CLEAN DEVELOPMENT MECHANISM
SIMPLIFIED PROJECT DESIGN DOCUMENT
FOR SMALL SCALE PROJECT ACTIVITIES (SSC-PDD)
Version 01 (21 January, 2003)

Socialist Republic of Vietnam

Song Muc Hydro Power Station Rehabilitation Project

Project Design Document

[VER.4]

November 2005

AGRICULTURAL-IRRIGATION-MECHINIZATION-
ELECTRIFICATION-CONSTRUCTION CORPORATION
TOHOKU ELECTRIC POWER CO., INC
INSTITUTE OF ENERGY

APPENDIX A[1] TO THE SIMPLIFIED MODALITIES AND PROCEDURES FOR SMALL-SCALE CDM PROJECT ACTIVITIES

Introductory Note

[1] This appendix has been developed in accordance with the simplified modalities and procedures for small-scale CDM project activities (contained in annex II to decision 21/CP.8, see document FCCC/CP/2002/7/Add.3) and it constitutes appendix A to that document. For the full text of the annex II to decision 21/CP.8 please see http://unfccc.int/cdm/ssc.htm).

1. This document contains the clean development mechanism project design document for small-scale project activities (SSC-PDD). It elaborates on the outline of information in appendix B "Project Design Document" to the CDM modalities and procedures (annex to decision 17/CP.7 contained in document FCCC/CP/2001/13/Add.2) and reflects the simplified modalities and procedures (herewith referred as simplified M&P) for small-scale CDM project activities (annex II to decision 21/CP.8 contained in document FCCC/CP/2002/7/Add.3).

2. The SSC-PDD can be obtained electronically through the UNFCCC CDM web site (http://unfccc.int/cdm/ssc.htm), by e-mail (cdm-info@unfccc.int) or in print from the UNFCCC secretariat (Fax: +49-228-8151999).

3. Explanations for project participants are in italicized font *(e.g. explanation)*.

4. The Executive Board may revise the SSC-PDD if necessary. Revisions shall not affect small-scale CDM project activities validated prior to the date at which a revised version of the SSC-PDD enters into effect. Versions of the SSC-PDD shall be consecutively numbered and dated. The SSC-PDD will be available on the UNFCCC CDM web site in all six official languages of the United Nations.

5. In accordance with the CDM modalities and procedures, the working language of the Board is English. The completed SSC-PDD shall therefore be submitted to the Executive Board in English.

6. Small-scale activities submitted as a bundle, in accordance with paragraphs 9 (a) and 19 of the simplified M&P for small-scale CDM project activities, may complete a single SSC-PDD provided that information regarding A.3 (*Project participants*) and A.4.1 *(Location of the project activity)* is completed for each project activity and that an overall monitoring plan is provided in section D.

7. A small-scale project activity with different components eligible to be proposed[2] as a small-scale CDM project activity may submit one SSC-PDD, provided that information regarding subsections A.4.2 (*Type and category(ies) and technology of project activity*), and A.4.3 (*brief statement on how anthropogenic emissions of greenhouse gases (GHGs) by sources are to be reduced by the proposed CDM project activity)* and sections B *(Baseline methodology)*, D *(Monitoring methodology and plan)* and E *(Calculation of GHG emission reductions by sources)* is provided separately for each of the components of the project activity.

8. If the project activity does not fit any of the project categories in appendix B of the simplified M&P for small-scale CDM project activities, project proponents may propose additional project categories for consideration by the Executive Board, in accordance to paragraphs 15 and 16 of the simplified M&P for small-scale CDM project activities. The project design document should, however, only be submitted to the Executive Board for consideration after it has amended appendix B as necessary.

9. A glossary of terms may be found on the UNFCCC CDM web site or from the UNFCCC secretariat by e-mail (cdm-info@unfccc.int) or in print (Fax: +49-228-8151999).

[2] In paragraph 7 of simplified M&P for small-scale CDM project activities, on clarifications by the Executive Board on small-scale CDM project activities, the Board agreed that in a project activity with more than one component that will benefit from simplified CDM modalities and procedures, each component shall meet the threshold criterion of each applicable type, e.g. for a project with both a renewable energy and an energy efficiency component, the renewable energy component shall meet the criterion for "renewable energy" and the energy efficiency component that for "energy efficiency".

CONTENTS

A General description of project activity

A.1 Title of the project activity:

Song Muc Hydro Power Station Rehabilitation Project in Vietnam

A.2. Description of the project activity:

(1) Objectives of the project activity

The Song Muc Power Station, where this project activity is to be carried out, was a dam type hydro power station. After the Ben May dam was built in 1977, with an aim to secure irrigation water, on the Muc River in Thanh Hoa Province in northern Socialist Republic of Vietnam with the government funds, the power station was constructed in 1980 by Thanh Hoa Provincial People's Committee to generate electricity by utilizing the irrigation water.

Back then, this power station adopted generators that had been made by improving a diesel generator and penstocks made of reinforced concrete because it was difficult to import generators and equipment and also materials were in short supply. Thus, in operating the plant, sufficient attention should have been paid in order to prevent any sudden operations. However, due to machine failure occurred by a driving error and lack of resistance to pressure of the reinforced concrete penstocks, the plant stopped only a day after the operation had started. After that, even though there existed the intention to resume power generation, the equipment could not be upgraded due to capital shortfall and then, with electric and machinery equipment including the water turbine and generator removed, the power station was closed. Meanwhile, the dam, reservoir and headrace are still being used to supply irrigation water.

This project is to newly install penstocks, water turbines and generators on the site where the abandoned Song Muc Power Station used to operate and regain its generating capability. By doing so, power generation at the maximum output of 2,000kW will be carried out and yearly electricity production of approximately 7,200MWh will be transmitted to the National Grid. With the electricity which replaces the fossil fuel-thermal power source, greenhouse gases: GHG (CO_2) can be reduced.

As the previous power generation plan disappeared, newly examined basic specifications for the recovered power generation are shown in Table-1.

Table-1 Basic specifications for the recovered power generation

Item	Specification	Abstract
① Maximum output	2,000 kW	1,000 kW × 2 generators
② Plant discharge	15 m^3/s	
③ Head	About 16 m	
④ Project cost	About 210 million Yen	
⑤ Electricity production	About 7,200 MWh	5 %, the sum of shutdown rate and station loss, has been already excluded.

(2) Views of the parties concerned on sustainable development of the project activity

According to Master Plan on Electric Power Development in Vietnam Period 2001-2010 perspective up to 2020 (revised in June 2003), the total generating capacity of Vietnam was 11 360MW as of the end of 2004, power demand is forecasted to surge at over 10% per annum to support social and economic development and the total generating capacity is projected to increase to about 2.1 times in 6 years and the year 2010 level will be up to 24 447MW . This Master Plan is targeting large-scale projects with the output of 50MW or more. In the development of power sources to which economies of scale greatly matter, small-scale hydro-power development like this project has been given low priority partly because of its low economical efficiency.

However, even though the scale is small, a regeneration project of an abandoned power station has immediate effects and enables effective use of rich hydro potential which is pure domestically available energy of Vietnam. Thus, the project is considered to contribute to the sustainable development of the nation from the perspective of the use of renewable energy and long-term stable power supply. Moreover, Japanese hydro power stations generally deliver operational performance for more than 40 years with proper maintenance. Accordingly, with participation of Japanese company, which has expertise in this field, in the project and transfer of maintenance-related technologies by the company, power generation is expected to be sustainable over the long term.

For Vietnam where the governmental system for implementation of CDM is well in place under the national policy to encourage the introduction of foreign capital, implementation of a regeneration project of closed hydropower as CDM is considered as meaningful and also as a promising field for the future. Meanwhile, this kind of small-scale hydro-power development has been included in the measures stated in "Vietnam National Strategy Study on Clean Development Mechanism" compiled by the government in July 2002.

A.3 Project participants:

(1) Sponsor

Expected sponsors of the project are the following two companies.

- Tohoku Electric Power Co., Inc.
- AGRIMECO (Hanoi city) : The largest manufacturer of irrigation/civil engineering equipment under the umbrella of Ministry of Agriculture and Rural Development(MOARD)

(2) Local parties concerned

- Song Chu Water & Agriculture Company (Thanh Hoa city) : Administrator of the Ben May dam and the irrigation water
- Thanh Hoa Power Company (Thanh Hoa city) : Affiliate of PC1 in Thanh Hoa Province

(3) Official contact for the CDM project activity

- Tohoku Electric Power Co., Inc.
- Agrimeco

A.4 Technical description of the project activity:

A.4.1 Location of the project activity:

A.4.1.1 Host country Party(ies) : Socialist Republic of Vietnam

A.4.1.2 Region/State/Province etc. : Thanh Hoa province

A.4.1.3 City/Town/Community etc : Nhu Thanh District, Xuan Thai Commune

A.4.1.4 Detailed description of the physical location, including information allowing the unique identification of this project activity *(max one page)*:

The site where the closed Song Muc Power Station used to operate is located in upper Muc River, about 40km southwest of the provincial capital Thanh Hoa in Thanh Hoa Province, which is some 140km south of the national capital Hanoi as shown in Figure-1.

The Ben May Dam has taken water from mountains around 200 ～400 meters above sea level as shown in Figure-2, aiming to irrigate the contributory area of 236 km^2 and meet the effective storage

capacity of 200×10^6 m^3 of the reservoir. Downstream from the dam lies the Long Dam which is able to control the amount of discharged water fluctuated by the Ben May Dam.

Road access to the site is via National Route 1 to Thanh Hoa (the width of the road: about 10m) and the provincial/local road from Thanh Hoa to the power station (the width of the road: about 4m), both of which are available to cars under the present conditions.

Operation and daily checking of the regenerated power station will be carried out by operators who are stationed near the power station. Periodic inspection expectedly around once a year and overhaul around every five years are planned to be carried out by manufactures living in Hanoi.

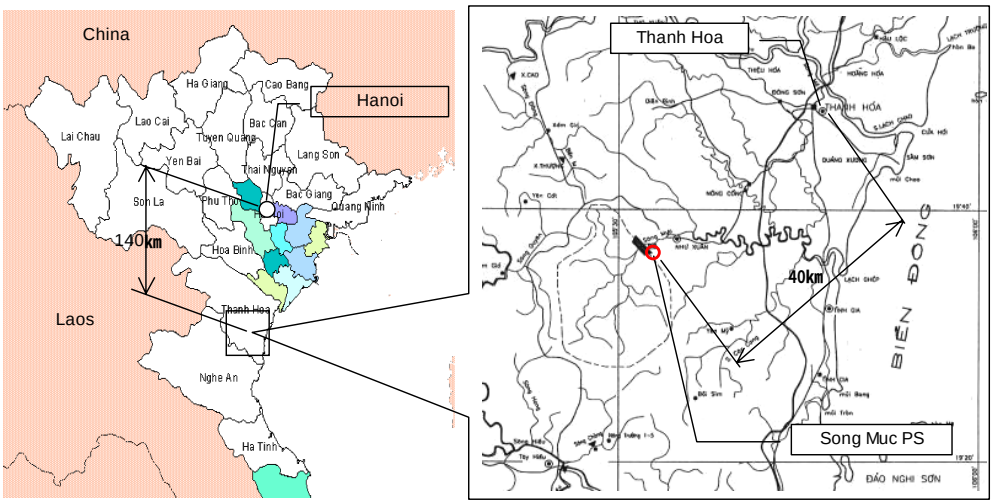


Figure-1 Location of the project site

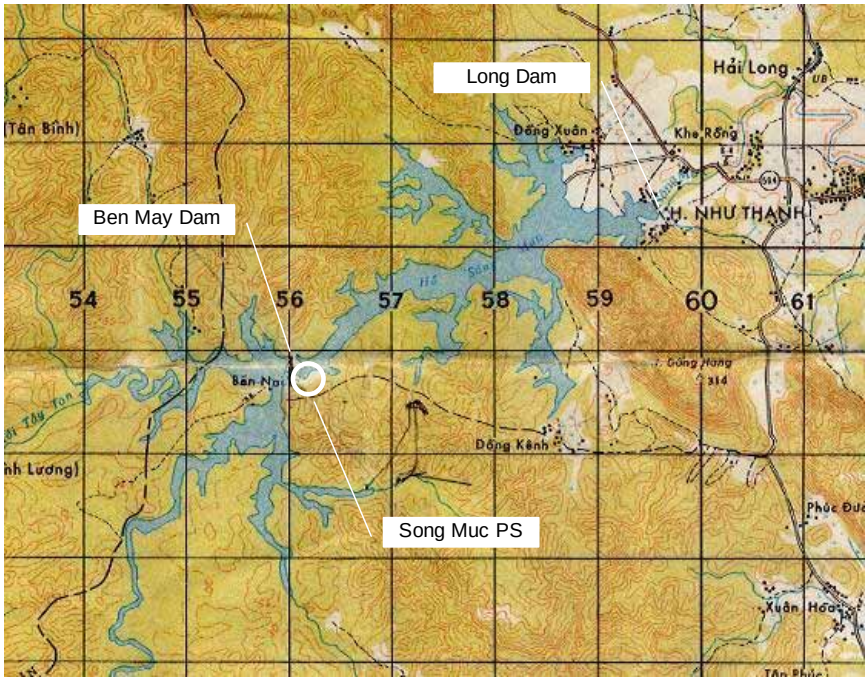


Figure-2 Terrain map of the project site

A.4.2 Type and category (ies) and technology of project activity:

The project can be classified as,

(1) TYPE：I RENEWABLE ENERGY PROJECTS

The type of the project is classified as "I　RENEWABLE ENERGY PROJECTS" since this is a hydroelectric power generation project.

(2)Category：I.D Renewable electricity generation for a grid

The category of the project is defined as "I.D. Renewable electricity generation for a grid" because the electricity generated by this project is to be supplied to the National Grid which includes thermal electric power generation.

In this project, Kaplan turbines will be used. Kaplan turbines, which were developed in 1913, have been widely adopted as being suitable to low head sites like this project site. Accordingly, they are not far from the local technical level and are fully capable for continuing operation.

Meanwhile, this is a regeneration project of the abandoned hydro power station and irrigation shall have priority over power generation after the resumption of power generation as it did when the plant was in operation before. In other words, water operation will be the same as before; i.e., electricity is to be generated with the amount of water controlled by a gate based on demands from users of irrigation water. Thus, there is no problem on environmental preservation.

A.4.3 Brief statement on how anthropogenic emissions of greenhouse gases (GHGs) by sources are to be reduced by the proposed CDM project activity:

Electricity generated by this project is to be transmitted to the National Grid. As the electricity replaces fossil fuel-thermal power source of the National Grid, GHG (CO_2) can be reduced.

This is a hydroelectric power generation project and, thus, GHG emissions by the project activity, or by power generation, is zero. Also, leakage is extremely small as the scale of the project is small. Therefore, GHG emissions in the baseline represent GHG emission reductions by this project activity.

① GHG emissions in the baseline :

EBLy = EC × Wy = **0.597**（kg-CO_2／kWh）×7,200（MWh）= **4 248**（t-CO_2）

EBLy : Yearly GHG emissions in the baseline（t-CO_2）

EC : Emission coefficient（kg-CO_2／kWh）

Please refer to"E.2 Table providing values obtained when applying formulae above" for calculation of emission coefficient.

Wy : Electricity production by the project（MWh）

② GHG emissions by the project activity : EPJy = 0（t-CO_2）

③ GHG emission reductions : ERy = EBLy － EPJy = **4 248**（t-CO_2）

Consequently, expected GHG emission reductions by this project activity is **4,248**（t-CO_2/year）.

A.4.4 Public funding of the project activity:

No public funding is appropriated for this project. This project is to be carried out with funds extended by Tohoku Electric Power Co., Inc. on the Japan's side and AGRIMECO and others on the Vietnam's side.

A.4.5 Confirmation that the small-scale project activity is not a de-bundled component of a larger project activity:

- Participants in this project have been organized exclusively for this project.
- There is no project in the same category within 1km of the project boundary.

Based on the above, numeral 1 of Appendix C of the simplified M&P for small-scale CDM project activities do not apply to this project. Therefore, it is not a de-bundled component of a larger CDM activity.

B. Baseline methodology

B.1 Title and reference of the project category applicable to the project activity:

(1) Title of the project category: I.D. Renewable electricity generation for a grid

(2) Reference: The list of the small-scale CDM project activity categories contained in appendix B of the simplified M&P for small-scale CDM project activities

B.2 Project category applicable to the project activity:

The category referred to in B.1 is applicable to renewable energies such as photovoltaics, hydro, tidal /wave, wind, geothermal and biomass that supply electricity to a grid which includes at least one fossil fuel-thermal generator.

This project is to regenerate the 2MW hydro power station (to newly install generators) which transmits generated electricity through a 35kV transmission line to the National Grid and replaces thermal power generation in the grid with the electricity.

Accordingly, the category of this project falls under the category I.D. in Appendix B of the simplified M&P for small-scale CDM project activities. With regard to baseline calculation, a method which is defined as other fields than "methane recovery" and "fossil fuel-thermal power generation" among the category I.D is used.

B.3 Description of how the anthropogenic GHG emissions by sources are reduced below those that would have occurred in the absence of the proposed CDM project activity *(i.e. explanation of how and why this project is additional and therefore not identical with the baseline scenario)*:

(1) Investment Barriers

Through recycling of the remaining facilities of the abandoned power station to the utmost extent, the construction unit cost for this project comes to around 100,000yen/kW, lower than for new construction of a comparable hydro power station. However, as the construction unit cost for the Phu My Ⅱ-2, a 720-MW combined cycle thermal power station scheduled to come into operation in September 2004, was around 60,000yen/kW, thermal power sources require less development costs compared with this project. Accordingly, it is inevitable for the nation to choose thermal power sources that have larger installed capacity and require lower costs in order to meet an increasing electricity demand.

Likewise, in terms of hydro power stations, development of larger-scale stations is virtually given higher priority and small-scale hydropower development like this project is normally shelved from the perspective of economies of scale. For these reasons, large-scale power development comes to the basis in the National Grid of Vietnam.

Considering these backdrops, this project is considered to entail "investment barriers" stated in Attachment A of Appendix B of the simplified M&P for small-scale CDM project activities, and hold investment additionality.

Meanwhile, economical efficiency of this project does not reach the economically viable level for investment given country risks and so forth, however the investment barriers are considered to be lowered with additional values of credits acquired by carrying out this project as CDM.

(2) Technical Barriers

Most of the large-scale power sources have been developed by technical cooperation from abroad. As appropriate responses have been taken for failures in operation, the operation has been continuing.

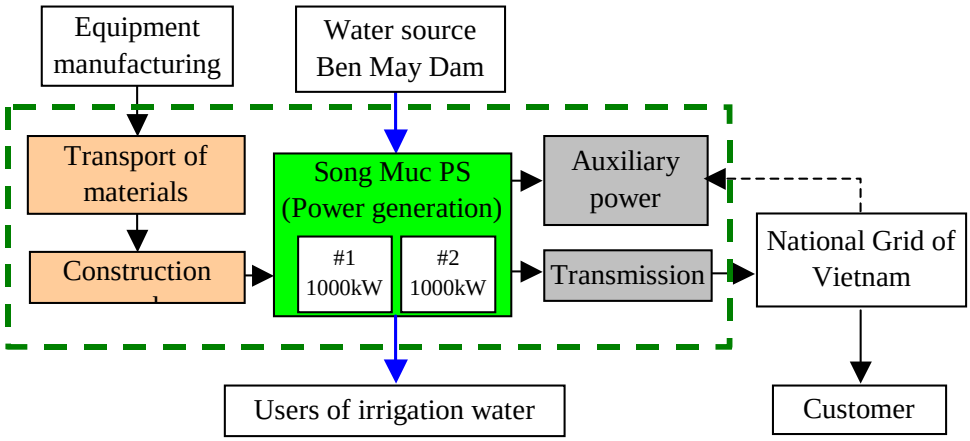
Meanwhile, in the case of small-scale hydro power stations, operation tends to stop for a prolonged period when a failure occurs, ending up in abandonment of the plant in most cases.

These small-scale hydro power stations are normally in distant regions from urban areas, operated by local governments or small and medium-sized companies which do not have sufficient techniques on operation and maintenance. Accordingly, in case that a trouble occurs, operation is somehow continued in a makeshift manner with the trouble left unresolved, which leads to shutdown in the long run as the situation now stands. Concrete problems in this regard include neglect of daily maintenance such as patrol and check, ambiguity on locus of responsibility as well as chain of command in case of troubles and lack of operational rules including a back-up system of manufacturers and fund-raising scheme. Moreover, support from the government or injection of foreign capital to an individual halted small-scale hydro power station is unlikely since electricity supply from the station and its recipients are limited. Therefore, in the present circumstances, there are technical barriers to realize continuing operation of this project over the long term.

In this project, in order to overcome the technical barriers, operational manuals for the power station that include maintenance management system will be created and technology transfer through OJT will be conducted to sustain this project activity. Thus, this project is considered to have technical additionality.

B.4 Description of the project boundary for the project activity:

The project boundary of this project is defined as Figure-3 below, regarding the physical and geographical scope of the power station as the boundary.



- Broken line is project boundary

Figure-3 Definition of Project Boundary

B.5 Details of the baseline and its development:

B.5.1 Specify the baseline for the proposed project activity using a methodology specified in the applicable project category for small-scale CDM project activities contained in appendix B of the simplified M&P for small-scale CDM project activities:

The baseline of the system, which is defined as other fields than “methane recovery” and “fossil fuel-thermal power generation” in the category I.D. in Appendix B of the simplified M&P for small-scale CDM project activities, is calculated by multiplying electricity production (MWh) using renewable

energy by emission coefficient which is determined transparently and conservatively based on power sources included in the grid.

In Vietnam, power source configuration is projected to change down the road from the current situation due to remarkable increase of oil and gas turbines in the power supply capacity. Thus, emission coefficient of this project is defined as the average of the approximate operation margin and the build margin.

EC = （AOM ＋ BM）／2

EC : Emission coefficient（kg-CO_2／kWh）

AOM : Approximate operating margin（kg-CO_2／kWh）。

The weighted average emissions of all generating sources serving the system, excluding hydro, geothermal, wind, low-cost biomass, nuclear and solar generation

BM : Build margin（kg-CO_2／kWh）

The weighted average emissions of recent capacity additions to the system, defined as the lower of most recent 20% of plants built or the 5 most recent plants

Please refer to”E.2 Table providing values obtained when applying formulae above” for calculation of emission coefficient.

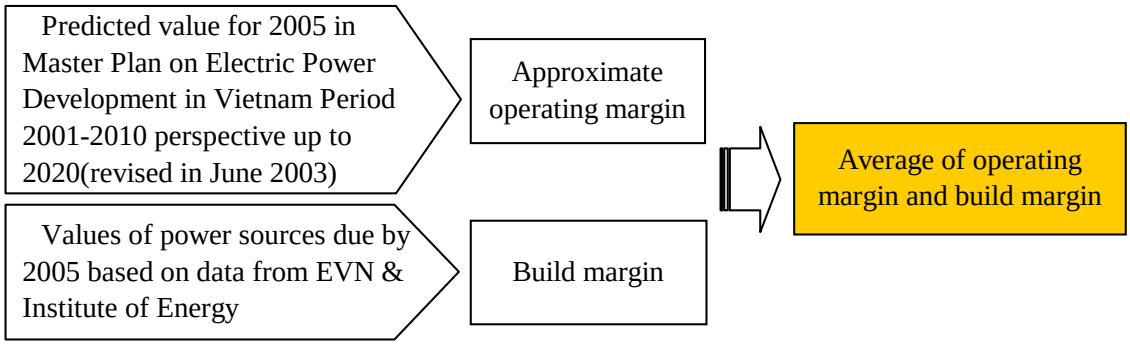


Figure-4 Calculation method of baseline (Emission coefficient)

B.5.2 Date of completing the final draft of this baseline section:

January 21, 2005

B.5.3 Name of person/entity determining the baseline:

(1) Entity responsible: Tohoku Electric Power Co., Inc.

(2) Person in charge: Takeyoshi Yaegashi
TEL: +81-22-799-6281
E-mail: w820159@tohoku-epco.co.jp

C. Duration of the project activity and crediting period

C.1 Duration of the project activity:

C.1.1 Starting date of the project activity:

Jan, 2006 (start of construction)

C.1.2 Expected operational lifetime of the project activity: *(in years and months, e.g. two years and four months would be shown as: 2y-4m.)*

36y-0m

C.2 Choice of the crediting period and related information: *(Please underline the selected option (C.2.1 or C.2.2) and provide the necessary information for that option.)*

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

21years

C.2.1.1 Starting date of the first crediting period:

April 1, 2007 (expected starting date of trial run)

C.2.1.2 Length of the first crediting period *(in years and months, e.g. two years and four months would be shown as: 2y-4m.)*:

7y-0m: from April 1, 2007 to March 31, 2014

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

C.2.2.1 Starting date *(DD/MM/YYYY)*: **01/04/2007**

C.2.2.2 Length (max 10 years): *(in years and months, e.g. two years and four months would be shown as: 2y-4m.)* ***10years-0 months***

D. Monitoring methodology and plan

Monitoring methodology and plan are indicated in the attached Monitoring and Verification Plan.

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

According to Type I, Category I.D. Renewable Electricity Generation for a Grid contained in Appendix B of the simplified M&P for small-scale CDM project activities, monitoring shall consist of metering the electricity generated by the renewable technology (hydropower).

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

Monitoring methodology to be used is as suggested in Category I.D. Renewable Electricity Generation for a Grid of Appendix B for such as hydroelectricity and due to the fact that it fulfils the criteria for small-scale (less than 15MW) CDM project activity and its simplified procedures.

D.3 Data to be monitored:

GHG emissions within the project boundary are shown below.

① Song Muc Power Station : GHG emissions by power generation are zero as renewable energy is used. To start operation, an initial start battery is to be used for initial excitation with micro electricity. Electricity to charge the battery has been already counted as auxiliary power.

② Transport of materials : No GHG should be counted as the construction scale is small, which leads to only a few times of material transport for the construction.

③ On-site construction : GHG emissions will be negligible because of a little amount of works needed.

④ Transmission loss : GHG emissions will be negligible as this is a small-scale power source and electricity generated is expected to be supplied to nearby regions.

Thus, GHG emissions within the project boundary are very small amount, and they do not influence the calculation of GHG emissions.

Therefore, in this project, sending end electric energy and receiving end electric energy are to be monitored by watt-hour meters as the data used to determine electricity production which is necessary for calculation of GHG emissions in the baseline. Monitoring will be carried out based on the Monitoring and Verification Plan by Administration Group to be deployed in the power station.

Speculations for data collection are as follows.

Table-2 Data to be monitored

ID number	Data type	Data variable	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	Sending end electric energy (Ws)	Cumulative value	kWh	m	Daily (at the fixed time)	100%	Paper	Crediting period + 2 years	For calculation of electricity production
2	Receiving end electric energy (Whr)	Cumulative value	kWh	m	Daily (at the fixed time)	100%	Paper	Crediting period + 2 years	For calculation of electricity production
3	Auxiliary electric energy (Wh)	Cumulative value	kWh	m	Daily (at the fixed time)	100%	Paper	Crediting period + 2 years	For back-up
4	Electricity production of Generator 1 (Wg1)	Cumulative value	kWh	m	Daily (at the fixed time)	100%	Paper	Crediting period + 2 years	For back-up
5	Electricity production of Generator 2 (Wg2)	Cumulative value	kWh	m	Daily (at the fixed time)	100%	Paper	Crediting period + 2 years	For back-up

D.4 Name of person/entity determining the monitoring methodology:

(1) Entity responsible: Tohoku Electric Power Co., Inc.

(2) Person in charge: Takeyoshi Yaegashi
TEL：+81-22-799-6281
E-mail：w820159@tohoku-epco.co.jp

E. Calculation of GHG emission reductions by sources

E.1 Formulae used:

E.1.1 Selected formulae as provided in appendix B:

Calculation formula for GHG emission reductions in this category is not available in Appendix B of the simplified M&P for small-scale CDM project activities.

E.1.2 Description of formulae when not provided in appendix B:

E.1.2.1 Describe the formulae used to estimate anthropogenic emissions by sources of GHGs due to the project activity within the project boundary: *(for each gas, source, formulae/algorithm, emissions in units of CO_2 equivalent)*

This is a hydroelectric power generation project and, thus, GHG emissions in the project boundary by the project activity are zero.

E.1.2.2 Describe the formulae used to estimate leakage due to the project activity, where required, for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities *(for each gas, source, formulae/algorithm, emissions in units of CO_2 equivalent)*

This is not applicable as the renewable energy technology used is not equipment transferred from another activity. Therefore, as per the simplified procedures for small-scale CDM project activities, no leakage calculation is required.

E.1.2.3 The sum of E.1.2.1 and E.1.2.2 represents the project activity emissions:

Based on the consideration above, GHG emissions by the project activity are defined as zero.

E.1.2.4 Describe the formulae used to estimate the anthropogenic emissions by sources of GHG's in the baseline using the baseline methodology for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities: *(for each gas, source, formulea/algorithm, emissions in units of CO_2 equivalent)*

GHG emissions in the baseline are calculated by multiplying electricity production (kWh), which is generated by renewable energy and is supplied to the grid, by an emission coefficient which is determined transparently and conservatively based on power sources included in the grid.

GHG emissions in the baseline are defined as the following formula.

$EBLy = EC \times Wy$

EBLy : Yearly GHG emissions in the baseline（t-CO_2）

EC : Emission coefficient（kg-CO_2／kWh）

$EC = （AOM + BM）／2$

AOM : Approximate operating margin（kg-CO_2／kWh）

BM : Build margin（kg-CO_2／kWh）

Wy : Electricity production by the project（MWh）
Wy = Ws－Whr
Ws : Sending end electric energy（MWh）
Whr : Receiving end electric energy（MWh）

The approximate operating margin and the build margin are calculated by the following formula as average emission coefficient.

$CEFy = \{\Sigma\ (EG \times k \times GEF \times \rho \times CO_2/C \div \eta)\} \div \Sigma P$

CEFy : Average CO_2 emission factor（kg-CO_2/kWh）
EG : Yearly electricity production by sources（MWh）
k : Energy unit conversion ; 1MWh＝3.6×10^{-3}TJ
GEF : Emission factor by sources（t-C/TJ）; Coal＝**26.8 ,Diesel Oil**＝**20.2, Fuel Oil=21.1 ,**Gas＝15.3
Source; 1996ｙ, IPCC Guideline
P :Oxidization proportion coefficient of carbon ; Coal＝0.98, Oil＝0.99, Gas＝0.995
Source; 1996ｙ, IPCC Guideline
CO_2/C : CO_2 unit conversion ; 44/12
η : Generating efficiency by sources（%）;
For the approximate operation margin, coal=32.8, oil=31.9 and gas=46.5 are adopted.
For the build margin, values of the most recent power source are used.
Σ P : Sum of yearly electricity production of all the power sources（MWh）

Please refer to"E.2 Table providing values obtained when applying formulae above" for calculation of emission coefficient.

E.1.2.5 Difference between E.1.2.4 and E.1.2.3 represents the emission reductions due to the project activity during a given period:

GHG emissions in the baseline: E.1.2.4
= Emission coefficient×Yearly electricity production
= **0.597**（kg-CO_2／kWh）×7,200（MWh）= **4 248**（t-CO_2/year）
－）GHG emissions by the project activity: E.1.2.3 = 0（t-CO_2/year）
Yearly GHG emission reductions = **4 248**（t-CO_2/year）

Accordingly, expected yearly GHG emission reductions by the project activity are **4248**（t-CO_2/year）.

E.2 Table providing values obtained when applying formulae above:

Emission coefficient are calculated by the approximate operating margin and the build margin.

(1) Approximate operating margin

From the standpoint of transparency and conservativeness of data, two methods using the following values are used to determine the approximate operating margin. The values are, from the Master Plan on Electric Power Development in Vietnam Period 2001-2010 perspective up to 2020(revised in June 2003), ①Predicted value for 2005 and ②Average of the predicted values for three years from 2004 to 2006. After the examination, the lower data is adopted.

Average of the predicted values for three years from 2004 to 2006

Table-4 Average emission coefficient by approximate operating margin

Type of plants	Power generation (MWh/year)	Generating efficiency (%)	Emission coefficient (t-C/TJ)※2	Emissions (tCO2/year)
Hydro	Excluding			
Coal-thermal	**7,885,333.33**	**26.9**	**26.8**	**10.165,994.52**
Fuel Oil-thermal	**1,219,000.00**	**31.5**	**21.1**	**1,022,320.21**
Diesel oil thermal	**242,000.00**	**30.3**	**20.2**	**220,318.72**
Natural Gas	**24,226,333.33**	**33.2**	**15.3**	**14,645,868.02**
Associated gas	**1,077,333.33**	**28.9**	**15.3**	**748,066.17**
Geothermal	**Excluding**			
Total	**34,650,000.00**			**26,802,567.63**

Approximate operating margin : AOM = $\{\Sigma\ (EG \times k \times GEF \times \rho \times CO_2/C \div \eta)\} \div \Sigma P$

= {（Coal-thermal : 7,885,333.33×3.6×10^{-3}×26.8×0.98×44/12÷0.269）＋ (Fuel Oil –thermal :1,219,000.00 x 3.6 x10^-3 x21.1 x 44/12 /0.315) + (Diesel oil thermal : 242,000.00 x3.6 x 10^-3 x20.2 x 0.99 x 44/12 /0.303) + (Natural gas thermal : 24,226,333.33 x 3.6 x10^-3 x 15.3 x 0.995 x 44/12 /0.332) + (Associated gas thermal : 1,077,333.33 x 3.6 x 10^-3 x 15.3 x 0.995 x 44/12 / 0.289) } / 34,650,000

= { 10,165,994.52 +1,022,320.21 + 220,318 +14,645,868.02 + 748,066.17 }÷34,650,000

= 26,802,567.63÷34,650,000＝0.774（kg-CO_2/kWh）

Calculation results of the approximate operating margin from the above two methods both turn to **0.774**(kg-CO_2／kWh). Thus, this value is adopted as the operating margin.

(2)Build margin

In terms of the build margin, it is impossible to cover all the power sources including small-scale ones and, thus, calculation is made as to the following five large-scale power sources which are scheduled to launch operation by 2005 according to data obtained from EVN and Institute of Energy.

Table-5 Average emission coefficient by build margin

Month/Year of operation	Names of plants	Capacity (MW)	Power generation※1 (MWh/year)	Type of plants	Generating efficiency (%) ※2	Emission coefficient (t-C/TJ) ※3	Emissions (t-CO_2/year)
2004.3	Phu My 3	720	3,279,744	gas	50	15.3	1,318,130
2004.4	Na Duong	100	350,400	coal	35	25.8	334,130
2004	Phu My 2-2	720	3,279,744	gas	50	15.3	1,318,130
2005(Estimate)	Phu My 4	450	2,049,840	gas	50	15.3	823,832
2005(Estimate)	Phu My 2-1EXT	450	2,049,840	gas	50	15.3	823,832
Total		2,440	11,009,568				4,618,054

※1 : Calculation has been made with the capacity utilization rate of 52% for gas and 40% for coal based on the predicted value for 2005.
※2 : IPCC Guideline

Build margin : BM = $\{\Sigma\ (EG \times k \times GEF \times \rho \times CO_2/C \div \eta)\} \div \Sigma P$
= $\{$ (Phu My 3, 2-2 : $3,279,744 \times 3.6 \times 10^{-3} \times 15.3 \times 0.995 \times 44/12 \div 0.5$) $\times 2$
+ (Na Duong : $350,400 \times 3.6 \times 10^{-3} \times 25.8 \times 0.98 \times 44/12 \div 0.35$)
+ (Phu My 4, 2-1 EXT : $2,049,840 \times 3.6 \times 10^{-3} \times 15.3 \times 0.995 \times 44/12 \div 0.5$) $\times 2\}$
$\div 11,009,568$
$=\{ 1,318,130 \times 2 + 334,130 + 823,832 \times 2 \} \div 11,009,568$
$= 4,618,054 \div 11,009,568 =$ 0.42 (kg-CO_2/kWh)

(3)Emission coefficient
Emission coefficient is defined as (**0.774**+0.42) ÷2=**0.597** (kg-CO_2/kWh) by averaging out the approximate operating margin and the build margin,

F. Environmental impacts

F.1 If required by the host Party, documentation on the analysis of the environmental impacts of the project activity: *(if applicable, please provide a short summary and attach documentation)*

Irrigation shall have priority over power generation in this project and thus there will be no difference from the existing environment by the project activity. In this regard, however, irrigation operation will have to be reviewed during the construction, though in the short term, and countermeasures against it will have to be discussed and worked out with local parties.

All projects carried out in Vietnam are required to conduct an environmental impact assessment in conformity with Law on Environmental Protection issued in 1994, committing to compliance with the environmental standard and prevention of environmental pollution.
Hydroelectric power generation is divided into Category I for power plants which have a reservoir with the storage capacity of more than 100 millionm^3 and Category II for others, both of which are obliged to report an environmental impact assessment and obtain a certification of environmental standard compliance. Given that the storage capacity of the existing reservoir in this project is 200 millionm^3, this project is considered to fall under Category I. However, considering that the storage capacity will not be changed and the dam will be operated with priority on irrigation as it is now, there will be no environmental impact caused by power generation.

Meanwhile, as other environmental impacts, air pollution, water contamination, vibration and so forth may occur along with the construction. However, as stated in A-2, the existing facilities will be used to the utmost extent and turbines and generators will be newly installed. Accordingly, these impacts are considered small.

G. Stakeholders comments

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

Though details are yet to be examined, potential stakeholders in local residents are farmers who use irrigation water. This project will not alter the existing facilities including irrigation units and, therefore, negative environmental impacts or social effects on them are unlikely to emerge.

The followings are comments from other stakeholders obtained through the FS study.

（1）AGRIMECO : We welcome Tohoku's participation in the project. In this regard, however, we hope to decide the contribution rate of Tohoku through consultations down the road.

（2）PC1 : We welcome that this project becomes a CDM project and that Tohoku Electric Power Company joins the project.

（3）Song Chu Water & Agriculture Company : We welcome Tohoku's participation in the project. However, irrigation should have priority over power generation. We are planning to ensure around two months of the period to suspend discharge from the dam during the construction.

G.2 Summary of the comments received:

All the companies welcome Tohoku's participation in the project and have intentions to make cooperation towards the implementation of the project.

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

（1）Ministry of Agriculture and Rural Development（MOARD): This is the project for rehabilitating an old hydropower station, using available water resource to generate power, supplying clean energy, and meeting a part of the local demand on energy and requirements for CDM. Implementing the project will encourage to apply the recycling energy technology, improve the productivity of the reservoir, make contribution to the social and economic development, protect the local environment, and reduce greenhouse emission gas.

(2）Thanh Hoa Provincial People's Committee: The project for rehabilitation of Song Muc Hydropower Station is the project for rehabilitation of an old power plant; utilizing the existing reservoir and water resource (not constructing new reservoir). Therefore, It will not affect on the environment. The project will be carried out according to Clean Development Mechanism (CDM) that may create economic outcome, ensure durably development and cleanly improve the environment.

(3) Thanh Hoa Provincial People's Committee Dept. of Agricultural and Rural Development(DARD): The project will have no harmful effects on the environment as it will utilize the existing water source. The project will be able to supply electricity over a prolonged period and require durable development and relatively small costs.

(4）Thanh Hoa Provincial People's Committee Dept. of Industry（DOI)：The Song Muc Hydro Power Station Regeneration Project will effectively utilize water discharged from the Song Muc Reservoir to the irrigation channel without building a new reservoir. The project has met the requirements for CDM and will contribute to steady economic and social developments as well as environmental protection.

(5) Thanh Hoa Provincial People's Committee Dept. of Natural Resource and Environmen (DONRE：The project will ultilize the water source that Song Chu Water and Agricultural Company has been managing without building a new reservoir, Accordingly, there will be no effects on the use and management of the water source.

（5）Nhu Thanh District People's Committee：The project will have no harmful effects on the environment, enable the effective use of agricultural water and provide residents in Nhu Thanh District with electricity for their daily consumption. The project will greatly contribute to the industrialization and modernization of farm villages.

（7）Song Chu Water & Agriculture Company：We always support to carry out this project

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Annex 1

Participants of the project and their links are shown in Figure-5.
Project operators are Tohoku Electric Power Company and AGRIMECO. The owner of the dam and water right is Song Chu Water & Agriculture Company, a subordinate organization of Ministry of Agriculture and Rural Development (MARD), while the operator of maintenance and monitoring is Thanh Hoa Power Company.

Development of power sources in Vietnam has been promoted by Electricity of Vietnam (EVN) for large-scale power sources and PC1 for small hydro power plants in rural areas under the Ministry of Industry (MOI). PC1 is the largest power distributor managing northern Vietnam among seven financially independent distributors under the umbrella of EVN. The company has been engaged not only in operation and maintenance of transmission and distribution lines with 110kV or below and administrative tasks such as bill collection, but also in operation of small hydro power plants in rural areas.
CDM National Authority (CNA), a communication channel of CDM Designated National Authority (DNA), serves as the CDM implementation structure of Vietnam. CNA is led by Director General, International Cooperation Department of Ministry of Natural Resource and Environment (MONRE) and consists of MONRE National Office for Climate Change and Ozone Protection (NOCCOP), a subordinate body of MONRE. NOCCOP is in charge of practical tasks as communication channel.

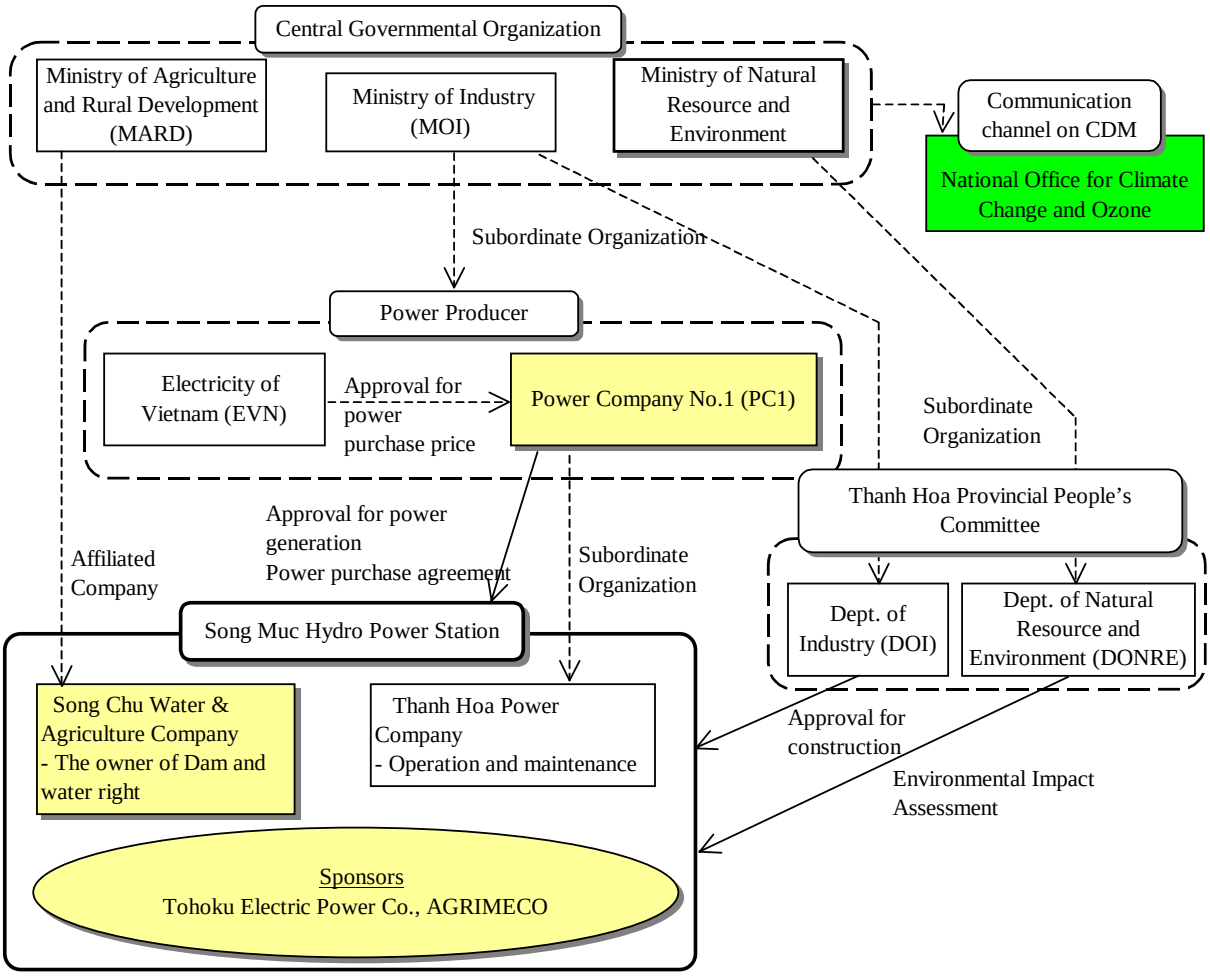

Figure-5 Project participants and their links

CONTACT INFORMATION FOR PARTICIPANTS IN THE PROJECT ACTIVITY

Sponsor-1

Organization:	Tohoku Electric Power Co., Ltd.
Building:	
Street/P.O.Box:	7-1, Honcho, 1-Chome, Aoba-ku
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E-Mail:	
URL:	
Represented by: Takeyoshi Yaegashi	
Title:	Senior Manager
Salutation:	
Last Name:	
Middle Name:	
First Name:	
Department:	Overseas Business, Group Business Department
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Direct FAX:	+81-22-213-5190
Direct tel:	+81-22-799-6281
Personal E-Mail:	w820159@tohoku-epco.co.jp

－ in charge of determination on the baseline
－ in charge of determination on the monitoring method

Sponsor-2

Organization:	AGRIMECO
Street/P.O.Box:	Km 10 – 1A Highway, Thanh Tri
Building:	
City:	Hanoi
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Postcode/ZIP:	
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E-Mail:	Agrimeco@hn.vnn.vn
URL:	
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Salutation:	
Last Name:	
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Mobile:	+84-91-3234795
Direct FAX:	
Direct tel:	
Personal E-Mail:	

CONTACT INFORMATION FOR PARTICIPANTS IN THE PROJECT ACTIVITY

The owner of water right

Organization:	Song Chu Water & Agriculture Company
Street/P.O.Box:	
Building:	
City:	Thanh Hoa
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E-Mail:	
URL:	
Represented by: Le Van Minh	
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Salutation:	
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Direct FAX:	
Direct tel:	
Personal E-Mail:	

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No Public Funding Obtained.

Annex 3

STAKEHOLDERS COMMENT