Chapter 1 Basic Components of the Project Implementation

1.1 Outline and Background of the Proposed Project

1.1.1 Outline of the Proposed Project

There are two sites in the Project: namely Talubin Mini-Hydropower Plant (MHP) and Caneo MHP. The Talubin MHP and the Caneo MHP will utilize natural river flow of Talubin River. Talubin River is a tributary of Chico River, which originates in Mountain Province and flows toward to north. Chico River is one of the major rivers in Luzon.

The Talubin MHP can generate maximum output of 5,400 kW with maximum discharge of 9.71 m^3/s and effective head of 66.24 meters. The Caneo MHP, which is located at downstream of the Talubine MHP, also has maximum output of 5,400 kW with maximum discharge of 11.41 m^3/s and effective head of 57.13 meters.

Table1.1 General Features of the Talubin MHP

Items		Subjects	Remarks
Catchment area (km^2)		70.8	
Power Generation Plan	Power Generation Type	Run-of-river	
	Gross Head (m)	70.03	
	Maximum Output (kW)	5,400	
	Maximum Discharge (m^3/s)	9.71	
	Effective Head (m)	66.24	
	Annual Electricity Generation (MWh)	35,308	
	Effective Electricity Generation (MWh)	33,543	Loses : 5%

Table1.2 General Features of the Caneo MHP

Items		Subjects	Remarks
Catchments area (km^2)		83.6	
Power Generation Plan	Power Generation Type	Run-off-river	
	Gross Head (m)	59.87	
	Maximum Output (kW)	5,400	
	Maximum Discharge (m^3/s)	11.41	
	Effective Head (m)	57.13	
	Annual Electricity Generation (MWh)	35,073	
	Effective Electricity Generation (MWh)	33,319	Loses: 5%

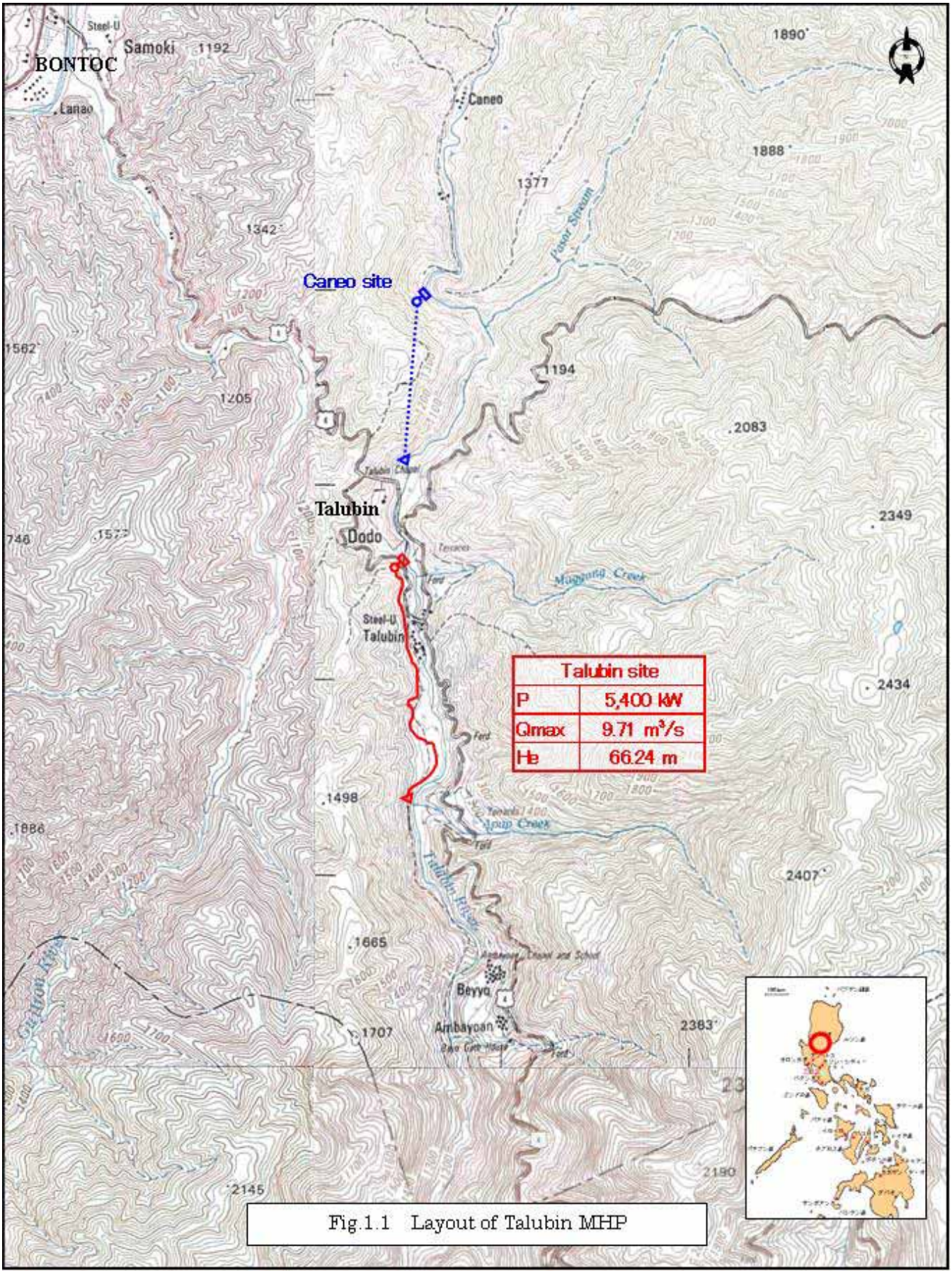

Fig.1.1 Layout of Talubin MHP

1.1.2 Background of the Proposed Project

In 2004, Tokyo Electric Power Services Company Ltd. (TEPSCO) implemented Feasibility Study on Talubin River Basin Hydropower (the F/S) that was financed by METI through NEF.

In 2005, the Ministry of Environment Japan (MOE) decided to assist financially for preparation of the PDD based on the F/S. Then Global Environment Center Foundation (GEC), which is concerned agency of the MOE, has contracted with TEPSCO to prepare the PDD on Talubin River Basin Hydropower Development.

1.2 Outline of the Electric Market Situation in the Philippines

Philippine Energy Plan 2005 Update shows the following Market Situation of Luzon-Visayas grid where the Talubin and Caneo MHP will be connected.

(1) Energy Supply Mix in 2004;

- Total electricity power generation of Luzon-Visayas grid in 2004 was approximately 48,870 GWh.
- In 2004, the electricity power source in Luzon-Visayas grid was 28.1% renewable energy (8.9 % of hydro and 19.2 % of geothermal) and 71.9% conventional energy came from fossil-fuel source (13.5 % of oil-based, 33.1 % of coal and 25.3 % natural gas).

(2) Power Demand and Supply;

- The peak demand will increase in gross capacity from 7,889 MW in 2004 to 16,808 MW in the year 2014 with annual growth rate of 7.9 % in Luzon-Vizayas grid.
- Simulating the peak demand forecast, Luzon-Vizayas grid will need a total of 3,450MW of new capacity additions to meet the electricity demand in the next ten years.
- Out of the total 3,450 MW, 290MW comes from committed projects while the remaining 3,160 MW are indicative capacity additions identified.

(3) Energy Supply Mix to meet the future demand;

- Of the 290 MW committed projects, 180 MW will come from renewable energy such as 65 MW of wind-power, 55 MW of bio-energy and 60 MW of geothermal. The remaining 110 MW comes from diesel, which is including in Pinaucan diesel-fired transfer program.
- Of the 3,160 MW indicative projects, 395 MW will come from renewable energy, such as 70 MW of wind-power, 115 MW of bio-energy, 210 MW of geothermal. The remaining 2,765 MW come from fossil-fuel source such as diesel (15 MW), coal (650 MW) and natural gas (2,100MW).
- Although 911 MW of hydropower capacities are required to meet the 60 % self-sufficiency target by 2010, specific hydropower development is not planned in above new capacity additions.
- Thus, the fossil-fuel will be also dominant as electric power source in the next ten years.

(4) Statuses of Existing Mini-Hydro in the Philippines

Since 1930's in the Philippines, 55 mini-hydropower plants[1], which installed capacity is up to 10 MW, have been developed. However, "Philippines Hydropower Database, Feb.2003, DOE" indicates that 8 hydropower plants are not operational and other 8 hydropower plants have been required the rehabilitation.

Furthermore, the actual plant factors of MHPs in the Philippines are approximately 20 % to 40% (average in 1993-1999 is 36 %), the actual plant factors are terribly low generally. As a reference, plant factors of TEPCO owned MHPs in Japan are 36 % to 100% (its average is 78%). The plant factor of the Talubin MHP and the Caneo MHP are respectively 74.6 % and 74.1 %.

1.3 Policy and Situation of CDM/JI in Philippines

The Philippines has ratified the Kyoto Protocol in November 2003, and Department of Environmental and Natural Resources (DENR) has been specified as Designated National Authority (DNA) in December 2004.

The guideline of CDM in the Philippines was released in August, 2005 (DENR Administrative Order No.2005-17), and establishment of the organizations and systems for CDM project have been completed mostly.
In the recognition process of CDM project in the Philippines, a duty of presentation of PAD (Project Application Document) is also imposed besides a PDD, and importance is attached to the evaluation to the contribution to the sustainable development especially in a host country.

Moreover, the Department of Energy (DOE) is presupposing that a technical target is evaluated only about the energy field to the recognition procedure of CDM (Special order SO 2004-07-023).

1.4 Contribution to Sustainable Development of Philippines Country by Proposal Project

(1) Reduction of electricity tariff and stabilization of electric power supply in the rural areas.
(2) A part of electric power profit will be reduced

1.5 Organizations for the implementation of the Study

The study was conducted by TEPSCO in cooperation with Department of Energy.

[1] The total capacity is 90,632kW (Source: Philippines Hydropower Database Third General Distribution)

Chapter 2 Planning of The Project

2.1 Contents of the Project

The construction costs of the Tulubin MHP and the Caneo MHP are as shown in Table 2-1.

Table 2-1 Construction Costs of the Project (peso)

No.	Contents	Talbine MHP	Caneo NHP	Bundled Case
Ⅰ	Preparation Work	10,060,610	18,325,554	28,386,164
Ⅱ	Environmental Mitigation	1,991,989	3,471,376	5,463,365
Ⅲ	Civil Works	199,198,872	347,137,597	546,336,469
Ⅳ	Hydraulic Equipments	15,841,842	19,029,284	34,871,126
Ⅴ	Electrical and Mechanical	287,374,600	285,862,000	573,236,600
Ⅵ	Transmission Works	42,480,000	37,170,000	42,480,000
Ⅶ	Sub-Station	29,033,480	29,033,480	58,066,960
	Direct Costa	585,981,392	740,029,291	1,288,840,684
Ⅷ	Engineering and Administration	29,299,070	37,001,465	64,442,034
Ⅸ	Contractor's Profit	19,919,887	34,713,780	54,633,647
Ⅹ	Contigency	58,599,651	74,002,929	128,884,068
	Total Cost	693,800,000	885,700,000	1,536,800,000

2.2 Baseline Methodologies for the Project

2.1.1 Boundary of the Project

The project boundary of the Power Plants was decided as the area, which included the intake, the headrace, the penstock and the powerhouse. The project boundary of the Transmission Line is from the power plants to the existing sub-station in the Bontoc City.

2.2.2 Baseline Methodologies for Small-Scale Project

Installed capacity of the proposed the Talbin MHP and the Caneo MHP is respectively 5.4MW each. And electric generation of these power stations connects to Luzon-Visayas grid. In Accordance with CDM-Executive Board, these projects are adapted to the category I.D. This category is named as the "I.D. renewable electricity generation for a grid". Baseline methodology for this category is as follows.

The baseline is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in kg CO2equ/kWh) calculated in a transparent and conservative manner as:

(a) The average of the "approximate operating margin" and the "build margin", where:

- The "approximate operating margin" is the weighted average emissions (in kg CO2equ/kWh) of all generating sources serving the system, excluding hydro, geothermal, wind, low-cost biomass, nuclear and solar generation;
- The "build margin" is the weighted average emissions (in kg CO2equ/kWh) of recent capacity additions to the system, which capacity additions are defined as the greater (in MWh) of most recent 20% of existing plants or the 5 most recent plants.

or

(b) The weighted average emissions (in kg CO_2equ/kWh) of the current generation mix.

(Source: http://cdm.unfccc.int/Projects/pac/ssclistmeth.pdf)

Option (b) is selected for this project because information of the recent capacity additions to the system which capacity additions are defined as the greater (in MWh) of most recent 20% of existing plants or the 5 most recent could not open to the public in the Philippines as of August 2005.

2.2.3 Additionality

According to Attachment A to B of the simplified modalities and procedures for CDM small-scale project activities evidence to why the proposed project is additional is offered under the following categories of barriers: (1) investment barrier, (2) technological barrier, and (3) prevailing practice.

(1) Investment Barrier:

The barriers on investment are identified from the viewpoint of 1) the project IRR and 2) the comparison of the project investment cost with the alternative power supply without the Talubin and the Caneo MHP. The details are shown below.

Project IRR of the Talubin and Caneo project is estimated to be 12.4 % and 9.3 %. Project IRR of the bundling case is estimated to be 11.2 %.

Table2-2 Project IRR

Item	unit	Talubin	Caneo	Bundling of Talbine & Caneo
Project IRR	%	12.4	9.3	11.2

Discount Rate is calculated using the Capital Asset Pricing Model (CAPM) formula, as determined by Brealy and Myers in their book "Principles of Corporate Finance".

A conservative Discount Rate to be use as benchmark to compare with the project IRR is 13.2 %, which is much higher than the bundled project IRR 11.2%. Low IRR, compared to be hurdle rate, indicates that the projects are not financially attractive without CDM assistance.

If the Talubin MHP and the Caneo MHP will be not developed, natural gas plants develop to meet the demand as an alternative power source. The information contained in the table below shows the cost of installing 1 MW of a natural gas turbine generation plant and compares it with the cost of installing 1 MW of the Talubin MHP and the Caneo MHP.

Table 2-3 Comparison of Generation Cost with Gus Turbine and Proposed Projects

	Cost of a Gus Turbine	Talubin and Caneo Projects
Generation Cost ($/MW)	300,000 to 650,000	2,360,000 to 2,960,000

Source: Gas turbine Engineering Handbook, p.8

Generation costs includes equipment cost, transport cost, civil works and the installation costs.

The cost of the Talubin and the Caneo MHP is higher than the cost for natural gas plant. (US$ 2,360,000 to US$ 2,960,000 versus US$ 300,000 to US$ 650,000) It is clearly demonstrated that taking into account the investment cost, building a natural gas plant is financially much more attractive than building a mini-hydropower plant.

(2) Technical Barrier

The appropriate technology for mini-hydropower development has not been established yet in the Philippines. Because until recent year large-scale hydropower technology has been established by mainly foreign assistance prior to mini-hydropower due to economic reasons. The high ratio of the failure and low plant factor are major cause of low financial profitability of existing mini-hydropower plants. As a result, investors and banks see other type of electricity generation such as natural gas as less risky.

The Talubin and the Caneo MHP aim to be a showcase for mini-hydropower development for the future of the Philippines.

(3) Prevailing Practice:

The Government of Philippines is promoting the development of the country's natural gas market (since new natural gas fields were discovered), which has a direct negative effect on development of other type electricity generation, particularly renewable energy.

2.3 GHG Emission Reductions and Leakage of the Project

2.3.1 Calculation of the GHG Emission Reductions

Based on the information of DOE and IPCC default value for Luzon-Visayas grid in 2004, CO_2 emission factor for each generation type are shown in Table 2-4.

Table 2-4 CO_2 emission factor for each type of power station in Luzon-Visayas grid (2004)

	(1) Fuel Consumption (10^3toe)	(2) Electricity Generation (MWh)	(3) Net Calorific Value (TJ/toe10^6)	(4)=(1)x(3) Energy Content (TJ)	(5) CEF (tC/TJ)	(6) Oxidation Factor	(7) tCO_2/tC	(8)=(4)x(5) x(6)x(7) CO_2 Emission (tCO_2)	(9)=(8)/(2) Individual CEF (tCO_2/MWh)	Assumption
Petroleum	1,490	6,588,522	41,868	62,372	21.1	0.990	3.667	4,777,666	0.725	residual fuel oil
Hydro	1,079	4,331,156	41,868	45,155	0.0	0.000	3.667	0	0.000	
Geothermal	2,334	9,371,734	41,868	97,705	0.0	0.000	3.667	0	0.000	
Coal	3,187	16,194,412	41,868	133,425	26.8	0.980	3.667	12,850,168	0.793	anthracite
Natural Gas	2,121	12,384,467	41,868	88,798	15.3	0.995	3.667	4,957,102	0.400	natural gas (dry)
Total	10,210	48,870,291								

Source
(1): Table E.2 (10)
(2): Department of Ebergy, Power Bureau
(3) : Revised 1996 IPDC Guidelines for National Greenhouse Gas Inventories Workbook (Volumu 2) Energy
(5),(6) : Revised 1996 IPDC Guidelines for National Greenhouse Gas Inventories Reference Manual (Volumu 3)

Based on the Table 2-4 above mentioned, the weighted average emissions factor is 0.462 ($kgCO_2$/kWh) shown in Table 2-5.

Table 2-5 The weighted average emissions (2004)

	(1) Weight in Grid (%)	(2) Individual CEF ($kgCO_2$/kWh)	(3)=(1)x(2) weighted CEF (kgCO2/kWh)
Petroleum	13.48	0.725	0.098
Hydro	8.86	0.000	0.000
Geothermal	19.18	0.000	0.000
Coal	33.14	0.793	0.263
Natural Gas	25.34	0.400	0.101
Total	100.00		0.462

Emission reductions of project activity = 0.462 tCO_2/MWh * 66,862 MWh/year = 30,890 tCO_2/year.
Therefore the CO_2 emission reduction during project period is estimated as 648,690 tCO_2.

2.3.2 Leakage of the Project

The leakage of this project is not considered.

2.4 Monitoring

Based on the CDM Executive Board, monitoring for small-scale CDM project is planned. Therefore the monitoring method will use the simplified methodology for small-scale CDM project in this project.

2.5 Environmental Impact

As a result of the study, it is concluded that there is no significant impacts on the natural and social environments due to the project.

The plan needs to be updated base on the detailed data/information, and IEE Checklist shall be prepared. For the residents, in particular elderly residents, it is necessary a patiently dialog to alleviate the suspicion of residents and to get them to understand in the period leading up to the construction.

2.6 Stakeholders' Comments

a. Government of Mountain Province

- The Government of Mountain Province has expected the implementation of the project.
- Provincial Energy Council (PEC) will support the project.

b. Government of Municipality Bontok

- Municipality of Bontok has been also willing to work with Mountain Province in supporting Project implementation.
- The largest obstacle to the Project would be lead by the lack of understanding of especially elderly residents. The mayor planed to visit each community and talk to the residents.

c. Residents of Barangay Talubin

- The local youth group in Talubin has been willing to actively cooperate with the Project. It will be a ways to form an organization mainly consist of young people to coordinate opinions within the village, and they will organize residents as representative of the residents in negotiations.
- The people will discuss with the investors about the route of the headrace of the Talubin MHP.

d. MOPRECO

- MOPRECO was in great need the local hydropower development which will be expected to lead the price reductions.
- MOPRECO is considering supporting the Project by collaborating with the DOE and PEC.

Chapter 3 Implementation of the Project

3.1 Project participants:

The project company will be established between a private investor in the Host country and the Japanese private. The project participants are conceivable the followings.

Host Country: Republic of the Philippines

Project Proponent: Philippines National Oil Company and

The Provincial Government of Mountain Province

Sta. Clara International Corporation (private)

Other Project Participant: Tokyo Electric Power Company Ltd. (TEPCO) in Japan

3.2 Financial Scheme

It is assuming that construction costs of the projects will be financed from two-step loan from Japan Bank for International Cooperation (JBIC) and Japanese private banks through Development Bank of Philippine (DBP).

3.3 Financial Analysis

Table 3.1 Results of Financial Analysis

Item		Unit	Talubin MHP	Caneo MHP	Bundled
Generation Cost		Php/kWh	1.9	2.3	2.0
Project IRR >13.2%	Without CER	%	12.4	9.3	11.2
	With CER	%	12.9	9.7	11.7
Equity IRR >20.0%	Without CER	%	18.6	9.4	14.3
	With CER	%	**20.7**	10.3	16.0

The differences of the project IRR between without CER and with CER are approximately 0.5%. And the differences of the equity IRR are 1.0 % - 2.0 %.

In the comparison between the project IRR and the discount rate of 13.2 % which to be use as benchmark (refer to Chapter 3), only the Talubine MHP with CER seems to be acceptable to develop in spite of that the project IRR of 12.9 % is still lower than the discount rate. Whereas it is difficult to develop the Caneo MHP because the project IRR (9.3 % - 9.7 %) is much lower, if the Caneo MHP will be not bundled with the Talubin MHP.

Although the project IRR of 11.7 % of the bundled case also still lower than the discount rate, it has a possibility of the development in consideration of a contribution toward reduce the CO_2 emissions.

In any case, the projects are not financially attractive without CDM assistance.

3.4 Conclusion

The project target in the study was the Talubin MHP and the Caneo MHP, which located at the middle reaches of the Talubin River, in the Mountain Province, the northern Luzon Island. The study was conducted to examine the feasibility of the project as a CDM project from the viewpoints listed below.

- Will the project be approved as a CDM project?
- Is the project feasible as a hydropower project?

The study is composed of the Talubin MHP and the Caneo MHP. The Talubin MHP is located just upstream of the Talubin village, and the Caneo MHP is located further downstream of the Talubin village. The type of generation system is run-of-river type with maximum output of 5,400kW for each project, and 10,800kW in total. Based on the CDM-Executive board, the project is categorized in the small-scale CDM project.

Baseline, investment barrier, technical barrier and prevailing barrier are adapted as additionality for proposed project. Financial Analysis also shows that the projects are not financially attractive without CDM assistance.

From the above, this project can prove the additionality as investment barrier of CDM Project.

In this study, "the weighted average emissions (in kg CO_2equ/kWh) of the current generation mix" is adopted for the Baseline Methodology to calculate the CO_2 emission factor (CEF). In the Luzon-Visayas grid, it is considerable that the methodology of "the average of the 'approximate operating margin' and 'the build margin'" will be able to get higher CEF. It is recommended to obtain higher CEF that DOE will publish the build margin.

The further study as follows.

- Social Consideration

  Most residents basically understood the project, but some resident, in particular elderly residents, still have a suspicion for hydropower development. Therefore, it is necessary a patiently dialog to alleviate them in the period up to the construction.

- Power Purchase Agreement

  It is important to make a power purchase agreement with the power distribution companies and/or cooperatives at as favorite condition as possible. This is main concern of Japanese participants; they desire stable and long term contract with the off-taker of generated electricity from proposed projects. Moreover, in most instance, they will require any assurance in case the contract can not be abided, such as the government assurance.

- Grit data for the baseline

  In the Luzon-Visayas grid, when the build margin will be published by DOE, higher CEF will be able to calculate. It is recommended to obtain higher CEF that DOE will publish the build margin.

  It is also necessary to draw up a Project Design Document (PDD) and to obtain the approval of a designated national authority (DNA) on the PDD.

- To conduct FPIC

  The proponents of the projects must conduct Free Prior Inform Consent (FPIC) before implementation of the projects.