【参考６　Thermal Power Plant Repowering Project in Thailand
Project Design Document】

Project Design Document

for

Thermal Power Plant Repowering Project in Thailand

February 2003

CONTENTS

A. General description of project activity

A.1 Title of the project activity

Y Thermal Power Plant Repowering Project.

A.2 Description of the project activity:

Outline of the Project

The Y Power Plant is the largest power plant in Thailand. It has total output capacity of 3,680MW. This output accounts more than 20% of the total electric power output capacity of Thailand. Both of its unit #1 and unit #2 each has an output of 550MW and they went into operation in 1983 and 1984, respectively.

The amount of power generation to be produced in the next ten years is predicted to increase at the annual rate of 6.52%. Based on this rate of growth, the amount of power generation produced in fiscal year 2011 will reach 194,930GWh. Therefore, in addition to the aim of increasing ability to compete and raising the power plant efficiency, there will be a necessity for the Y #1 and #2 power plants to increase output from 550MW to 700MW. Thus, another implicit merit of the Repowering Project is that this plan will also play an important part in the Thai government plan for further developing electric power capabilities

The purpose of the project is to repower the existing units at Y Power Plant to improve the efficiency of their electricity production, and allow them to meet part of the growth in demand for electricity in Thailand. This will assist sustainable development in Thailand by increasing the amount of available electricity whilst minimizing the increase in fuel consumption, thus contributing towards economic growth at minimal environmental cost.

The reason that the Y Power Plant unit #1 and unit #2 have been selected as targets for repowering is that they have just the right capacity for the use of 200MW class maximum capacity, maximum efficiency gas turbines.

For repowering system options, the following system was selected;

Fully fired combined cycle system

Regarding the fully fired combined cycle system, it has a very high level of efficiency and the required equipment costs are relatively less expensive so that this system can be said to be superior in terms of cost.

Probability of Diffusion of the Project Technology

The plants in Thailand that fill the conditions for possible further introduction of the Project technology are as follow:

- Plants for which ten years have passed since initial completion of the facilities.
- Plants for which facilities for the supply of natural gas already exist, or for which such facilities are scheduled for construction in the future.
- Thermal power plants

In the case of power plants located in Thailand, there are 12 plants that meet this criterion. They have a total output capacity of 3867.5MW. Thus, there exists the possibility that these plants may become candidates for similar repowering projects.

Based on the calculation result of this Repowering Project, the total emission reduction is as follows;

920,378t・CO_2/year

A.3 Project participants:

Project company

(1) J Co., LTD.
Japan

(2) B POWER COMPANY
Thailand

A.4 Technical description of the project activity:

A.4.1 Location of the project activity:

A.4.1.1 Host country Party(ies): Thailand

A.4.2 Category(ies) of project activity

At the time of writing this PDD, there was no list of approved project categories made available on the UNFCCC website. As an alternative, the project categories provided in the Simplified Modalities and Procedures for CDM Small-scale Project Activities[26] were referred to, and "Supply-side energy efficiency improvements – generation" was chosen as the most appropriate.

A.4.3 Technology to be employed by the project activity:

1) Fully Fired Gas Turbine Combined Cycle Plant is new technology in Thailand.

2) Technical Ability

B POWER COMPANY has built many electric power plants in the past, beginning with first-stage engineering and has long experience in many different related aspects of such projects, including such items as supervision of construction and supervision of on-site safety. In addition, in the area of rebuilding and improving existing plants, it has carried out such tasks as moving gas turbines.

In addition, it is carrying out ample management in such areas as keeping detailed operation and maintenance records, including efficiency of main equipment and plant efficiency.

The current repowering plan that is the subject of this report includes removal of existing equipment except of steam turbine generator units or their renovation and the introduction of gas turbines. Therefore, based on the pool of experience and actual performance that B POWER COMPANY has built in the past, it is safe to say that the company has ample ability to carry out the Project.

The design concept of Fully Fired Gas Turbine Combined Cycle Plant is different from that of general gas turbine combined cycle plant, that is, a gas

[26]Draft Simplified Modalities and Procedures for Small-scale CDM Project Activities, UNFCCC, http://unfccc.int/cdm/ssc.htm

turbine is installed in place of a F. D. F. and high temperature gas turbine exhaust is fed directly into a boiler, which effectively utilizes the calorific value of the gas turbine exhaust.

Fully Fired Gas Turbine Combined Cycle Plant shall bring the following new technology.

・Modification of Existing Boiler such as heating surface, burner and windbox
・Installation of Heat Exchanger such as a Duct Evaporator and H.P/L.P Stack Gas
Coolers
・Removal of an Air Heater and a Forced Draft Fan

In accordance with an addition of such new technologies, the following additional skills are required to B POWER COMPANY's employees;

・the skill of operations (especially at the time of start-up and shut-down)
・the skill of the managing replacement for many kinds of Heat Exchangers besides
Gas Turbine Hot Parts at every inspections

As mentioned below, it can be said that B POWER COMPANY's employees already have basic skills and technical knowledge/experiences for operations.

Level of Ability to Adequately Staff the Project

B POWER COMPANY headquarters staff and the personnel of all power plants consist of about 30,000 persons. The total work force of the Y Power Station is 1,400 persons, of which 1,000 are involved in operations and maintenance. The plant's extensive management systems cover all aspects of operations down to, and including, inventories of parts, storage facilities for tools and on-site maintenance facilities. In addition, many members of the company's staff have experience of construction project planning, supervising and executing gained during the 1980s and 1990s. In the current situation where the amount of electric power supplied by IPPs and SPPs is growing, the number of new power plants that are being constructed has dropped off so that there exists an adequate number of staff personnel capable of handling the Project that is the subject of this report.

Level of Company Systems Needed for Executing the Project

In the event that this Project reaches the stage of actual execution, this will mean the introduction of new gas turbines. However, there are four combined cycle system operations at the Y Power Station so that the plant personnel have a large amount of experiences with this type of system. Thus, it is through that it will be possible for the related staff to carry out the repowering project construction and installation work (including inauguration of the project office) in a relatively short time.

Through its construction period and its training period, B POWER COMPANY's engineers, who are already skilled, can learn all skills required for this power station after repowering.

In order for B POWER COMPANY's employees to acquire the advanced skills for the above new technology, the following methods of technical transfer should be applied.

・On-the-Job training during the trial operation period
・Technical lectures, if necessary

A.4.4 Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed CDM project activity, including why the emission reductions would not occur in the absence of the proposed project activity, taking into account national and/or sectoral policies and circumstances:

The project, involving repowering units 1 and 2 of the existing Y power station to a combined cycle system, will result in a significant increase in efficiency for that plant, from 38% to 47.6%. With the increase in overall efficiency for units 1 and 2, the plant will be able to provide additional electricity equivalent to the electricity capacity increased by some adjustments of operation by the existing power plants within the same grid or newly constructed more large-scale power plant. Furthermore, the repowering will result in significant reduction of GHGs.

As identified in B.4, the repowering project is not given the priority in PDP compared to the more advanced large-scale power plant. Without CER revenue, this repowering project is unlikely to proceed.

The total emission reduction to be achieved by the project activity was estimated at 920,378. tonnes CO2 equivalent per year.

A.4.5 Public funding of the project activity

We will not receive ODA for the development of repowering project.

B. Baseline methodology

B.1 Title and reference of the methodology applied to the project activity

At the time of writing this PDD, there was no list of approved methodologies available on the UNFCCC website. The baseline methodology was instead selected in line with an approach recognised in the Marrakesh Accords.

Of the three approaches given in the Accords, the approach that gives a baseline representing "emissions from a technology that represents an economically attractive course of action, taking into account barriers to investment" – 48(b) – was selected.

B.2 Justification of the choice of methodology and why it is applicable to the project activity

There is currently a growing demand for electricity in Thailand. The project proposes to provide for 300MW of this demand through repowering. In order to determine what will happen in the absence of the proposed CDM project – i.e. the baseline scenario – it is assumed that in the absence of incentives or constraints to do otherwise, B POWER COMPANY will most likely choose the most financially viable alternative to meet the required capacity increase. Therefore, a methodology that applies an interpretation of 48(b) of the Marrakesh Accords is the most appropriate for this project.

B.3 Description of how the methodology is applied in the context of the project activity

According to the latest "Power Development Plan (PDP)" in Thailand, this repowering project for Y Power Plant have not been scheduled yet. And also there is no plan to construct 150MW class new power plant, which is equivalent to the increased capacity in this repowering project, at this stage.
On the other hand, it is expected that electricity demands in Thailand keep increasing for long period taking the economic growth in Thailand into account. Under such circumstances, PDP seems to indicate that new project for large sized thermal power plant are mainly scheduled in order to meet the electricity demand in the future.
Therefore, there is little possibility that repowering project for Y Power Plant is considered as base project in PDP at this moment.
Baseline scenario for this repowering project is to be defined as the result of consideration that how the increased capacity to be brought by repowering project can be compensated in case this repowering project is not carried out. The detailed method for its consideration is as follows;

Case 1 : to construct the new power plant in the same grid
Case 2 : to adjust the operation condition of the existing power plant in the same grid

First, as for Case 1(one), in order to make up for 150 MW x 2 of the increased capacity, coal firing power plant or gas firing power plant may be newly constructed. However, it seems that their capacity does not match PDP and are not realistic in terms of its financial and technical aspects. And also even if coal firing power plant or gas firing power plant is supposed to be constructed, it should be quite difficult to explain the mechanism that the net electricity output which generates from new plant is counted only for compensation of the shortage when this repowering project is not carried out. Therefore, it is judged that case 1(one) is not appropriate method.
Second, renewable energy such as wind turbine does not seem to be feasible in financial matter and the biomas power plant is less reliable because it is unstable to supply power equivalent to this repowering project. So these renewable projects are not practical.
Therefore, it is judged that the capacity to be increased by the repowering project should be compensated by case 2(two).
In such case, it is also considered that a certain power station in the same grid such as old power plants may be rehabilitated or renovated. However, it should be reasonable to consider that the above idea for baseline scenario is the most suitable because it is impossible to specify the appropriate power plants for such

rehabilitation or renovation and its detailed technical method at this stage.
Consequently, taking the above reasons into account, we decided to apply case 2(two) as baseline scenario for this repowering project.
In order to figure out emission amount of CO_2, the following method is used based on the data of emission factor in World Bank;

(1) To add up the total CO_2 amount of every power plant in B POWER depending on generating output classified by each fuel. The ratio of composition of fuel usage is supposed to be average.

(2) To calculate the total CO_2 amount in case the repowering project is not carried out as shown in below
(1) x 700 MW x 2 units / (1 - electric power consumed in power plant(%)) x total operating hours per year x load factor / B POWER total power output (MWh)

B.4 Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity *(i.e explanation of how and why this project is additional and therefore not the baseline scenario)*

In the absence of the project activity, the most economically attractive option will be taken to cater for the increased demand for electricity, taking into account trends in the grid fuel mix.

As concluded in B.3 above, natural gas-fired combined cycle power generation will be the main current in electricity generating field. This proposed project is a repowering project involving the upgrade of much of the plant equipment, such that the Y plant itself will become a natural gas-fired combined cycle system.

CDM designation will increase the ability of the project to attract investors, with the higher status associated with CDM designation. It will also result in approx.USD 9,203,780per year from CER revenues, assuming a price of USD10 per tonne CO_2 equivalent. These factors will enhance the financial viability of the project, which will encourage the approval and implementation of the repowering project.

B.5 Description of how the definition of the project boundary related to the baseline methodology is applied to the project activity:

The following diagram represents the project boundary for the Y Power Plant project.

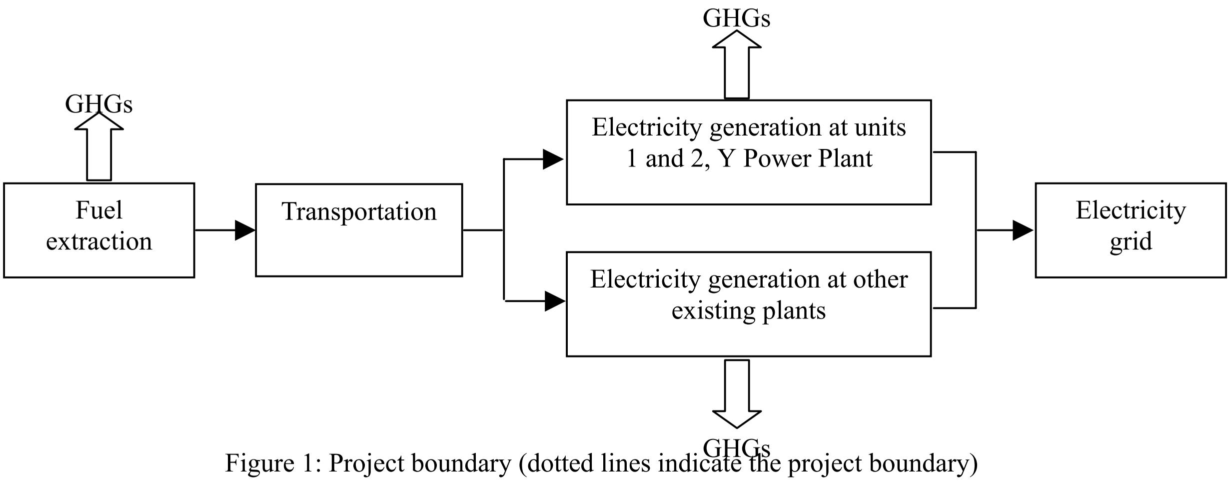

Figure 1: Project boundary (dotted lines indicate the project boundary)

The natural gas fuel is supplied to the Y Power Plant through a pipeline. Therefore, it is not necessary to include transportation emissions in the project boundary.

B.6 Details of baseline development

B.6.1 Date of completing the final draft of this baseline section:

31st / 03 / 2003

B.6.2 Name of person/entity determining the baseline:

J Co., LTD.

C. Duration of the project activity / Crediting period

C.1 Duration of the project activity:

C.1.1 Starting date of the project activity:

From 31st / May / 2006

C.1.2 Expected operational lifetime of the project activity:

25 years

C.2.1 Renewable crediting period *(at most seven (7) years per period)*

Not applicable

C.2.2 Fixed crediting period *(at most ten (10) years)*:

C.2.2.1 Starting date:

31st / May / 2006

C.2.2.2 Length *(max 10 years)*:

10 years

D. Monitoring methodology and plan

D.1 Name and reference of approved methodology applied to the project activity:

At the time of writing this PDD, there was no list of approved methodologies available on the UNFCCC web site. The suggested name for the monitoring approach used in this project is *"direct measurements and data/inventory management"*.

D.2 Justification of the choice of the methodology and why it is applicable to the project activity:

The monitoring approach for the project involves the direct measurements of all but one of the pertinent data required to ascertain the actual emission reductions resulting from the project activity. The remaining data, the calorific value of natural gas, is provided in fuel purchase contracts.

This approach was chosen due to its reliability – measurements are conducted continuously and logged, all of which are automated. The accuracy of the measurements is verified against commercial or other relevant records, as given in D.6 below.

It is believed that this two-tier approach for monitoring will leave little room for error, and is the most appropriate for this project.

D.3 Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

Refer to attached table (D.3)

D.4 Potential sources of emissions which are significant and reasonably attributable to the project activity, but which are not included in the project boundary, and identification if and how data will be collected and archived on these emission sources.

Not applicable

D.5 Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHG within the project boundary and identification if and how such data will be collected and archived.

Refer to attached table (D.5)

D.6 Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored.

Refer to attached table (D.6)

D.7 Name of person/entity determining the monitoring methodology:

B POWER

D.3 Data to be collected in order to monitor emissions from the project activity, and how this data will be archived

ID number	Data type	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/paper)	For how long is archived data to be kept?	Comment
1.	Annual Fuel Consumption	Kt/year	m	Hourly	100%	electronic	Minimum of 2 years after last CER issuance	
2.	Calorific Value of Natural Gas	KJ/t	m	Monthly	100%	electronic	Minimum of 2 years after last CER issuance	
3.	Annual Energy Consumption	KJ/year	c	Monthly	100%	electronic	Minimum of 2 years after last CER issuance	

Total power output, categorized by each fuel, within the same grid shall be monitored.
These data will be monitored at both unit 1 and unit 2.

D.5 Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHG within the project boundary and identification if and how such data will be collected and archived.

ID number	Data type	Data unit	Will data be collected on this item? (If no, explain).	How is data archived? (electronic/paper)	For how long is data archived to be kept?	Comment
1.	Generated Power Output	GWh	yes-measured	electronic	Minimum of 2 years after last CER issuance	

These data will be monitored at both unit 1 and unit 2.

D.6 Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored

Data	Uncertainty level of data (High/Medium/Low)	Are QA/QC procedures planned for these data?	Outline explanation why QA/QC procedures are or are not being planned.
D3-1	Low	Yes	Meters will undergo maintenance (calibration) subject to appropriate industry standards. The meter readings will be checked against fuel purchase receipts and inventory data.
D3-2	Low	Yes	Sampling results will be checked against the specified calorific value on the fuel purchase agreement.
D3-3	Low	Yes	Energy consumption will be back-calculated from the power transmission readings, using relevant plant efficiency and parasitic load values.
D5-1	Low	Yes	Meters will undergo maintenance (calibration) subject to appropriate industry standards. The meter readings will be checked against B POWER’s internal sales record.

E. Calculations of GHG emissions by sources

E.1 Description of formulae used to estimate anthropogenic emissions by sources of greenhouse gases of the project activity within the project boundary: *(for each gas, source formulae/algorithm, emissions in units of CO_2 equivalent)*

The two (2) new, advanced gas turbine-generator plants would be added to the existing power plants and the exhaust gas from these gas turbines would be used for combustion air in order to augment unit power output and to raise plant efficiency, i.e., fully fired type combined cycle power plant (fully fired type repowers).

In the case of the fully fired combined cycle power plant, the plant utilize gas turbine exhaust gas containing 14-15% oxygen in place of fresh air as the combustion air of the current boilers and recovers sensible heat from the exhaust gas. The output of the existing power plant would be raised from 550MW to 700MW each and the efficiency would rise by 38% to 47.6%.

For the fully fired type combined cycle power plants, the temperature range that utilizes effectivity combustion heat of the fuel (primary energy) will be greater than the former boiler/turbine plants. Therefore, it will be possible to achieve more efficient energy conversion and, thus, by implementing Project, it will also be possible to obtain increased energy saving effects.

(1) Annual quantity of electric power transmitted after completion of the Project

The following calculation method will be used to calculate the annual amount of power transmitted.

$$P = W (1 - r) \times T \times U \times N$$

P : Annual electric power transmitted (MWh)
W : Rated output (MW)
r : Electric power consumed in power plant (%)
T : Total hours per one year (365 day/year × 24 hours/day)
U : Load factor
N : Number of plants

Rated output (MW)	700 × 2
Electric power consumed in the power plant (%)	0.04
Total hours	8760
Load factor	0.85
Number of plants	2
Annual power transmitted (MWh)	10,007,424

$$P = 700 \text{ (MW)} \times (1 - 0.04) \times 8{,}760 \text{ (h)} \times 0.85 \times 2 \text{ (units)}$$

$$= 10{,}007{,}424 \text{ (MWh)}$$

(2) Annual Energy Consumption after Completion of the Project

The amount of annual energy can be calculated as follows:

$$Y = P \div [(1 - r) \times \eta] \times 3.6 \times 10^{-3}$$

Y : Annual energy consumption (TJ/year)
P : Annual electric power transmitted (MWh)
r : Electric power consumed in power plant (%)
η : Plant efficiency (%)

Rated output (MW)	700 × 2
Annual power transmitted (MWh)	10,007,424

Electric power consumed in the power plant	0.04
Electric energy conversion efficiency	0.476
Energy consumed (TJ/year)	78,840

Y = 10,007,424 (MWh) ÷ [(1 - 0.04) × 0.476] × 3.6 × 10^{-3}
= 78,840 (TJ/year)

(3) Calculation Method of CO_2 emission.

Green gas (CO_2) emission can be calculated by multiplying the annual energy (equal to annual electric power produced by new power system taken in the Project) by conversion factors of carbon dioxide. The conversion factor of carbon-dioxide which are defined by IPCC Guideline for National Greenhouse Gas Inventories Reference manual/1.4.1 Approaches for Estimating CO_2 emission is used for the calculation of CO_2 emission.

$$CO_2 = Y \times \gamma \times \rho \times \beta$$

In addition, the various conversion factors are defined by IPCC Guideline (Natural gas)

CO_2	: Annual CO_2 emissions	(t・CO_2/year)
Y	: Annual energy consumption	(TJ/year)
γ	: Conversion factor of carbon emission	15.3
ρ	: Carbon oxidation coefficient	0.995
β	: CO_2 carbon conversion coefficient	44/12

CO_2 = 78,840 (TJ/year) × 15.3 × 0.995 × 44/12 = 4,400,809(t・CO_2/year) …...(E.1)

In order to verify this figure of greenhouse gas emissions, default carbon emission factors for Electricity Generation should be used for the calculation of greenhouse gas emissions of 700MW×2 Gas Turbine Combined Cycle Plant.
The World Bank EM Model* provides default CEFs for various types of electricity generation.
The relevant figures are reproduced in Table 1 .

(*) Version 1. Developed by Oeko Institute and University of Kassel, sponsored by the World Bank et.al http://www.worldbank.org/html/fpd/em/model/model.stm

Table 1: Carbon Emission Factors for Electricity Generation

Type	CEF in kgCO_2/kWh
Hydro	0.000
Natural Gas - Single Cycle	0.610
Natural Gas - Combined Cycle	0.398
Heavy Oil	0.721
Gas S/T (Big)	0.481
Lignite	0.885
Imported Coal	0.930
Coal (small scale)	0.988
Oil (small scale)	0.613
Renewables	0.000

10,007,424(MWh) ÷ (1 - 0.04) × 0.398 = 4,148,911(t・CO_2/year)

This figure is almost same as that one. Therefore the calculation method which was applied to this project is quite reasonable.

E.2 Description of formulae used to estimate leakage, defined as: the net change of anthropogenic emissions by sources of greenhouse gases which occurs outside the project

boundary, and that is measurable and attributable to the project activity: ***(for each gas, source, formulae/algorithm, emissions in units of CO_2 equivalent)***

The leakage is negligible small because it is assumed that the project activity should not be rearranged and the effect which is derived from the implementation is not complicated.

Therefore $CO_2 = 0$ ....(E.2)

E.3 The sum of E.1 and E.2 representing the project activity emissions:

E.1 + E.2 = 4,400,809 (t･CO_2/year) ....(E.3)

E.4 Description of formulae used to estimate the anthropogenic emissions by sources of greenhouse gases of the baseline: ***(for each gas, source, formulae/algorithm, emissions in units of CO_2 equivalent)***

The emission amount to be defined as baseline shall be calculated herein in accordance with the actual power output categorized by each fuel in Annual Report 2001. And the composition ratio of power production souce between year 2006 and 2015 shall be decided based on Annual Report to be issued annually and, therefore, shall be monitored every year .
The reason to adopt the data of Annual Report instead of PDP is that Annual Report shall surely show the actual record of power output produced by all power plants of B POWER. On the other hand, since PDP is made based on the data about not only the current status but also the forecast of future demand, it may be changed due to the policy and the economic condition. Therefore, the data of actual record in Annual Report shall be used herein for the calculation of the baseline.
In case that this project is carried out, the consumption of Natural Gas will increase relatively. However, as diversity of fuel will be progressed in near future, the composition ratio of power output categorized by each fuel shall be kept according to the optimum combination decided by B POWER.

Total power output of B POWER from B POWER 2001 Annual Report (Unit：MWh)

Natural Gas	34,871,180	
Lignite	17,306,580	
Fuel Oil	3,110,610	
Hydro	6,310,550	
Diesel Oil	155,230	
Renewable Enegy	1,740	
Total	61,755,890	①

In accordance with the Wold Bank EM Model, total CO2 amount, in case the repowering project, is not implemented is calculated as follows ;
The electric power consumed in power plant (4%) is already taken into account.
(Unit : t･CO_2/year)

(a) Natural Gas
34,871,180 ÷ 0.96 x 0.398 = 14,457,010

(b) Lignite
17,306,580 ÷ 0.96 x 0.885 = 15,954,503

(c) Fuel Oil
3,110,610 ÷ 0.96 x 0.721 = 2,336,198

(d) Hydro
0

(e) Diesel Oil
155,230 ÷ 0.96 x 0.613 = 99,121

(f) Renewable Energy
0

(a) + (b) + (c) + (d) + (e) + (f) = 32,846,832 - (2)

Type	CEF in $kgCO_2/kWh$
Hydro	0.000
Natural Gas - Single Cycle	0.610
Natural Gas - Combined Cycle	0.398
Heavy Oil	0.721
Gas S/T (Big)	0.481
Lignite	0.885
Imported Coal	0.930
Coal (small scale)	0.988
Oil (small scale)	0.613
Renewables	0.000

(2) x 10,007,724 / (1) = 5,321,187tCO_2/Yr

E.5 Difference between E.4 and E.3 representing the emission reductions of the project activity:

(E.4) - (E.3) = 5,321,187- 4,400,809 = 920,378 (t・CO_2/year)

E.6 Table providing values obtained when applying formulae above:

Refer to E.1 ~ E.5 above (unit: t・CO_2/year)

	Baseline Emissions	Project Emissions	Total Emission Reductions
Every Year	5,321,187	4,400,809	920,378

F. Environmental impacts

F.1 Documentation on the analysis of the environmental impacts, including transboundary impacts

The Y Power Plant repowering Project planning will serve an important role in the future supply of electric power in Thailand and also, at the same time, will help to raise the level of heat conversion and achieve improved efficiency in the use of energy resources.

The improvement Project planning contemplates the use of low pollution natural gas as fuels for the repowering approach for the plant.

The plan includes the use of gas turbines and also other equipment that will contribute to protecting the environment. Thus, the plan will include every possible measure to protect the surrounding environment.

(1) Regarding the repowering plans, since the plan calls for using the existing site within the Y Power Plant grounds, there is no need to acquire or develop a site.

(2) Regarding the re-powerd thermal generating plant, when natural gas is combusted, no SO_2, CH_4, N_2O, HFCs, PFCs, SF_6 and smoke or soot are produced. In addition, as a measure to reduce the quantity of NOx emissions, the plan includes the use of a low NOx combustor to hold down the amount of NOx emissions.

(3) With regard to the cooling water, the condensing equipment will be design keep the temperature of the water low. The intake and release of cooling water will be carried out at a low flow rate so that the affects on navigation of boats on the river will be kept to a minimum.

(4) With regard to noise, types of equipment that are sources of noise, as necessary, will be placed inside buildings, or noise-muffling devices will be used, or sound barrier walls will be erected, to reduce the noise level. For equipment that are sources of vibration, as necessary, measures will be taken to strengthen the floor of the mounting area in order to reduce the amount of vibration.

(5) The plan will include sufficient measures concerning maintaining and increasing the green vegetation with the plant.

(6) During the construction period, suitable methods will be used for protection of the environment and the plan calls keeping the effects on the environment to an absolute minimum.

(7) In addition, during the period of construction, and the initiation of operations, the conditions of environment will be monitored.

(8) Efforts will be made to hold down the amount of CO_2 emissions by increasing the efficiency of the power generating equipment as part of the plan.

(9) In addition to the point covered above, many other measures will be carried to keep the effects of the effects on the environment at an absolute minimum.

When these various features of the Project are subjected to a comprehensive evaluation, it can be seen that the effect on the surrounding environment of repowering Project plan will be very limited. Considering the importance of such factors for B POWER as the development of additional power generating resources and achieving economy in the use of energy resources by improvements in heat efficiency that will also to serve to protect natural resources, it is recommended that this Project plan be carried out in the near future.

F.2 If impacts are considered significant by the project participants or the host Party:

The impact assessment will be conducted at the next stage, based on the LAW on EIA in Thailand.

G. Stakeholders comments

G.1 Brief description of the process on how comments by local stakeholders have been invited and compiled:

The stakeholder comments session will be conducted at the next stage, based on the relevant Thailand laws and EB requirements.

G.2 Summary of the comments received:

To be considered at the next stage.

G.3 Report on how due account was taken of any comments received:

To be considered at the next stage.