CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)
Version 03 - in effect as of: 22 December 2006

CONTENTS

Annexes

Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
03	22 December 2006	• The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.

SECTION A. General description of small-scale project activity

A.1 Title of the small-scale project activity:

Name of the project: Ban Nhung Small Hydropower Project

Version of document: 02

Date of Completion: 2 July 2012

PDD history:

Version 02, updated version based on DOE requests

A.2. Description of the small-scale project activity:

Ban Nhung Small Hydropower Project (hereafter referred to as "the proposed project") is located in Tran Ninh Commune, Van Quan District, Lang Son Province, Socialist Republic of Viet Nam. The proposed project will install 2 sets of generator and turbine to generate electricity, with the gross installation capacity of 11MW. The annual net power supply is estimated to be 39,803MWh with the operation hours of 3,655h/y[1]. Same amount of power would be supplied by Viet Nam National Grid without the implementation of this project. The baseline scenario of the proposed project is the same with the scenario existing prior to the proposed project.

The proposed project will reduce GHG emission by using hydraulic potential of Ky Cung River to generate electricity. It could substitute a part of power from Viet Nam National Grid, which is dominated by thermal power plants. It is estimated that the proposed project will annually generate 18,504 tCO_2e emission reductions comparing to the baseline scenario.

The proposed project will also contribute to the sustainable development for the host country by means of:

- Stimulating local economy development by providing electricity to meet increasing energy demands in Lang Son as well Vietnam;
- Creating job opportunities, promoting local economic development by supplying stable power output to industry and domestic demand, contribute to industrialization of this province;
- Reducing the emission of other pollutants resulting from the power generation industry in Vietnam, compared to a business-as-usual scenario;
- Improved access roads as the result of project development enhance local transport networks.

A.3. Project participants:

[1] Based on the hydrological data

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Socialist Republic of Vietnam (Host)	Tuan Anh Hydraulic Development and Construction Investment Corporation	No
Socialist Republic of Vietnam (Host)	Vietnam Renewable Energy Investment Joint-Stock Company (VENERIS., JSC)	No
United Kingdom	Climate Corporation Emissions Trading GmbH	No
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.		

Detailed contact information on the Participants is provided in Annex 1.

A.4. Technical description of the small-scale project activity:

A.4.1. Location of the small-scale project activity:

A.4.1.1. Host Party(ies):

Vietnam

A.4.1.2. Region/State/Province etc.:

Lang Son Province

A.4.1.3. City/Town/Community etc:

Tran Ninh Commune, Van Quan District

A.4.1.4. Details of physical location, including information allowing the unique identification of this small-scale project activity :

The proposed project activity involves the construction of a dam and a powerhouse which is located on the Ky Cung River in Van Quan District, Lang Son Province, Socialist Republic of Viet Nam. The geographical coordinates of the project are east longitude of 106°35'15" and north latitude of 22°00'10".

The site of the project is shown in the Figure 1:

Figure 1: The location of Ban Nhung Small Hydropower Project

A.4.2. Type and category(ies) and technology/measure of the small-scale project activity:

Type and category(ies) of the small-scale project

The project utilizes hydraulic potential to generate power, which falls into the category of renewable energy.

The installed capacity of the proposed project is 11 MW.

Therefore, according to UNFCCC Appendix B of the simplified modalities and procedures for small-scale CDM project activities, the type and category of the project fall into:

Type I - Renewable Energy Project

Category I.D - Grid Connected Renewable Electricity Generation

Technology/measure of the small-scale project activity

The project involves the construction of a new grid-connected hydropower plant and the installation of new hydro turbines and generators in order to convert potential flowing energy of water from the Ky Cung River to electricity energy, which will be supplied to National electricity grid through 35kV transmission line. Since hydropower generation technology is a renewable electricity generation technology which displaces fossil fuel fired power generation technology to supply electricity to the grid, the implementation of this project activity will generate emission reductions.

Figure below shows the layout of proposed project.

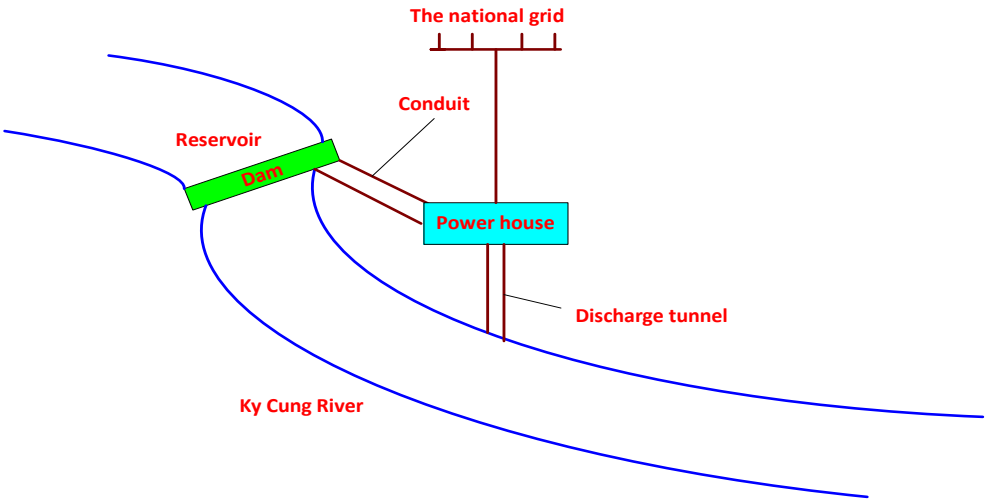

Figure 2: Layout of Ban Nhung Hydropower Project

The main equipments are imported from China. Main technical parameters of the proposed project are shown in Table 1.

Table 1: Main technical parameters of the proposed project activity[2]

Main parameters	Units	Values
1. Turbine		
• Type		Kaplan- Vertical Shaft
• Number of Turbine	Set	2
• Rated Output	MW	5.729
• Rated Revolution	r/min	300
• Rated Head	m	19.1
• Rated Flow	m^3/s	42.1
• Efficiency	%	90.39
2. Generator		
• Number	Set	2
• Type		Synchronous, vertical axis
• Single-unit Capacity	MW	5.5
• Rated Voltage	kV	6.3
• Rated Revolution	r/min	250
• Efficiency	%	96.5

The annual operation hours for the project are expected to be 3,655h, with the plant load factor of 41.72%. The project activity does not involve any greenhouse gas emissions or burning of any fossil fuels during the process of power generation, and the technology applied for the project activity is environmentally safe and sound.

A.4.3 Estimated amount of emission reductions over the chosen crediting period:

Fixed crediting period is selected for the proposed project. The estimated emission reductions over the crediting period (January 1st, 2014-December 31st, 2023) are 185,040 tCO_2e.

Table 2: Estimation of project emission reductions

Year	Annual estimation of emission reductions in tonnes of CO_2 e
2014	18,504
2015	18,504
2016	18,504
2017	18,504
2018	18,504
2019	18,504
2020	18,504
2021	18,504

[2] FSR volume II-1- Main part of the Project

2022	18,504
2023	18,504
Total estimated emission reductions (tCO_2e)	185,040
Number of the fixed crediting years	**10**
Annual average over the crediting period of estimated reductions (tCO_2e)	18,504

A.4.4. Public funding of the small-scale project activity:

There are no public funds involved in the proposed project.

A.4.5. Confirmation that the small-scale project activity is not a debundled component of a large scale project activity:

According to EB 54 Annex 13, a proposed small-scale project activity shall be deemed to be a de-bundled component of a large project activity if there is a registered small-scale CDM project activity or an application to register another small-scale CDM project activity:

- With the same project participants;
- In the same project category and technology/measure; and
- Registered within the previous 2 years; and
- Whose project boundary is within 1 km of the project boundary of the proposed small scale activity at the closest point.

Ban Nhung is the unique project of project owner so that they do not have any previously registered projects nor do they have another project within a 1km of the Ban Nhung project boundary. Clearly, Ban Nhung is not a de-bundled component of a large scale activity.

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline and monitoring methodology applied to the small-scale project activity:

The methodology applied for this project is the approved small-scale CDM baseline methodology "AMS-I.D, version 17: Grid connected renewable electricity generation". For more information regarding the methodology, please refer to the link:
http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html

Related Guideline and Tool:

"Non-binding best practice examples to demonstrate additionality for SSC project activities" version 1.0 .http://cdm.unfccc.int/Reference/Guidclarif/ssc/methSSC_guid15_v01.pdf.

"Attachment A to Appendix B of the simplified modalities and procedures for CDM small-scale project activities" version 8.0. http://cdm.unfccc.int/Reference/Guidclarif/ssc/methSSC_guid05.pdf.

"Guidelines on the assessment of investment analysis (Version 5)" http://cdm.unfccc.int/Reference/Guidclarif/reg/reg_guid03.pdf.

"Tool for calculation of emission factor for electricity systems (Version 2.2.1)" is adopted to calculate the emission factor of the Vietnam Power Grid. http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v2.2.1.pdf.

B.2 Justification of the choice of the project category:

The proposed project meets all the applicability conditions of AMS-I.D which are justified as follows:

Table 3: Applicability conditions of the methodology AMS-I.D

	Applicability Criteria	Applicability	Project Activity
1	This methodology comprises renewable energy generation units, such as photovoltaic, hydro, tidal/wave, wind, geothermal and renewable biomass: a) Supplying electricity to a national or a regional grid; or b) Supplying electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.	Applicable	The proposed project will use the hydro power to generate electricity and supply to Viet Nam National grid, which is dominated by power from thermal power plants.
2	This methodology is applicable to project activities that (a) install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (Greenfield plant); (b) involve a capacity addition1; (c) involve a retrofit2 of (an) existing plant(s); or (d) involve a replacement3 of (an) existing plant(s).	Applicable	The hydropower plant involved in the proposed project is Greenfield plant.

3	Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology: • The project activity is implemented in an existing reservoir with no change in the volume of reservoir; • The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 W/m2; • The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m^2.	Applicable	Power density for the proposed project is 6.2 W/ m^2, which is greater than 4 w/ m^2.
4	If the new unit has both renewable and non-renewable components (e.g.. a wind/diesel unit), the eligibility limit of 15MW for a small-scale CDM project activity applies only to the renewable component. If the new unit co-fires fossil fuel[1], the capacity of the entire unit shall not exceed the limit of 15MW.	Applicable	The proposed project does not involve any non-renewable components. This criterion is therefore not applicable. The installation capacity of the proposed project is 11MW, which is within the limit of 15 MW stipulated for the chosen (small-scale) methodology.
5	Combined heat and power (co-generation) systems are not eligible under this category.	N/A	There is no combined heat and power system in the proposed project. This criterion is therefore not applicable.
6	In the case of project activities that involve the addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct from the existing units.	N/A	The proposed project is a new construction project. This criterion is therefore not applicable.

7	In the case of retrofit or replacement, to qualify as a small-scale project, the total output of the retrofitted or replacement unit shall not exceed the limit of 15MW.	N/A	The proposed project is a new construction project and is not involved with retrofit or replacement of an existing facility. This criterion is therefore not applicable.

B.3. Description of the project boundary:

According to methodology AMS I.D, version 17 the boundary for this project type is delineated by:

- Geographical site: the area where the project is constructed.
- Physical boundary: the national power grid to which the project is connected.

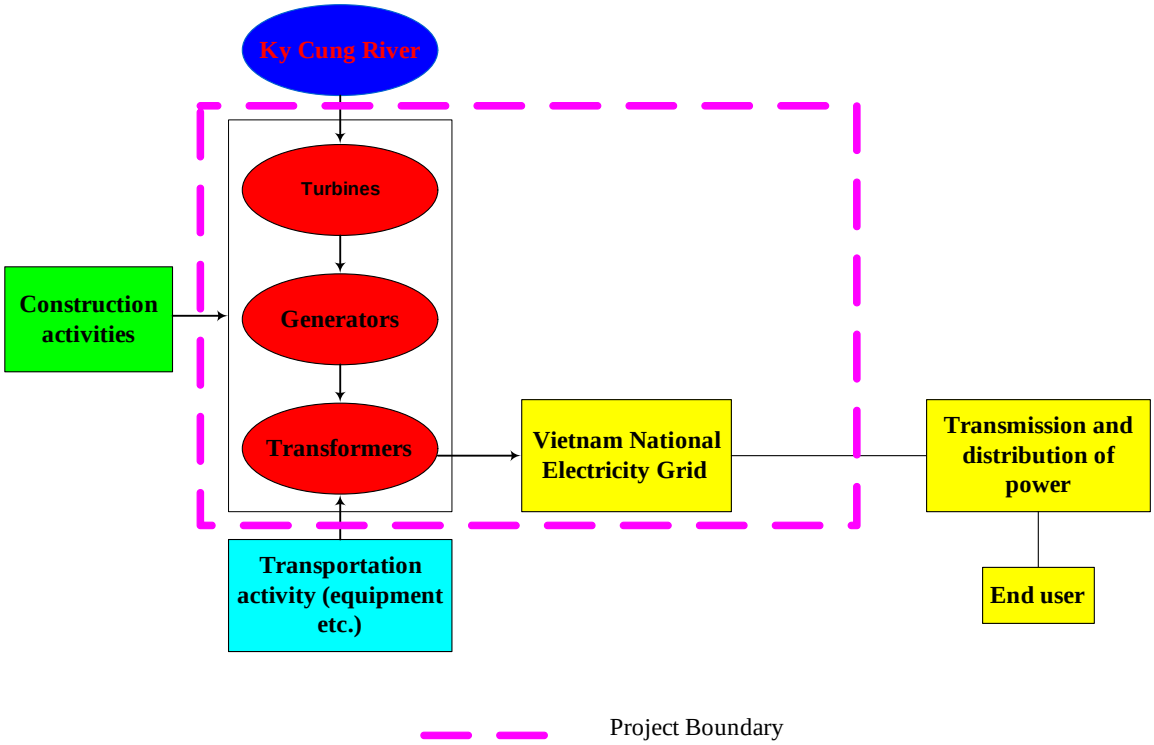

Figure 3: Project Boundary

The greenhouse gases and emission sources included in or excluded from the project boundary are shown in the following table.

Table 4: Emission sources included in or excluded from the project boundary

	Source	Gas	Included?	Justification/Explanation
Baseline	CO_2 emission from electricity generation	CO_2	Yes	Main emission source

	in fossil fuel fired power plants that is displaced due to the project activity	CH_4	No	Excluded for simplification. This is conservative
		N_2O	No	Excluded for simplification. This is conservative
Project Activities	For hydro power plants, emissions of CH_4 from the Reservoir	CO2	No	Excluded for simplification.
		CH4	Yes	Since the power density of all power plants are greater than 4 W/m^2 but lower than $10W/m^2$, CH_4 emissions will be taken into consideration.
		N_2O	No	Excluded for simplification.
	For backup power consumption	CO_2	No	The project will use electricity from battery for the back-up purpose and this is considered as a part of the auxiliary consumption.
		CH_4	No	Exclude for simplification
		N_2O	No	Exclude for simplification

B.4. Description of baseline and its development:

According to the methodology AMS-I.D version 17, the baseline scenario is that the electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources into the grid. In case of project activity, the baseline scenario is determined as the continuation of electricity supply from Vietnam's National Grid, which is mainly served by greenhouse gas intensive fossil fuel power plants.

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered small-scale CDM project activity:

Prior consideration of CDM

CDM has been seriously considered by the project owners prior to the commencement of the construction, and a series of continuing actions have been taken by the project participants to secure CDM support throughout the planning and construction phases. The chronology for the proposed project is as follows:

Table 5: Timeline for Ban Nhung Small Hydropower Project

Date	Events
2/6/2007	CDM approached by VECC
20/7/2007	FSR completed with CDM considered as an important revenue
1/10/2007	Investment License
5/12/2007	Board Decision to invest with CDM revenue as an important factor for the investment
5/12/2007	Environmental Impact Assessment (EIA) report

	completed
5/12/2007	EIA approval
1/4/2008	The first expense for land compensation **(Start date of the project activity)**
5/4/2008	Construction contract
20/6/2008	CDM consultant contract with VECC
15/10/2008	Official letter sent from PO to the Provincial authority to seek the support for CDM project.
11/1/2009	Due Diligence report for the project from VECC
10/7/2009	Bank loan contract
25/8/2009	CDM consultant contract with VECC was terminated
15/8/2009	PO approached by Climate Corporation for CDM
15/12/2009	MOU between project owner and Climate Corporation
04/01/2010	Letter from bank to delay the disbursement for the project
8/4/2010	CADA signed between Climate Corporation and project owner
20/10/2010	CDM Stakeholders meeting
20/1/2011	ERPA signed between Climate Corporation and project owner
19/9/2011	Contract between project owner and Veneris JSC to facilitate the CDM development for the project
5/1/2012	Global Stakeholder Consultation

Additionality

With the implementation of the proposed project, the emissions of GHGs will be reduced below the level that would have occurred in the absence of the registered CDM project activity. The proposed project is a small scale project activity. According to Attachment A to Appendix B of the simplified modalities and procedures for CDM small-scale project activities, the project participant is required to demonstrate that the proposed project would not have occurred anyway due to at least one of the following barriers:

a. Investment barrier, i.e., a financially more viable alternative to the project activity would have led to higher emissions
b. Technological barrier, i.e., a less technologically advanced alternative to the project activity, though would involves lower risks due to the performance uncertainty or low market share of the new technology adopted by the project activity and so would have led to higher emissions;
c. Barrier due to prevailing practice, i.e., prevailing practice or existing regulatory or policy requirements would have led to the implementation of a technology with higher emissions;
d. Other barriers, i.e., without the project activity, for another specific reason identified by the project participant, such as institutional barriers or limited information, managerial resources, organizational capacity, financial resources, or capacity to absorb new technologies, emissions

would have been higher.

Investment barrier is the main obstacle for the proposed project. According to "Non-binding best practice examples to demonstrate additionality for SSC project activities": Best practice examples include but are not limited to, the application of investment comparison analysis using a relevant financial indicator, application of a benchmark analysis or a simple cost analysis (where CDM is the only revenue stream such as end-use energy efficiency). It is recommended to use national or global accounting practices and standards for such an analysis. Since the proposed project could get income from electricity sales, benchmark analysis is selected for the proposed project's financial analysis.

The internal return rate (IRR) of the total investment is selected as the financial indicator. A project IRR before tax is calculated for the proposed project and this is compared with a benchmark to prove the financial unattractiveness of the project.

According to EB 62 Report Annex 5, "Guidelines on the Assessment of Investment Analysis" (Version 05): In cases where a benchmark approach is used, the applied benchmark shall be appropriate to the type of IRR calculated. Local commercial lending rates or weighted average cost of capital (WACC) are appropriate benchmarks for a project IRR. Thus for the proposed project, the weighted average cost of capital (WACC) is selected as the benchmark.

WACC is calculated by the following formula:

$$WACC = \left(\frac{E}{V}\right) \times R_e + \left(\frac{D}{V}\right) \times R_d \times (1 - T_c)$$

In which:

E: Amount of Equity in the project

D: Amount of Debt in the project

V: Total investment cost (V=D+E)

R_e: Cost of equity

R_d: Cost of debt

T_c: Average enterprise tax rate

Further instruction from this guideline, the proportion of 50% debt and 50% equity financing will be applied in case such information is not readily available. Hence $\left(\frac{E}{V}\right) = \left(\frac{D}{V}\right) = 50\%$ [3]is selected for the calculation.

This guideline also gives the default expected return on equity (cost of equity) for different countries and different sectors. For Vietnam and its energy industries, this default value is 12.75%[4]

Cost of debt is the commercial lending rate that project owner can afford. According to the report of IMF for Vietnam in 2007, this rate is 13.7%[5] for the medium term lending rate. Additionally, the basic interest

[3] "Guidelines on the Assessment of Investment Analysis" (Version 05)

[4] "Guidelines on the Assessment of Investment Analysis" (Version 05)

[5] IMF country report 2007

rate set up by the State Bank of Viet Nam in December 2007 was 8.25%[6] .According to the Vietnamese civil law[7], commercial banks may charge up to of 150% of the base rate, i.e. 12.37%. Conservatively, the cost of debt for the proposed project is chosen at 12.37%.

Corporate tax is excluded from the calculation because WACC will be compared with project IRR before tax.

Selected values and the computed WACC are summarized in the following table:

Table 6: Values and WACC

Parameters	**Value**
(E/V)	50%
(D/V)	50%
Cost of Equity	12.75%
Cost of Debt	12.37%
Corporate tax	0%
WACC	**12.56%**

Therefore 12.56% will be the value of the benchmark for the proposed project.

The following input parameters were considered in making the projected income statement and IRR computation:

Table 7: Key Input Parameters

Parameter	Unit	Values	Source
Construction investment	mVND	217,907	FSR
Cost on construction and equipment	mVND	175,694	Calculated
Installed capacity	MW	11	FS
Operational hours	hours	3,655	FS
Gross Power Generation	MWh	40,205	FS
Net Power Generation	MWh	39,803	Calculated
Exchange rate	EUR - mVND	0.02345	Vietcombank on 5/12/2007

[6] From State bank of Viet Nam: http://www.sbv.gov.vn/wps/portal/vn
[7] Civil law no. 33/2005/QH11, dated 25/12/2001 Civil law no. 33/2005/QH11, dated 25/12/2001

Exchange rate	USD - mVND	0.01604	Vietcombank on 5/12/2007
O&M cost (as percentage of fixed asset)		1.00%	FS
Auxiliary consumption rate		1.00%	FS
Power Tariff	$US/MWh	42.0	FS
Operation lifespan	years	20	FS
Natural resource tax (as percentage of sale electricity)		2%	Decree 68/1998/ND-CP
Fixed electricity price to calculate Natural resource tax	mVND/MWh	0.75	Circular 42/2007/TT-BTC
Grid emission factor	tCO_2/MWh	0.5558	Calculated from source of DNA Vietnam
CER price	EUR/CER	18	

The IRR calculations were based on the following conservative assumptions:

- Total operating costs do not include escalation of O&M cost.
- Corporate tax is excluded from the calculation.
- Interest rate during construction is excluded.
- Proposed project had not signed the Power Purchase Agreement (PPA) by the time of writing the PDD. According to Decision 2014, the tariff for hydropower projects with installed capacity smaller than 30MW ranges from 2.7UScent/kWh to 5.2 UScent/kWh in dry season and from 2.5UScent/kWh to 5.0 UScent/kWh in wet season. The dry season is defined from 1st October to 30th June next year, and the wet season from 1st July to 30th September, Thus the average power tariff in dry season is 3.95 US$cent/kWh and in wet season is 3.75 US$cent/kWh. Such average values are all lower than the selected power tariff for the proposed project, i.e. 4.2 US$cent/kWh equivalent with 674 VND/kWh at the time of making the board decision (1USD = 16040VND on 5/12/2007)[8]. Further demonstration for the conservativeness of power tariff selection can be referred to the sensitivity analysis below.

The results of the IRR calculations are shown in table 8 below:

Table 8: IRR of Ban Nhung Small Hydropower Project

Ban Nhung

[8] Refer to: "http://www.vietcombank.com.vn/ExchangeRates/Default.aspx"

Project IRR	Without CDM	**9.44%**
	With CDM	**12.76%**
Benchmark		**12.56%**

In accordance with the benchmark analysis if the financial indicators (such as the IRR) of a project are lower than the benchmark, the project is not considered to be financially attractive. From the table above, we find that the IRR for the proposed project (without CDM benefit) is 9.44%, which is lower than the selected benchmark (12.56%) and therefore the project is not financially attractive.

With the CDM revenue, the project IRR will be significantly improved. Therefore, the project with CDM revenue can be considered as financially attractive to investors.

Sensitivity analysis

The robustness of the conclusion drawn above has been tested by subjecting critical assumptions to reasonable variations. Guidelines on the Assessment of Investment Analysis define critical assumptions as those which constitute more than 20% of total project costs or total project revenue and reasonable variation has been defined as a range of +10% and - 10% (item No 20 and 21 of the Guidelines). Four factors have thus been identified as sensitive, viz., project cost, O&M cost, plant load factor (number of annual operating hours) and tariff. The impact of a "reasonable variation" in these four parameters on the project IRR have been worked out and the results are as follows:

Table 9: Sensitivity analysis of Ban Nhung Project

Project IRR	-10%	-5%	0	5%	10%
Construction Investment	10.98%	10.17%	9.44%	8.76%	8.13%
OM Cost	9.54%	9.49%	9.44%	9.39%	9.33%
Power tariff	7.86%	8.66%	9.44%	10.20%	10.95%
Load factor	7.86%	8.66%	9.44%	10.20%	10.95%

In order to illustrate the respected project IRR subject to the assumed variations of above factors, the highest values of project IRR in such cases are selected and compared to the benchmark. This is plotted in the following figure:

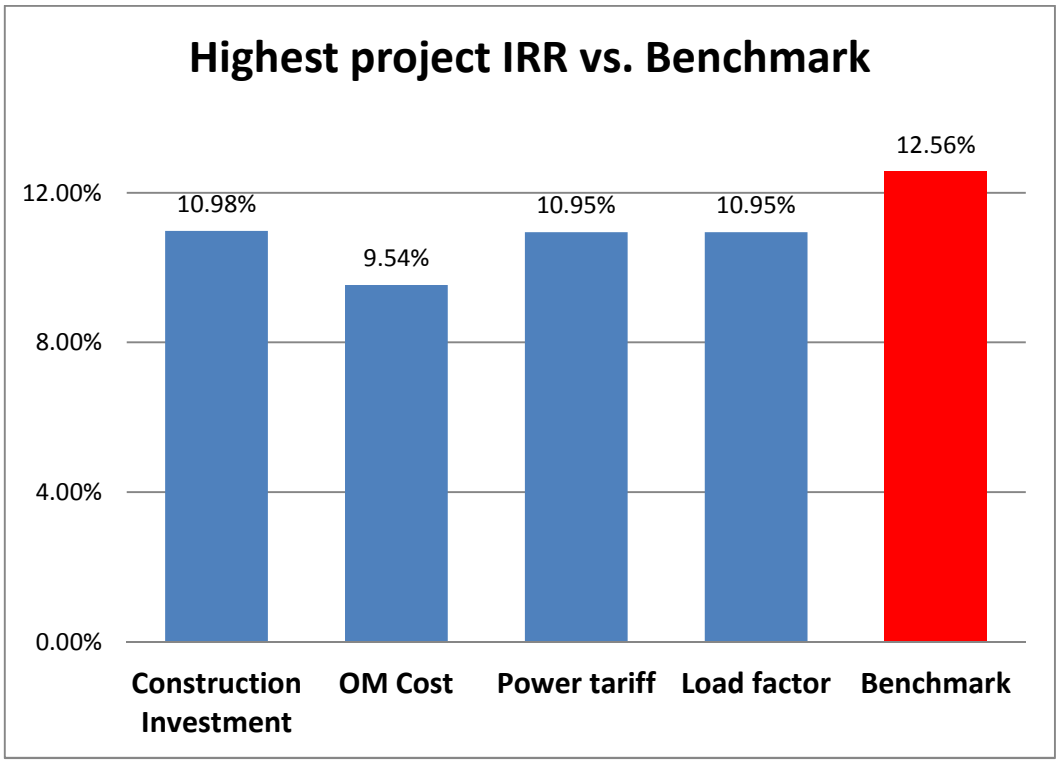

Figure 4: Highest Project IRR vs. Benchmark- Ban Nhung Project

Above analysis show that when the parameters vary by ±10%, IRR of Ban Nhung project could not reach the benchmark and this supports for the conclusion that the proposed project is financially unattractive. The proposed project therefore faces investment barrier and is additional.

Table 10 shows changes needed to reach benchmark 12.56%.

Table 10: Sensitivity analysis of change needed to reach benchmark of 12.56%

Parameters	Ban Nhung Hydropower project
Power tariff	21%
Load Factor	21%
Construction investment	-18.67%
O&M cost	-321%

In reality, these scenarios are highly unrealistic for the following reasons.

Load Factor

The project IRR will reach 12.56% when the operation hours increase 21%. However, the annual operation hours are calculated according to historical hydrological data. With the proposed project activity, the annual operation hours were estimated based on 40 years of historic hydrological data as

presented in the FSRs. Therefore it is highly unlikely that the annual net electricity supply would increase by so much to meet the benchmark.

Power tariff

The project IRR will reach 12.56% when the electricity tariff increases 21%. In Viet Nam, power tariff is strictly controlled by the government, and the government only increases tariff rate due to the rise of Consumer Price Index (CPI) of operation cost of power generation such as materials, labour costs and interest rate of the loan etc. In that case, the annual operation cost will also go higher, and there is no actual increase on power tariff. The Table 11 summarizes the average avoided cost tariff, country CPIs and present values of such tariffs in 2007.

Table 11: Avoided cost tariff through years and comparison with selected power tariff of proposed project activity

Years	Average avoided cost tariff (VND)	CPI of the country (end of period) in previous year[9]	Present value in 2007 (VND)	Actual changes compared to selected power tariff of proposed project
2009	658[10]	19.90%	549	-18.55%
2010	674[11]	6.5%	528	-21.59%
2011	801[12]	11.8%	561	-14.74%
2012	823[13]	13.8%	507	-24.77%

It can be seen that, the actual values of avoided cost tariff through years are all lower than selected power tariff of the project activity.

Construction investment

The project IRR will reach 12.56% when the construction decreases by 18.67%. It is not likely for the investment costs to decrease to the level required to meet the benchmark. Viet Nam has been experiencing a period of high inflation, consequently, the price of materials, construction costs and relevant other costs are increasing. Thus decrease of construction investments is not realistic.

O&M cost

When the O&M cost of Ban Nhung reduces 321%, the project IRR could touch benchmark, but it is impossible to decrease more than 100% (O&M cost could never be minus).

In conclusion, the proposed project is financially unattractive when comparing the project IRR with the selected benchmark. The proposed project therefore faces investment barrier and **is additional**.

[9] http://www.imf.org/external/np/sec/pn/2011/pn1181.htm

[10] Calculated from the Decision No. 74/QD-DTDL dated 24/12/2008 on avoided cost tariff for the year 2009

[11] Calculated from the Decision No. 73/QD-DTDL on avoided cost tariff for the year 2010

[12] Calculated from the Decision No. 66/QD-DTDL on avoided cost tariff for the year 2011

[13] Calculated from the Decision 06/QD-DTDL on avoided cost tariff for the year 2012

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

The methodology AMS.I.D is applicable to the project, so emission reductions are calculated according to the latest version of methodology AMS.I.D (Version 17), and the main steps are as follows:

Baseline Emission (BE_y)

According to AMS-I.D, baseline emissions for electricity supplied from the grid shall be calculated as the amount of electricity produced multiplied by the CO_2 emission factor of that grid, in this case Viet Nam National Grid.

$$BE_y = EG_{BL,y} * EF_{CO_2,grid,y} \qquad \textbf{Equation 1}$$

Where:

BE_y Baseline emissions in year y; t CO2

$EG_{BL,y}$ Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year y (MWh)

EF_{CO2} CO_2 emission Factor of the grid in year y (tCO2e/MWh)

Calculation of the emission factor (EF) of the national electricity grid

For the calculation of emission factor, the methodology refers to the *"Tool to calculate the emission factor for an electricity system"* version 2.2.1 issued in EB 63. In accordance with the Tool, the baseline emission factor is calculated as a combined margin: a weighted average of the operating margin emission factor and the build margin emission factor. Both the operating margin and build margin factors are calculated *ex ante.*

The grid boundary has been determined in accordance with the Tool as the national grid.

Step 1: Identify the relevant electricity systems

The electricity generated by the proposed project will be delivered to the Viet Nam National Grid. Ban Nhung power plant is physically connected to the national grid; hence this is the relative electricity system for the proposed project.

Step 2: Choose whether to include off-grid power plants in the project electricity system (optional)

Option I: Only grid power plants are included in the calculation.

Option II: Both grid power plants and off-grid power plants are included in the calculation.

In Vietnam, the National grid is reliable and stable. Also, off-grid power plants just fulfil the minor own request of producer; hence they are not significant. In summary, Option I is chosen to calculate the proposed project's operating margin and build margin emission factor.

Step 3: Select method to determine the operating margin (OM)

The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is based on one of the following methods:

(a) Simple OM
(b) Simple adjusted OM
(c) Dispatch data analysis OM
(d) Average OM

Option (a) - Simple Operation Margin can only be used if low-cost/ must- run resources constitute less 50% of the total power generation of the grid. Within the most recent 5 years for which data is available for power generation of Viet Nam Power (2004-2008), the proportion of power generated by low cost and must run resources was below 50% being 39.71%, 32.52%, 34.13%, 33.74%, and 34.72% in 2004, 2005, 2006, 2007 and 2008 respectively.

Table 12: Low cost/ must run resources

	2004	2005	2006	2007	2008
Low-cost/must-run	39.71%%	32.52%	34.13%,	33.74%	34.72%

As shown above, low cost/ must run power generation in Viet Nam constituted less than 50% of the total in the recent past, therefore, the project will use option (a) to calculate the Operation Margin.

The simple OM is calculated ex-ante using a 3-year's generation weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation. By doing so, the emission factor will not need to be monitored or re-calculated during the fixed crediting period.

Step 4. Calculate the operating margin emission factor according to the selected method

The simple OM emission factor ($EF_{OM,Simple,y}$) is the generation-weighted average emissions per electricity unit (tCO_2/MWh) of all generating sources serving the system, not including low-operating cost and must-run power plants. It may be calculated:

- Option A: Based on net electricity generation and a CO_2 emission factor of each power unit; or
- Option B: Based on data on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system

Option A is selected to calculate the OM emission factor. Under this option the simple OM emission factor is calculated based on the electricity generation of each power unit and an emission factor for each power unit, as follows:

Equation 5: $$\mathbf{EF_{grid,OMsimple,y}} = \frac{\sum_{m} EG_{m,y} \times EF_{EL,m,y}}{\sum_{\mathbf{m}} \mathbf{EG_{m,y}}}$$

Where:

$EF_{grid,OMsimple,y}$	= Simple operating margin CO2 emission factor in year *y* (tCO_2/MWh)
$EG_{m,y}$	= Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
$EF_{EL,m,y}$	= CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
m	= All power plants/units serving the grid in year *y* except low-cost/must-run power plants/units
y	= The relevant year as per the data vintage chosen in step3

In the DNA report, data related to fuel consumption and electricity generation is available, the emission factor ($FEEL_{,m,y}$) is determined as follows:

Equation 6: $$EF_{EL,m,y} = \frac{\sum_{i} FC_{i,m,y}.NCV_{i,y}.EF_{CO2,i,y}}{EG_{m,y}}$$

Where,

$EF_{EL,m,y}$	= CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
$FC_{i,m,y}$	= Amount of fossil fuel type i consumed by power unit m in year y (Mass or volume unit)
$NCV_{i,y}$	= Net calorific value (energy content) of fossil fuel type I in year y (GJ/mass or volume unit)
$EF_{CO2,i,y}$	= CO_2 emission factor of fossil fuel type i in year y (tCO_2/GJ)
$EG_{m,y}$	= Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
m	= All power units serving the grid in year y except low-cost/must-run power units
i	= All fossil fuel types combusted in power unit m in year y
y	= The relevant year as per the data vintage chosen in Step 3

Step 5. Calculate the build margin (BM) emission factor

In accordance with the Emission Factor Tool, the BM emission factor is calculated according to Option 1. For the fixed crediting period, calculate the build margin emission factor *ex ante* based on the most recent information available on units already built for sample group *m* at the time of CDM-PDD submission to the DOE for validation. This option does not require monitoring the emission factor during the fixed crediting period

According to the Tool, the sample group of power units m used to calculate the build margin should be determined as per following procedure:

(a) Identify the set of five power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently ($SET_{5\text{-units}}$) and determine their annual electricity generation ($AEG_{SET\text{-}5\text{-}units}$, in MWh);

(b) Determine the annual electricity generation of the project electricity system, excluding power units registered as CDM project activities (AEG_{total}, in MWh). Identify the set of power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently and that comprise 20% of AEG_{total} (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) ($SET_{\geq 20\%}$) and determine their annual electricity generation ($AEG_{SET\text{-}\geq 20\%}$, in MWh);

(c) From $SET_{5\text{-units}}$ and $SET_{\geq 20\%}$ select the set of power units that comprises the larger annual electricity generation (SET_{sample}); Identify the date when the power units in SET_{sample} started to supply electricity to the grid. If none of the power units in SET_{sample} started to supply electricity to the grid more than 10 years ago, then use SET_{sample} to calculate the build margin. In this case ignore steps (d), (e) and (f).

From DNA data, $AEG_{SET\text{-}\geq 20\%} > AEG_{SET\text{-}5\text{-}units}$ and none of power units in $SET_{\geq 20\%}$ started to supply electricity to grid more than 10 years ago, then $SET_{\geq 20\%}$ is used to calculate the build margin and steps (d), (e) and (f) are ignored.

Equation 7: $$EF_{grid,BM,y} = \frac{\sum_{m} EG_{m,y} \times EF_{EL,m,y}}{\sum_{m} EG_{m,y}}$$

Where:

$EF_{grid,BM,y}$	= Build margin CO_2 emission factor in year *y* (tCO_2/MWh)
$EG_{m,y}$	= Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
$EF_{EL,m,y}$	= CO_2 emission factor of power unit m in year y (tCO_2/MWh)
m	= Power units included in the build margin
y	= Most recent historical year for which power generation data is available (2008)

The CO_2 emission factor of each power unit m ($EF_{EL,m,y}$) will be determined as per the guidance in step 4 for the simple OM, using option A.

Step 6. Calculate the combined margin ($EF_{grid,CM,y}$) emissions factor

The calculation of the combined margin (CM) emission factor ($EF_{grid,CM,y}$) is based on one of the following methods:

(a) Weighted average CM; or
(b) Simplified CM.

The option (a) will be selected:

Equation 8: $EF_{grid,CM,y} = EF_{grid,OM,y} \times \omega_{OM} + EF_{grid,BM,y} \times \omega_{BM}$

Where:
w_{OM} Weighting of OM emissions factor (%)
w_{BM} Weighting of BM emissions factor (%)

According to the Tool, the following default values are used for the proposed project: w_{OM} = 0.5 and w_{BM} = 0.5 will be used for the fixed crediting period.

Based on above demonstration, the calculated factor is **0.5558 tCO2/MWh**

Leakage

The proposed project is newly built and there is no energy generating equipment is transferred from another activity, therefore no leakage is considered in the proposed project.

Equation 2: $LE_y = 0tCO_2e$

Project activity emissions

According to the methodology, for hydro project activities that result in new reservoirs and hydro power project activities that result in the increase of existing reservoirs, PE_y is equal to $PE_{HP,y}$:

a) if the power density of the proposed project (PD) is greater than 4W/m^2 and less than or equal to 10W/m^2

Equation 3:

$$PE_{HP,y} = \frac{EF_{\text{Res}} \times TEG_y}{1000}$$

Where:
$PE_{HP,y}$ Project emission from water reservoirs (tCO_2e/yr)
EF_{Res} Default emission factor for emissions from reservoirs of hydro power plants in year y (kg CO_2e/MWh)
TEG_y Total electricity produced by the proposed project, including the electricity supplied to the grid and the electricity supplied to internal loads, in year y (MWh)

b) If the power density of the proposed project (PD) is greater than 10W/m^2:

Equation 4: $PE_{HP,y} = 0$

The power density of the proposed project (PD) is calculated as follows:

Equation 5: $PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}}$

Where:
PD Power density of the proposed project (W/m^2)
Cap_{PJ} Installed capacity of the hydro power plant after the implementation of the proposed project (W)
Cap_{BL} Installed capacity of the hydro power plant before the implementation of the proposed project (W). For new hydro power plants, this value is zero
A_{PJ} Area of the reservoir measured in the surface of the water, after the implementation of the proposed project, when the reservoir is full (m^2)
A_{BL} Area of the reservoir measured in the surface of the water, before the implementation of the proposed project, when the reservoir is full (m^2). For new reservoirs, this value is zero.

Emissions reductions are calculated as follow:

Equation 6: $ER_y = BE_y - PE_y - LE_y$

Where:
ER_y Emission reductions in year *y*
BE_y Baseline emission reduction in year y
PE_y Project activity emission in year *y*
LE_y Project leakage emission in y

B.6.2. Data and parameters that are available at validation:

Data / Parameter:	$EG_{m,y}$
Data unit:	MWh
Description:	Net electricity generated and delivered to the grid by power plant/unit m in year *y*
Source of data used:	Data public released by EVN
Value applied:	See annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data provided by EVN can be considered reliable.
Any comment:	-

Data / Parameter:	$EF_{CO2,m,,i,y}$
Data unit:	tCO_2/GJ
Description:	CO_2 emission factor of fossil fuel type *i* in year *y*
Source of data used:	IPCC 2006 Volume2, Table 2.2
Value applied:	Anthracite Coal: 0.0946, Bituminous Coal: 0.0895 Diesel Oil: 0.0726 Fuel Oil: 0.0755 Natural Gas: 0.0543
Justification of the choice of data or	Emission factor of fuels is not available in Viet Nam. As such IPCC default values at the 95% confidence interval must be used and considered the best

description of measurement methods and procedures actually applied :	approximation for Viet Nam.
Any comment:	-

Data / Parameter:	$EF_{EL,m,y}$
Data unit:	tCO_2/MWh
Description:	CO_2 emission factor of power unit *m* in year *y*
Source of data used:	Data public released by DNA
Value applied:	See annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data provided by DNA can be considered reliable.
Any comment:	-

Data / Parameter:	NCV_i
Data unit:	GJ/ unit
Description:	Net Calorific Value (energy content) per mass or volume unit of fuel i used to generate power in the Viet Nam National Grid used to calculate the OM
Source of data used:	IPCC
Value applied:	Refer to Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	No further comments

Data / Parameter:	$EF_{grid, CM,y}$
Data unit:	tCO_2/MWh
Description:	Baseline Emission factor for the Viet Nam National Grid
Source of data used:	Data public released by EVN
Value applied:	0.5558
Justification of the choice of data or description of measurement methods and procedures actually applied :	The baseline emission factor is calculated as the weighted sum of the operating margin and build margin emission factors in accordance with "Tool for calculation of emission factor for electricity systems" (version2.2.1), which is as described in Section B6.1. According to the tool, both margins have equal weights of 50% during the fixed crediting period.
Any comment:	The combined margin is calculated once for the crediting period using the simple operating margin and build margin as described above (ex-ante option).

Data / Parameter:	Cap_{BL}
Data unit:	W
Description:	Installed capacity of the hydro power plant before the implementation of the project activity. For new hydro power plants, this value is 0
Source of data used:	Project site
Value applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied :	The proposed project is new project
Any comment:	-

Data / Parameter:	$A_{BL,}$
Data unit:	m^2
Description:	Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m^2). For new reservoirs, this value is zero
Source of data used:	Project site
Value applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied :	The proposed project is a new project
Any comment:	-

Data / Parameter:	EF_{Res}
Data unit:	$kgCO_2e/MWh$
Description:	Default emission factor for emissions from reservoirs
Source of data used:	Decision by EB23
Value applied:	90 $kgCO_2e/MWh$
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default value justified by EB.
Any comment:	-

B.6.3 Ex-ante calculation of emission reductions:

1. Baseline Emission (BE_y)

1.1. Grid Emission factor

Viet Nam National Grid emission factor is calculated based on the data described in Annex 3 and it is 0.5558 tCO_2/MWh

1.2. Baseline emission

According to the equation:

$$BE_y = EG_{BL,y} * EF_{CO_2,grid,y}$$

Equation 1, baseline emissions are as follows:

Table 13: Baseline emission calculation

Parameter	**Ban Nhung**	
Annual Net power supplied to the grid ($GE_{y)}$	MWh	39,803
EF = $EF_{CM, grid, y}$	tCO_2	0.5558
BE_y = GE_y x $EF_{CM, grid, y}$	tCO_2/yr	22,123

2. Project emissions

According to Equation 9

Equation 5: $PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}}$

The power density of the project is:

Table 14: Power Density

Parameter	**Unit**	**Ban Nhung**
Installed capacity (Cap_{PJ})	**W**	11,000,000
Reservoir area (A_{PJ})	**m^2**	1,775,000
Power Density (PD)	**W/m^2**	6.2

The power density of the project is lower 10W/m^2, therefore, the project emissions is calculated according to the following equation:

$$PE_{HP,y} = \frac{EF_{Res} \times TEG_y}{1000}$$

Table 15: Project emission

Parameter	**Unit**	**Ban Nhung**
EF_{Res}	**tCO_2/MWh**	0.09
TEG_y	**MWh**	40,205
Project Emission $PE_{HP,y}$	**tCO_2**	3,618

3. Emission reduction (ER_y)

According to Equation 6:

Equation 6: $$ER_y = BE_y - PE_y - LE_y$$

Emission reductions are calculated as follow:

Table 16: Emission Reduction

	Unit	Ban Nhung
BE_y	(tCO_2/yr)	22,123
PE_y	(tCO_2/yr)	3,618
LE_y	(tCO_2/yr)	0
ER_y	(tCO_2/yr)	18,504

B.6.4 Summary of the ex-ante estimation of emission reductions:

The ex-ante annual emission reduction of the proposed project in the fixed crediting period is 18,504 tCO_2e/a, and the estimated start date of the crediting period is Jan 1st, 2014 or the date of registration, whichever is later.

Details regarding the calculation are provided in B6.3.

Table 17: Emission reduction for Ban Nhung

Year	Annual estimation of emission reductions in tonnes of CO_2 e
2014	18,504
2015	18,504
2016	18,504
2017	18,504
2018	18,504
2019	18,504
2020	18,504
2021	18,504
2022	18,504
2023	18,504
Total estimated emission reductions (tCO_2e)	185,040
Number of the fixed crediting years	**10**
Annual average over the crediting period of estimated reductions (tCO_2e)	18,504

B.7 Application of a monitoring methodology and description of the monitoring plan:

B.7.1 Data and parameters monitored:

Data / Parameter:	TEG_y
Data unit:	MWh
Description:	Total electricity produced by the Ban Nhung Hydropower Plant, including the electricity supplied to the grid and the electricity supplied to internal loads in year y
Source of data to be used:	Directly measured by power meters
Value of data	40,205
Description of measurement methods and procedures to be applied:	Power meters comply with local industry standards. The electricity will be measured continuously and monthly report will be generated. The meter is bi-direction meter, which could compensate the imported electricity during maintenance period and repairing period. Gross power supply (exclude the off grid power) will be measured by using this meter.
Monitoring frequency:	Continuously, aggregate by month
QA/QC procedures to be applied:	Power meters will be calibrated by qualified party no less than once per 2 years
Any comment:	Data shall be archived for 2 years following the end of the crediting period.

Data / Parameter:	EG_y
Data unit:	MWh
Description:	Net Electricity supplied to Viet Nam National Grid by Ban Nhung hydropower station
Source of data to be used:	Directly measured by power meters
Value of data	39,803
Description of measurement methods and procedures to be applied:	Power meters comply with local industry standards. The electricity will be measured continuously and monthly report will be generated. The meter is bi-direction meter, which could compensate the imported electricity during maintenance period and repairing period. Net power supply (exclude the off grid power) will be measured by using this meter.
Monitoring frequency:	Continuously, aggregate by month
QA/QC procedures to be applied:	The electricity records will be cross checked by the receipts of sales to EVN. And power meters will be calibrated by qualified party no less than once per 2 years.
Any comment:	Data shall be archived for 2 years following the end of the crediting period.

Data / Parameter:	CAP_{PJ}
Data unit:	W
Description:	Installed capacity of project

Source of data to be used:	Project site
Value of data	11,000,000
Description of measurement methods and procedures to be applied:	Determine the installed capacity based on equipment specification and nameplate
Monitoring frequency:	Yearly
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	A_{PJ}
Data unit:	m^2
Description:	Reservoir area for project
Source of data to be used:	Project site
Value of data	1,775,000
Description of measurement methods and procedures to be applied:	Measured from topographical surveys, maps, satellite pictures, etc
Monitoring frequency:	Yearly
QA/QC procedures to be applied:	-
Any comment:	-

B.7.2 Description of the monitoring plan:

The purpose of setting up a monitoring plan is to ensure that all the emission reductions can be successfully realised during crediting period

1. Monitoring organization

Following chart illustrates the organization serving to monitor the Project:

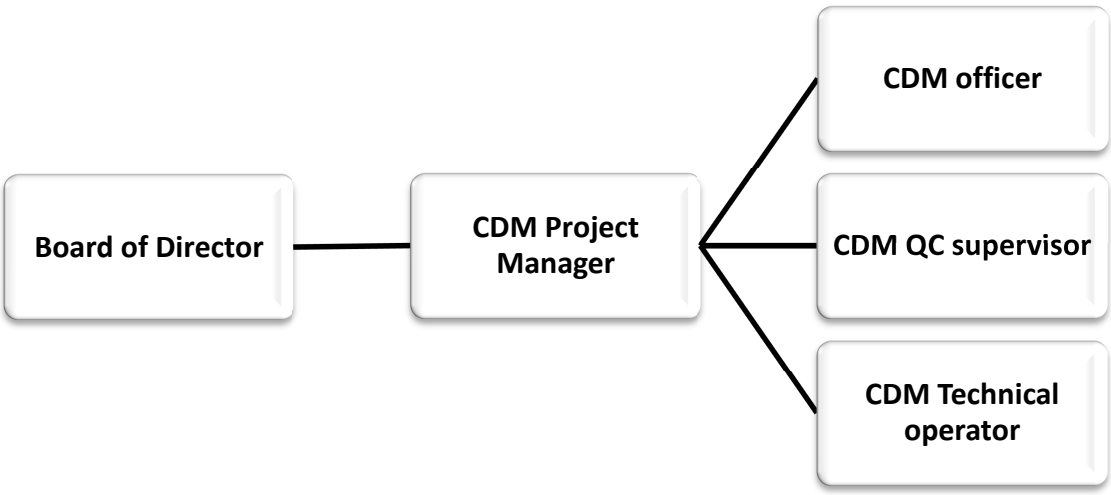

Figure 5: CDM Organization Structure

The role and responsibility of each component in the organization are as follows:

- CDM Project Manager will be appointed by the Board of Director of Tuan Anh Hydropower Company (Project Owner). The CDM Project Manager is responsible for the overall project management, in full charge of issues related to CDM projects, keeping communication with EB, DNA and related agencies, supervising the project operation status.

- CDM officer is responsible for the whole process of CDM project operation. CDM officer will calculate the CERs and prepare the monitoring report based on the operation data from CDM Quality Control and technical operator for CDM monitoring, prepare all relative documentations. He (She) is also responsible for archiving operation data and documents, such as calibration report.

- CDM Quality control supervisor will verify the operation data collected by CDM operation technician, gather the electricity invoices of sale or other financial receipts, and cross-check the net electricity supplied to the grid.

- CDM technical operator will maintain and calibrate the monitoring equipments to ensure their correct functioning, collect the operation data from the site.

2. Monitoring equipment and installation

2.1 Baseline emission

Based on the request of the methodology, Net electricity supplied by Ban Nhung hydropower project ($EG_{facility,y}$) needs to be monitored for baseline emission:

The net electricity supply to the power grid will be read from the meters installed by EVN. CT 1 is the main meter to read the electricity measurement and CT 2 is the backup meter. The accuracy of the electricity meters installed for the project will be 0.5(s) as national standard TCVN 7589-22:2007 (equivalent to the international standard IEC 62053-22:2003) .

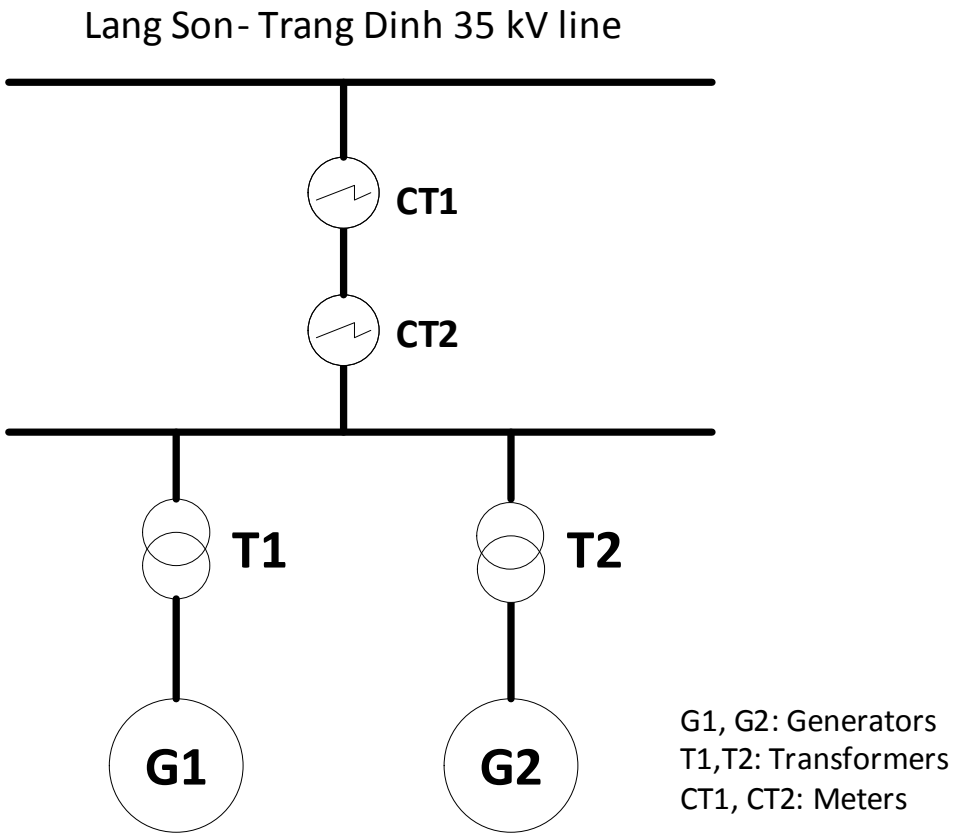

Figure 6: Power Monitoring System

2.2 Project emission

Based on the methodology, there are 2 parameters need to be monitored for project emission:

- Installation capacity ($Cap_{PJ,}$)
- Reservoir area (A_{PJ})

Monitoring installation capacity (Cap_{PJ})

Installation capacity of the proposed project activity will be checked according to the equipment nameplate.

Monitoring reservoir area (A_{PJ})

The reservoir area is determined on the basis of topographic data provided by a qualified third party before the first verification.

3. Calibration & Maintenance procedures

Procedures should be implemented in accordance with national standards, industrial standards or the manufacturer's instructions. The frequency to calibrate the meters will follow the decision 25/2007/QD-BKHCN and the procedures to verify the meter follow the national standard DLVN 39:2004. The period required for calibration process is 2 years.

All power meters of monitoring system will be calibrated according to the national calibration standard, and the calibration reports will be available for DOE Check.

4. Error Handling Procedure and Corrective Actions

If the reading of the measure meters is not precise, out of allowed ranges, or if the function of meter is abnormal, the amount of electricity that is connected to the grid will be back-up as follows:

(1) First, read data from the back-up meter, calculate the amount of project-generated electricity connected to the grid, except if either Party believes that the back-up meter is not precise after checking;

(2) If the back-up meter is not acceptable, the project owner and power grid company should design a reasonably conservative method to estimate the reading together, and explain how it's reasonable and conservative to the DOE during the Verification site visit.

If the backup line meter does not calibrate in time, the error will be applied in a conservative manner according to "Guidelines for assessing compliance with the calibration frequency requirements".

5. Data management

The management of data records should be undertaken as follows: All data collected shall be kept both in soft copy and archived at the end of every month, and printed and saved as hard copy documents. All electricity sell/purchase invoices shall also be kept. Other hard copy documents, such as maps, forms, the EIA report, etc., should be used to support the monitoring plan to check the authenticity of data. In order to expediently obtain the relevant documentation and all project information for the Verification DOE, the project owner shall provide an index of relevant materials and monitoring reports. All hard copy data and information should be kept in the archives by the CDM group, and all documents should have one copy as back-up. All data should be saved for 2 years after the crediting period.

6. Training

Training includes technical training and CDM training. The technical training focuses on principles and basics of maintenance and repair, power generation operation. CDM training includes an introduction to the CDM and its reporting requirements and procedures.

All staff involved in any of the procedures related with the proposed project will be trained before the start of the crediting period in order to perform the tasks specified in the monitoring plan.

B.8 Date of completion of the application of the baseline and monitoring methodology and the name of the responsible person(s)/entity(ies)

Date of completion: 23/12/ 2011

Name of persons determining the baseline study and monitoring methodology: Manfred Stockmayer, Climate Corporation Emissions Trading GmbH

Contact Information of the responsible person	**Is organisation a Project Participant *Yes/No***
Climate Corporation Emissions Trading GmbH Mr. Manfred Stockmayer Marchetstrasse 59 2500 Baden Austria Tel: +43 2236 8002 7000 Fax: +43 2236 8002 7099 Email: ms@climatecorp.com	Yes

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

1/4/2008[14]

C.1.2. Expected operational lifetime of the project activity:

20 years

C.2 Choice of the crediting period and related information:

C.2.1. Renewable crediting period

C.2.1.1. Starting date of the first crediting period:

Not applicable

C.2.1.2. Length of the first crediting period:

Not applicable

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

01/01/2014 or the effective registration date, whichever is later.

C.2.2.2. Length:

10 years

[14] The date in which the Project Owner paid the first amount for compensation valued 4,963,821,630 VND.

SECTION D. Environmental impacts

D.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

According to the national environmental protection rules and regulations, the project has completed an environmental assessment report. This was ratified by Lang Son Provincial People's Committee on 05/12/2007 and the implementation of the proposed project was approved. The environmental assessment report emphasizes the following points:

1. Environmental impacts

A summary of the environmental impacts identified during the assessments for the EIA which have been approved by the relevant local authority, is presented in Table 15.

Table 18: Environmental Impact Assessment

	Sources of impact	Objects of impact	Causes of impact	Degree of impact
I	**CONSTRUCTION PHASE AND WATER ACCUMULATION**			
1.1	The operation of vehicles	Air	Noise, dust and waste air from vehicles	Minor and in short term
		Water	Leak oil and residue oil from vehicles will increase the potential of water pollution especially in the rainy season	Strong and in short term
		Local transportation	Obstruct the transportation of local area and increase accidents	Medium and in short term
1.2	The exploitation of materials serving for the construction of the project	Air	The explosion of mines will cause shake, noise and dusts for contiguous areas	Medium and in short term
		Water and soil	Increase the potential of polluting surface water Increase soil erosion	Strong and in short term
		Human Being	Mine explosion will increase the potential of accident for workers and indigenous people	Strong and in short term
1.3	The construction of project items	Land use, water, natural landscape	Increase the potential of pollution and soil erosion	Medium and in short term
		Human being	Accidents	Strong and in short term
1.4	The clearance of reservoir	Plantation	Loss of forest and floristic composition.	Strong and in long term
		Wild animal	Loss of natural habitat	
1.5	Block of flow for the accumulation of water	Hydrography regime and projects at lower section	Daily regulation hence hydrography regime of the river and projects at lower section will not be affected	No impacts

		Soil and water	At the beginning of flow block, soil erosion will appear inside the reservoir, affecting to the water quality of lower section	Medium and in long term
		Aquatic biology	Aquatic biology will change from the live in the flow system to the live in the reservoir	Medium and in medium term
II	**OPERATION PHASE**			
2.1	The formation of the reservoir	Climate in the local area	The regulation of the flow in the rainy season and supply of water in the dry season will increase the humidity of the local area, under-ground water amount will increase. The biology will develop more	Positive impacts and in long term
		Water	The destruction of flora inside the reservoir will reduce dissolved Oxy in the water, increase the amount of CO_2 in the surface of the reservoir, increase the nutrition of the water and reduce the quality of surface water. This will increase the development of alga, seaweed…	Strong and in short term
		Air	Increase CO_2, CH_4. Increase the total surface of water, harmonizing the climate especially in the sunny season	Minor and in short term
		Fish and immigrant species	Create the barrier for immigrant species, reduce the number of kind of fish on the river	Minor and in short term

In conclusion: The proposed project causing both negative and positive impacts. The negative impacts mainly come from construction phase; however it is insignificant comparing with the benefits induced by project. Compensation process has been finished with high satisfaction of local residents. The construction of proposed project is an imperative need; it meets economic, technical and environmental requirements in Vietnam.

2. Measures to mitigate the environmental impacts

Project is expected to have long-term environmental and social benefits. Measures will be taken to mitigate any negative impacts on the environment as a result of the project construction and operation and the project will meet all Vietnamese national requirements for environmental safety.

Construction Phase

a) Soil erosion

During the construction period, there are two aspects that will induce soil erosion: the construction will change the landscape and destroy the primary land and vegetation, which will debase the capability on

water and soil conversion; the naked excavation surface and loose slag heap formed in the construction period are prone to induce soil erosion. The construction company will establish proper and effective schemes to prevent soil erosion, and they will resume the vegetation and the natural sight by engineering measures and biologic measures.

b) Waste water

Waste water discharged during the construction period mostly comes from construction process and daily life. All necessary measures will be taken to prevent water pollution during the construction works. This includes collection and disposal of generated waste, collection and disposal of lubricants and control on illegal waste disposal at soil and rock excavation sites. Following dam completion, regular checks of water quality will be performed.

c) Ecological effect

It is expected that the dam's construction will damage the vegetation to some degree. On the other hand, the vegetation damaged will mainly be without any botanical value, being mainly, secondary shrub woodlands and weeds. In order to prevent deforestation and soil erosion, local varieties of trees will be planted in the areas adjacent to the project site after the end of construction works. So the variety of plants and animals in the project area will not be affected or even improved.

d) Air pollution

Air pollution will occur mainly during construction phases of the project due to land movement and vehicles. The constructing companies will take appropriate measures to ensure that emissions of pollutants are minimised during construction. The constructing corporation should choose machines and appliances in accordance with the national standard, reduce the exhaust emission and install additional air cleaners if the exhaust is not in line with the emission standard. Dust collectors will be installed at the workplace of drilling machine; wet operation method will be taken on drilling and blasting to decrease the dust quantity. During the construction period, workplace, rich-dust materials, dump sites and road will be watered to debase dust.

The project's impact on atmosphere will be limited within the construction period, and the impacts will be zero after construction.

e) Solid waste

Solid waste produced in the construction period mainly comes from construction waste and living waste of construction workers. All kinds of living waste will be collected in time by installing garbage bins in the living area, so it will not affect much on surrounding environment. Dumping sites will be set up, and residue soil from the construction will be transported to dumping sites in time. The dumping site will be constructed in the concave and closed area, at the same time, the run-off pollution-proof in dumping sites during the construction period will also be cared. After the dumping sites have been eliminated, the area will be renovated and the vegetation will be recovered. Therefore, the solid waste produced during the construction period affects a little on environment.

Operation Phase

Aquatic animals and plants

This project will construct a new reservoir, and after the reservoir constructed, the primary ecological balance of the natural river will be impaired until a new balance induced by the environmental change is reached.

Solutions for impact on terrestrial animals and plants

The construction area of proposed project is not designated natural reserves area. There are no endangered animal species in the area; and the impact on local birds and small animals (such as civet, fox, etc) is expected to be minimal.

Due to the small decrease of fields and woodland area due to the reservoir construction, the population in the remaining terrestrial areas will comparatively increase, which will consequently affect the terrestrial animals, birds and plants to some extent. However, the proposed project will not substantially affect the types, amount and composition structure of the wildlife in the reservoir area.

In conclusion, environmental impacts arising from the proposed project are not considered significant.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

According to the report of environment impact assessment and the ratification of relative government departments, the project's environment impacts are not considered significant.

SECTION E. Stakeholders' comments

E.1. Brief description how comments by local stakeholders have been invited and compiled:

The project owners conducted stakeholder consultation meetings with the help of the CDM consultant to collect opinions and comments for the proposed project in the head office of Tran Ninh Commune in 20th October 2010. Local communities, state government and governmental agencies, employees, local residents, contractors and consultants/ advisors were identified as the most important stakeholders in the proposed CDM project activity.

Before the stakeholder meeting was held, project owner had sent the invitation letter and poster for the meeting to the People Committee of Tran Ninh commune in order to forward to local stakeholders including indigenous persons and local authorities. Then, they were posted in front of the head office of commune as well daily informed by public speaker to the community. Such combined methods guaranteed the purpose of the meeting being widely circulated to local stakeholders.

The meeting agenda was as follows:

1. Welcome address to the representatives by Chairman of Commune People's committee
2. Introduction of the project by project owner;
3. Open discussion on the merits of the project;
4. Summary of the concerns expressed by the stakeholder groups and the commitments to address the concerns made by the Chairman
5. Preparation and circulation of draft Minutes of the Meeting and signing of the MOM.

Questionnaires were distributed and collected in the meeting. The questionnaire included the following contents:

- Do you think the proposed is important? (Very important; Important; Not important; No idea)
- Do you support the Project? (Yes; No; Unconcerned)
- Which aspects of the proposed project do you think will affect your life: (Air pollution; Water pollution; Noises; Insignificant affect)
- What do you think about the proposed project's impacts on the local area's ecological environment (Improvement; Destruction; No impact)
- What do you think about the proposed project's impact on the surrounding environment: (Improvement; Destruction; No impact)
- Are you satisfied with the outlined environmental impact reduction measures: (Satisfaction; Dissatisfaction; uncertain; incomprehension about the measurement)
- What do you think will be the proposed project's impacts on the local area's economic development? (Meaningful; Meaningless; No impact)

- What do you think about the proposed project's impacts on employment in the local area? (Significant; Insignificant; No idea)

E.2.	Summary of the comments received:

The survey had a response rate of 100% (50 questionnaires distributed with 50 effective returns). The analysis results are summarized as follows:

- ✓ All respondents support for project and think that this project is important for local development. 6% (3/50) ideas think that project will cause noise impact during construction period, meanwhile, 94% (47/50) believe that this project will affect insignificantly to water, air or noise environment.
- ✓ All participants believe that this project would impulse socioeconomic development through power supply. 88% (44/50 returns) of them think that project will create employment opportunities for local juniors.
- ✓ 60% (30/50) respondents think that project would improve ecological environment, meanwhile, 40% (20/50) of them think that project would not effect to ecological environment.
- ✓ 76% (38/50) of respondents think that project would improve surrounding environment, whereas, 24% (12/50) of them assert that project has no impact.
- ✓ 82% (41/50) participants satisfy with framed policy to reduce negative impacts on environment while 18% (9/50) are uncertain about it.

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

The local government and residents strongly support the proposed project. According to the collected comments from local stakeholders, it is not necessary to make any adjustment to the current design, construction plan and operation of the proposed project.

For the ecological impacts of the proposed project, the project owner has made a detailed analysis in environmental impact report on the current environmental situation in the construction zone and of the environmental impacts in the construction phase and operation phase, and has made corresponding measures to minimise the ecological impact of the project.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No official funds from any Annex 1 country are involved in the proposed project.

Annex 3

BASELINE INFORMATION

Baseline information released by Vietnam DNA can be referred at the following web address:

http://www.noccop.org.vn/Data/vbpq/Airvariable_ldoc_vnHe%20so%20phat%20thai%202008.pdf

The main data used in this report to calculate emission factor of Vietnam national grid are given below:

OPERATING MARGIN EMISSION FACTOR IN 2006

Power Plant	Total electricity generation supply to the grid (MWh)	Main fuel consumed						Fuel included						Volume of emissions
		Type of fuel	Fuel consumption	Net calorific values		Emission factor of fuel		Type of fuel	Fuel consumption	Net calorific values		Emission factor of fuel		
			Coal, DO, FO: kt; Gas: mill.m3	Coal, DO, FO: kCal/kg; Gas: MJ/m3	Coal, DO, FO: GJ/kt; Gas: GJ/mill.m3	kg CO2/TJ	tCO2/GJ		Coal, DO, FO: kt; Gas: mill.m3	Coal, DO, FO: kCal/kg; Gas: MJ/m3	Coal, DO, FO: GJ/kt; Gas: GJ/mill.m3	kg CO2/TJ	tCO2/GJ	t CO2
A	B	C	D	E	Coal, DO, FO: F=E*4.1868 Gas: F=E*1000	G	H= G/10^6	I	J	K	L=K*4.1868	M	N= M/10^6	O=D*F*H+J*L*N

Coal-fired														
Phả Lại 1	2,462,209	Coal	1,717	4,953	20,737	94,600	0.0946	FO	7.62	9,800	41,031	75500	0.0755	3,391,921
Phả Lại 2	3,696,205	Coal	1,951	5,039	21,097	94,600	0.0946	FO	3.76	9,800	41,031	75500	0.0755	3,905,457
Uông Bí	766,634	Coal	554	5,258	22,014	94,600	0.0946	FO	1.52	10,097	42,273	75500	0.0755	1,157,907
Uông Bí 2	0	Coal	0	0	0	94,600	0.0946	FO	0.00	0	0	75500	0.0755	0
Ninh Bình	721,277	Coal	440	5,421	22,697	94,600	0.0946	FO	0.09	10,376	43,442	75500	0.0755	945,313
Na Dương	641,510	Coal	514	4,006	16,770	94,600	0.0946	FO	0.35	7,496	31,386	75500	0.0755	816,283
Cao Ngạn	0	Coal	0	0	0	94,600	0.0946	FO	0.00	0	0	75500	0.0755	0
Formosa	701,395	Other Bituminous Coal	470	6,483	27,143	89,500	0.0895	FO	0.23	9,810	41,073	75500	0.0755	1,142,615
Gas Turbine														
Gas-Turbine-Gas														
Bà Rịa	1,308,583	Gas	436.24	34.85	34,850	54,300	0.0543	-		0	0	0	0	825,524
Phú Mỹ	10,073,917	Gas	2,432.92	37.17	37,173	54,300	0.0543	-		0	0	0	0	4,910,834
		Gas	523.22	38.80	38,797	54,300	0.0543	-		0	0	0	0	1,102,253
Phú Mỹ 3	2,531,004	Gas	703.82	38.75	38,750	54,300	0.0543	-		0	0	0	0	1,480,929
Nhơn Trạch	0	Gas	0.00	0.00	0	54,300	0.0543	-		0	0	0	0	0
Cà Mau 1&2	0	Gas	0.00	0.00	0	54,300	0.0543	DO	0	10,150	42,496	72600	0.0726	0
Phú Mỹ 2.2	4,838,810	Gas	1,354.87	38.75	38,750	54,300	0.0543	-		0	0	0	0	2,850,809
VĨ ĐAN	47,894	Gas	236.67	42.80	42,800	54,300	0.0543	FO	1.09	9,665	40,465	75500	0.0755	553,370
Đạm Phú Mỹ	38,556	Gas	55.49	42.50	42,500	54,300	0.0543	-						128,062

Gas-Turbine-Oil														
Bà Rịa	13,958	DO	4	10,300	43,124	72,600	0.0726	-			0	0	0	13,900
Phú Mỹ	67,721	DO	18	10,895	45,615	72,600	0.0726	-			0	0	0	60,637
Phú Mỹ 3	12,615	DO	3	10,255	42,936	72,600	0.0726	-			0	0	0	10,369
Phú Mỹ 2.2	0	DO	0	0	0	72,600	0.0726	-			0	0	0	0
CẦN THƠ	106,998	DO	33	10,860	45,469	72,600	0.0726	-			0	0	0	110,304
THỦ ĐỨC	32,290	DO	11	10,800	45,217	72,600	0.0726	-			0	0	0	34,962
Steam tail														
Bà Rịa	660,965	Flare gas			0	0	0	-			0	0	0	0
Phú Mỹ	5,336,388	Flare gas			0	0	0	-			0	0	0	0
Phú Mỹ 3	1,473,329	Flare gas			0	0	0	-			0	0	0	0
Nhơn Trạch	0	Flare gas			0	0	0	-			0	0	0	0
Cà Mau 1&2	0	Flare gas			0	0	0	-			0	0	0	0
Phú Mỹ 2.2	0	Flare gas			0	0	0	-			0	0	0	0
Oil-fired														
HIỆP PHƯỚC	453,303	FO	229	10,220	42,789	75,500	0.0755	DO	0.011	10,150	42,496	72600	0.0726	740,161
CẦN THƠ	118,748	FO	36	10,226	42,814	75,500	0.0755	DO	1.9693	10,860	45,469	72600	0.0726	122,939
THỦ ĐỨC	471,940	FO	133	10,300	43,124	75,500	0.0755	DO	0.132	10,800	45,217	72600	0.0726	431,933
Diesel FO														
CÁI LÂN -	0	FO	0	0	0	75,500	0.0755	-			0	0	0	0

VINA SHIN														
AMATA	80,000	FO	16.60	9,600	40,193	75,500	0.0755	-			0	0	0	50,374
Diesel DO														
NM điện Đồng Khởi (Bến Tre)	3,150	DO	0.81	10,700	44,799	72,600	0.0726	-			0	0	0	2,621
NM điện Diesel Cà Mau	3,123	DO	0.83	10,970	45,929	72,600	0.0726	-			0	0	0	2,776
NM điện Diesel An Giang	1,505	DO	0.39	10,305	43,145	72,600	0.0726	-			0	0	0	1,222
Điện lực Đồng Tháp	119	DO	0.03	10,320	43,208	72,600	0.0726	-			0	0	0	107
Điện lực Bình Thuận	6,372	DO	1.54	10,150	42,496	72,600	0.0726	-			0	0	0	4,745
Diesel khác	10,732	DO	2.79	10,150	42,496	72,600	0.0726	-			0	0	0	8,609
Import	**937,000**	-			0	0	0	-			0	0	0	0

Total generated electricity	MWh	37,618,249
Total emissions	tCO2	24,806,935
Emission factor	tCO2/MWh	0.6594

OPERATING MARGIN EMISSION FACTOR IN 2007

Power Plant	Total electricity generation supply to the grid (MWh)	Main fuel consumed						Fuel included						Volume of emissions
		Type of fuel	Fuel consumption	Net calorific values		Emission factor of fuel		Type of fuel	Fuel consumption	Net calorific values		Emission factor of fuel		
			Coal, DO, FO: kt; Gas: mill.m3	Coal, DO, FO: kCal/kg; Gas: MJ/m3	Coal, DO, FO: GJ/kt; Gas: GJ/mill. m3	kg CO2/TJ	tCO2/GJ		Coal, DO, FO: kt; Gas: mill.m3	Coal, DO, FO: kCal/kg; Gas: MJ/m3	Coal, DO, FO: GJ/kt; Gas: GJ/mill.m3	kg CO2/TJ	tCO2/GJ	t CO2
A	B	C	D	E	Coal, DO, FO: F=E*4.1868 Gas: F=E*1000	G	H= G/10^6	I	J	K	L=K*4.1868	M	N= M/10^6	O=D*F*H+J*L*N
Coal-fired														
Phả Lại 1	2,501,097	Coal	1,728	4,946	20,708	94,600	0.0946	FO	6.59	9,800	41,031	75500	0.0755	3,405,500
Phả Lại 2	3,804,63	Coal	2,054	5,021	21,022	94,600	0.094	FO	4.66	9,800	41,031	7550	0.0755	4,099,163

	5						6					0		
Uông Bí	705,778	Coal	526	5,210	21,813	94,600	0.0946	FO	1.74	11,975	50,137	75500	0.0755	1,091,402
Uông Bí 2	520,000	Coal	281	5,021	21,022	94,600	0.0946	FO	0.64	11,975	50,137	75500	0.0755	560,692
Ninh Bình	652,464	Coal	412	5,286	22,131	94,600	0.0946	FO	0.10	10,376	43,442	75500	0.0755	861,910
Na Dương	660,520	Coal	546	4,076	17,067	94,600	0.0946	FO	0.17	9,973	41,754	75500	0.0755	882,111
Cao Ngạn	352,577	Coal	330	4,980	20,850	94,600	0.0946	FO	1.52	9,800	41,031	75500	0.0755	654,693
Formosa	639,334	Other Bituminous Coal	511	6,259	26,205	89,500	0.0895	FO	0.11	9,802	41,039	75500	0.0755	1,197,908
Gas Turbine														
Gas-Turbine-Gas														
Bà Rịa	1,244,018	Gas	416.89	34.85	34,850	54,300	0.0543	-		0	0	0	0	788,908
Phú Mỹ	10,700,737	Gas	3,040.39	36.99	36,988	54,300	0.0543	-		0	0	0	0	6,106,460
		Gas	99.85	38.49	38,486	54,300	0.0543	-		0	0	0	0	208,659
Phú Mỹ 3	2,393,620	Gas	665.69	38.56	38,560	54,300	0.0543	-		0	0	0	0	1,393,825
Nhơn Trạch	0	Gas	0.00	0.00	0	54,300	0.0543	-		0	0	0	0	0
Cà Mau 1&2	697,572	Gas	15.82	39.00	39,000	54,300	0.0543	DO	20.669	10,150	42,496	72600	0.0726	97,260
Phú Mỹ 2.2	4,942,360	Gas	1,383.86	38.56	38,560	54,300	0.0543	-		0	0	0	0	2,897,539
VÊ ĐAN	26,742	Gas	229.22	42.80	42,800	54,300	0.0543	FO	0.44	9,665	40,465	75500	0.0755	534,065
Đạm Phú Mỹ	18,542	Gas	59.23	42.50	42,500	54,300	0.0543	-			0	0	0	136,686
Gas-Turbine-Oil														
Bà Rịa	80,828	DO	25.33	10,300	43,124	72,600	0.0726	-			0	0	0	79,318
Phú Mỹ	240,652	DO	64.92	10,895	45,615	72,600	0.0726	-			0	0	0	214,993
Phú Mỹ 3	17,278	DO	4.50	10,244	42,890	72,600	0.072	-			0	0	0	14,027

							6							
Phú Mỹ 2.2	0	DO	0.00	0	0	72,600	0.0726	-			0	0	0	0
CẦN THƠ	148,862	DO	45.10	10,880	45,552	72,600	0.0726	-			0	0	0	149,165
THỦ ĐỨC	70,260	DO	23.41	10,800	45,217	72,600	0.0726	-			0	0	0	76,850
Steam tail														
Bà Rịa	618,330	Flare gas			0	0	0	-			0	0	0	0
Phú Mỹ	5,986,285	Flare gas			0	0	0	-			0	0	0	0
Phú Mỹ 3	1,377,820	Flare gas			0	0	0	-			0	0	0	0
Nhơn Trạch	0	Flare gas			0	0	0	-			0	0	0	0
Cà Mau 1&2	911,012	Flare gas			0	0	0	-			0	0	0	0
Phú Mỹ 2.2	0	Flare gas			0	0	0	-			0	0	0	0
Oil-fired														
HIỆP PHƯỚC	1,102,498	FO	410	10,196	42,690	75,500	0.0755	DO	0.018	10,150	42,496	72600	0.0726	1,322,437
CẦN THƠ	128,641	FO	38	10,215	42,768	75,500	0.0755	DO	3.1779	10,880	45,552	72600	0.0726	133,040
THỦ ĐỨC	603,270	FO	166	10,300	43,124	75,500	0.0755	DO	0.24	10,800	45,217	72600	0.0726	540,708
Diesel FO														
CÁI LÂN - VINASHIN	104,626	FO	25.15	9,800	41,031	75,500	0.0755	-			0	0	0	77,907
AMATA	0	FO	0.00	9,600	40,193	75,500	0.0755	-			0	0	0	0
Diesel DO														
NM điện Đồng Khởi (Bến Tre)	4,483.00	DO	1.14	10,700	44,799	72,600	0.0726	-			0	0	0	3,717
NM điện Diesel Cà	6,820.60	DO	0.18	10,870	45,511	72,600	0.0726	-			0	0	0	588

Mau														
NM điện Diesel An Giang	1,628.51	DO	0.42	10,305	43,145	72,600	0.0726	-			0	0	0	1,316
Điện lực Đồng Tháp	272.26	DO	0.08	10,320	43,208	72,600	0.0726	-			0	0	0	243
Điện lực Bình Thuận	7,246.00	DO	1.73	10,150	42,496	72,600	0.0726	-			0	0	0	5,349
Diesel khác	21,549.63	DO	5.60	10,150	42,496	72,600	0.0726	-			0	0	0	17,286
Import	**2,629,000**	-			0	0	0	-			0	0	0	0

Total generated electricity	MWh	43,921,357
Total emissions	tCO2	27,553,725
Emission factor	tCO2/MWh	0.6273

OPERATING MARGIN EMISSION FACTOR IN 2008

Power Plant	**Total electricity generation supply to the grid**	**Main fuel consumed**				**Fuel included**				**Volume of emissions**
		Type of fuel	**Fuel consumption**	**Net calorific values**	**Emission factor of fuel**	**Type of fuel**	**Fuel consumption**	**Net calorific values**	**Emission factor of fuel**	

	(MWh)		Coal, DO, FO: kt; Gas: mill.m3	Coal, DO, FO: kCal/kg; Gas: MJ/m3	Coal, DO, FO: GJ/kt; Gas: GJ/mill.m3	kg CO2/TJ	tCO2/GJ		Coal, DO, FO: kt; Gas: mill.m3	Coal, DO, FO: kCal/kg; Gas: MJ/m3	Coal, DO, FO: GJ/kt; Gas: GJ/mill. m3	kg CO2/ TJ	tCO2/ GJ	t CO2
A	B	C	D	E	Coal, DO, FO: F=E*4.1868 Gas: F=E*1000	G	H= G/10^6	I	J	K	L=K*4. 1868	M	N= M/10^6	O=D*F* H+J*L*N
Coal-fired														
Phả Lại 1	2,299,120	Coal	1,621	4,788	20,046	94,600	0.0946	FO	7.66	9,800	41,031	75500	0.0755	3,097,779
Phả Lại 2	3,929,218	Coal	2,081	4,995	20,913	94,600	0.0946	FO	4.05	9,800	41,031	75500	0.0755	4,129,534
Uông Bí	722,766	Coal	515	5,216	21,838	94,600	0.0946	FO	1.13	10,087	42,231	75500	0.0755	1,068,215
Uông Bí 2	532,000	Coal	282	4,995	20,913	94,600	0.0946	FO	0.55	10,087	42,231	75500	0.0755	559,172
Ninh Bình	675,372	Coal	431	5,191	21,734	94,600	0.0946	FO	0.16	10,376	43,442	75500	0.0755	887,373
Na Dương	627,930	Coal	532	4,034	16,889	94,600	0.0946	FO	0.20	9,923	41,545	75500	0.0755	850,587
Cao Ngạn	708,693	Coal	526	4,980	20,850	94,600	0.0946	FO	0.75	9,800	41,031	75500	0.0755	1,040,482
Formosa	560,295	Other Bituminous Coal	495	6,579	27,545	89,500	0.0895	FO	0.28	9,808	41,064	75500	0.0755	1,221,712
Gas Turbine														
Gas-Turbine-Gas														
Bà Rịa	1,331,905	Gas	450.37	34.85	34,850	54,300	0.0543	-		0	0	0	0	852,263
Phú Mỹ	11,085,997	Gas	3,193.95	36.99	36,991	54,300	0.0543	-		0	0	0	0	6,415,396
		Gas	72.54	38.18	38,184	54,300	0.0543	-		0	0	0	0	150,402
Phú Mỹ 3	3,167,237	Gas	883.26	38.59	38,590	54,300	0.0543	-		0	0	0	0	1,850,807
Nhơn Trạch	544,809	Gas	166.38	40.50	40,500	54,300	0.0543	-		0	0	0	0	365,894
Cà Mau 1&2	2,106,807	Gas	647.24	39.00	39,000	54,300	0.0543	DO	4.417	10,150	42,496	72600	0.0726	1,384,290
Phú Mỹ 2.2	4,141,980	Gas	1,159.75	38.59	38,590	54,300	0.0543	-		0	0	0	0	2,430,192
VÊ ĐAN	12,780	Gas	209.48	42.80	42,800	54,300	0.0543	FO	0.79	9,665	40,465	75500	0.0755	489,253

Đạm Phú Mỹ	4,716	Gas	56.15	42.50	42,500	54,300	0.0543	-			0	0	0	129,573
Gas-Turbine-Oil														
Bà Rịa	34,460	DO	10.64	10,300	43,124	72,600	0.0726	-			0	0	0	33,325
Phú Mỹ	69,324	DO	18.69	10,895	45,615	72,600	0.0726	-			0	0	0	61,895
Phú Mỹ 3	0	DO	0.00	10,246	42,898	72,600	0.0726	-			0	0	0	0
Phú Mỹ 2.2	0	DO	0.00	0	0	72,600	0.0726	-			0	0	0	0
CẦN THƠ	62,274	DO	19.39	10,890	45,594	72,600	0.0726	-			0	0	0	64,189
THỦ ĐỨC	17,030	DO	5.62	10,800	45,217	72,600	0.0726	-			0	0	0	18,449
Steam tail														
Bà Rịa	658,459	Flare gas			0	0	0	-			0	0	0	0
Phú Mỹ	6,037,037	Flare gas			0	0	0	-			0	0	0	0
Phú Mỹ 3	1,853,448	Flare gas			0	0	0	-			0	0	0	0
Nhơn Trạch	0	Flare gas			0	0	0	-			0	0	0	0
Cà Mau 1&2	2,728,872	Flare gas			0	0	0	-			0	0	0	0
Phú Mỹ 2.2	0	Flare gas			0	0	0	-			0	0	0	0
Oil-fired														
HIỆP PHƯỚC	877,631	FO	366	10,195	42,685	75,500	0.0755	DO	0.019	10,150	42,496	72600	0.0726	1,179,989
CẦN THƠ	66,709	FO	20	10,220	42,789	75,500	0.0755	DO	3.7286	10,890	45,594	72600	0.0726	76,804
THỦ ĐỨC	537,540	FO	149	10,300	43,124	75,500	0.0755	DO	0.228	10,800	45,217	72600	0.0726	484,277
Diesel FO														
CÁI LÂN - VINASHIN	90,465	FO	22.48	9,800	41,031	75,500	0.0755	-			0	0	0	69,633
AMATA	0	FO	0.00	9,600	40,193	75,500	0.0755	-			0	0	0	0
Diesel DO														
NM điện Đồng Khởi (Bến Tre)	860.00	DO	0.22	10,700	44,799	72,600	0.0726	-			0	0	0	719
NM điện Diesel Cà Mau	1,273.50	DO	0.33	10,940	45,804	72,600	0.0726	-			0	0	0	1,095
NM điện Diesel An Giang	252.86	DO	0.07	10,305	43,145	72,600	0.0726	-			0	0	0	219

Điện lực Đồng Tháp	51.25	DO	0.01	10,320	43,208	72,600	0.0726	-			0	0	0	45
Điện lực Bình Thuận	7,575.00	DO	1.80	10,150	42,496	72,600	0.0726	-			0	0	0	5,560
Diesel khác	4,987.39	DO	1.30	10,150	42,496	72,600	0.0726	-			0	0	0	4,001
Import	**3,220,000**	-			0	0	0	-			0	0	0	0

Total generated electricity	MWh	48,719,874
Total emissions	tCO2	28,923,123
Emission factor	tCO2/MWh	0.5937

Build Margin CO2 Emission Factor (BM), 2008

Total domestic electricity generation of Vietnam Grid in 2008	**74,689,635.97**	**MWh**
20% of domestic electricity generation of Vietnam Grid in 2008	**14,937,927.19**	**MWh**

Power Plant	**Commission year**	**Grid-connected out put (MWh)**	**Main fuel**						**Included fuel**						**Volume of emissions**
			Type of Fuel	**Fuel consumed**	**Net calorific value**		**Emission factor of fuel**		**Type of Fuel**	**Fuel consumed**	**Net calorific value**		**Emission factor of fuel**		
				Coal, DO, FO: kt; Gas: mill.m3	Coal, DO, FO: kCal/kg; Gas: MJ/m3	Coal, DO, FO: GJ/kt; Gas: GJ/mill.m3	kg CO2/TJ	tCO2/GJ		Coal, DO, FO: kt; Gas: mill.m3	Coal, DO, FO: kCal/kg; Gas: MJ/m3	Coal, DO, FO: GJ/kt; Gas: GJ/mill.m3	kg CO2/TJ	tCO2/GJ	t CO2
A	B	C	D	E	F	Coal, DO,	H	I=	J	K	L	M=L*4.186	N	O=	P=E*G*I+K*M*

						FO: G=F*4.1868 Gas: G=F*1000		H/10^6				8		N/10^6	O
5 most recently power plants															
A Vương	2008	168,103.50	Hydropower												
Tuyên Quang	2008	1,136,112.18	Hydropower												
Đại Ninh	2008	1,145,108.50	Hydropower												
Nhơn Trạch	2008	544,808.60	Gas	166.38	40.50	40,500	54300	0.054	-		0	0	0	0	365,894
Cà Mau 1&2	2007	2,106,807.24	Gas	647.24	39.00	39,000	54300	0.054	DO	4.417	10,909	45,674	72600	0.0726	1,385,309
		2,728,872.00	Flare gas												
Total		**7,829,812.02**													
Most recently power plant capacity additions in the electricity system that comprise 20%															
A Vương	2008	168,103.50	Hydropower												
SROC Phu Mieng IDICO	2006	241,556.00	Hydropower												
SÊ SAN 3A	2006	394,895.70	Hydropower												
Tuyên Quang	2008	1,136,112.18	Hydropower												
Đại Ninh	2008	1,145,108.50	Hydropower												
SÊ SAN 3	2006	1,131,614.00	Hydropower												
Quảng Trị	2007	250,804.40	Hydropower												
Uông Bí 2	2007	532,000.00	Coal	281.759	4995	20,913	94600	0.095	FO	*0.548*	*10,087*	42,231	75500	0.0755	559,172
Na Dương	2005	627,930.00	Coal	532	4,034	16,889	94600	0.095	FO	0.20	9,923	41,545	75500	0.0755	850,587
Cao Ngạn	2007	708,693.00	Coal	526	4,980	20,850	94600	0.095	FO	0.75	9,800	41,031	75500	0.0755	1,040,482
Formosa	2004	560,295.00	Other Bituminous Coal	495	6,579	27,545	89500	0.09	FO	0.28	9,808	41,064	75500	0.0755	1,221,712
Nhơn	2008	544,808.60	Gas	166.38	40.50	40,500	54300	0.054	-		0	0	0	0	365,894

Trạch															
Cà Mau 1&2	2007	2,106,807.24	Gas	647.24	39.00	39,000	54300	0.054	DO	4.417	10,909	45,674	72600	0.0726	1,385,309
		2,728,872.00	Flare gas												
Phú Mỹ 2.2	2004	4,141,980.00	Gas	1,159.75	38.59	38,590	54300	0.054	-		0	0	0	0	2,430,192
Đạm Phú Mỹ	2006	4,716.00	Gas	56.15	42.50	42,500	54300	0.054	-			0	0	0	129,573
CÁI LÂN - VINASHIN	2007	90,465.01	FO	22.48	9,800	41,031	75500	0.076	-			0	0	0	69,633
Total		**16,514,761.12**													**8,052,553**

Total generated electricity	MWh	16,514,761.12
Total emissions	tCO2	8,052,553.43
Emission factor	tCO2/MWh	0.4876

Combined Margin CO_2 emission factor (CM) 2008

OM Claculation	Unit	2006	2007	2008	Total
Total electricity generated from fossil fired power plants serving grid	MWh	37,618,249.13	43,921,356.89	48,719,874.05	130,259,480.07
Total emissions	tCO_2	24,806,935.42	27,553,724.52	28,923,123.30	81,283,783.23
OM emission factor	tCO_2/MWh	0.6240			

Build margin CO_2 emission factor in year 2008	BM	tCO_2/MWh	0.4876
Average Operating margin CO_2 emission factor (2006,2007, 2008)	OM	tCO_2/MWh	0.6240

Combined margin CO_2 emission factor in year 2008	**CM**	**tCO_2/MWh**	**0.5558**

Annex 4

MONITORING INFORMATION

No additional information.