electricity, NPC is subject to pressures from various groups. These are the formal and informal stakeholders of the NPC. Among them are the National government, the local government, the NGOs, the JBIC, and the people of Calaca and Balayan.

3.3.4. The change in government leaders both national and local, as well as privatization moves for government-owned corporations should also be taken into consideration. If the provisions of the MOA, Supplemental MOA, DOE – ER 1-94 and other agreements entered into by the NPC, with regard to environmental protection of the area and health of the people, will not be followed satisfactorily by new owner(s), this can create another problem for NPC as well as the government of the Philippines.

3.3.5. NPC has invested millions of pesos in physical infrastructure leading towards environmental and health protection, but the people still perceive the moves done by the NPC as inadequate.

3.4. Recommendations

3.4.1. It will be beneficial for the NPC to make use of Social Marketing techniques.

Social Marketing is the incorporation and application of social and environmental concerns into an organization's marketing strategy in order to improve society. Social marketing techniques include activities like providing or funding health services, employment generation for people in the nearby communities, recycling of wastes and pollution control. (Marketing Management, G. David Hughes, Addison Wesley Publishing Company, 1990).

Social Marketing techniques include activities like providing or funding health services, employment generation for people in the nearby communities, recycling of wastes and pollution control. NPC is suggested to analyze the problems encountered in these areas so as to come up with effective programs that would truly benefit the people. Eventually, this will lead to a better appreciation of the efforts of NPC to assist the people in improving their standards of living.

The requirements based on ECC, MOAs , DOE-ER 1-94 are all followed by NPC. Most of the respondents in the survey, however, feel that NPC is not doing much for the community in terms of protecting the environment or putting up of facilities to prevent air, noise and water pollution . The reason behind this is the lack of visible or concrete representation of the NPC in programs for environmental protection or health programs. The NGOs and the LGUs are the ones who take credit for most of these projects, thus, leading to the people's perception that the NPC is not fully protecting them from the ill effects of the plant's operations.

3.4.2. Proper information campaigns must be launched with regard to medical missions and health programs sponsored by the NPC. The medical missions are still being carried out by the NPC once every two (2) months.

The NPC has given financial assistance to the barangays and municipalities of Calaca and Balayan that led to the construction and operation of numerous health centers as well as funding medical missions.

The proponent followed up on the medical mission and based on the interviews with NPC representatives, the programs for the mission were followed. The people on the other hand, did not attribute the medical mission and the positive contributions of the mission directly to the NPC, but rather perceive these medical missions as projects of the LGU and the NGOs.

3.4.3. Foster more active involvement from the people of the community on environmental protection and health matters.

This can be done through programs that will educate the people on how to protect the environment at the barangay level, and also on how to prevent their families from contracting diseases and spreading them. This will guide and empower the people instead of always blaming the NPC. In this way, their participation and vigilance will be enhanced.

3.4.4. Set-up measures to effectively monitor adverse environmental impacts and contingency plans in order to inform the people of what to do in case of emergencies like the spontaneous coal combustion that happened in the past.

It is imperative that people in the community know how to react in the face of certain environmentally dangerous situations. The primary concern are for the children of the community. It is not suggested here that another situation like the one mentioned above will happen again, but it important that contingency measures be in-place before it happens. The NPC must be pro-active and not reactive to certain problems that may arise in the future.

① Calaca Coal-fired Thermal Power Plant (a complete view)

② 20m-high Windbreak Fence construction at the east and west side of the coal stockyard (one component of “Calaca I Coal-fired Thermal Power Plant Environmental Improvement Project”)

③ Air quality monitoring conducted by Multipartite Monitoring Team