CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006

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SECTION A. General description of project activity

A.1. Title of the project activity:

Project title: Song Giang 2 Hydro Power Project
PDD version: 1.7
PDD completion date: 20/06/2012
Revision History:

Version 1.0	Submitted for validation / global stakeholder comments
Version 1.1	Revised in response to the validation findings
Version 1.2	Revised in response to the further corrections and clarification requests
Version 1.3	Revised in response to the further corrections and clarification requests
Version 1.4	Revised in response to the further corrections and clarification requests
Version 1.5	Revised starting date of the first crediting period and textual edits
Version 1.6	Revised in response to technical review findings
Version 1.7	Revised in response to further technical review findings

A.2. Description of the project activity:

The Song Giang 2 Hydro Power Project (the "project" or the "proposed project activity") involves the construction and operation of a new hydroelectric power project on the Giang River in Khanh Trung Commune, Khanh Vinh District, Khanh Hoa Province, Viet Nam. The owner of the project is the Song Giang Hydropower Joint Stock Company(the "project entity" or "project owner").

The main objective of the project is to generate power from clean renewable hydropower in Viet Nam and contribute to the sustainability of power generation of the National Power Grid of Viet Nam (the "National Power Grid"). The project will install two turbine / generator units with an individual capacity of 18.5 MW, amounting to a total installed capacity of 37 MW.

Scenario existing prior to the start of the implementation project:
The scenario existing prior to the start of the implementation of the project consists of the continued expansion of the National Power Grid with a combination of fossil fuel-fired and renewable energy resources.

Baseline scenario:
The baseline scenario is identical to the scenario existing prior to the start of the project activity. The emission factor of the National Power Grid will be calculated as a combined margin emission factor that takes into account both the operating and build margin of the power grid as further described in section B.6.1.

Project scenario:
In the project scenario, the proposed project activity will provide clean, renewable power which will displace an equivalent amount of power otherwise to be generated by existing power plants and future additions to the National Power Grid.

Summary of employed technology

The project design consists of a new hydropower facility with a dam, a water diversion system, a power house, and a switching station. The expected effective operating time of the project is 3,666 hours annually. Total gross annual power generation is expected to be 135,640 MWh, the estimated consumption and grid outages is 0.5%, this results in a net annual power to be supplied to the grid is 134,962 MWh.The total flooded reservoir surface area of the proposed project activity equals 180,000 m^2 at full capacity[1]. The power density of the project is 205.56 W/m^2 (see section B.6.1 for calculation of power density). Power generated by the project will be routed to the National Power Grid.

Contribution to sustainable development

The project activity's contributions to sustainable development are:

- Reduction of the dependence on exhaustible fossil fuels for power generation;
- Reduction of air pollution by displacing coal-fired power plants with clean, renewable power;
- Reduction of the adverse health impacts from air pollution;
- Reduction of the emissions of greenhouse gases to combat global climate change; and
- Promotion of local economic development through the creation of transport infrastructure and employment.

This project is consistent with the energy development policies of the Vietnamese government and satisfies the sustainable development criteria as defined by the Designated National Authority ("DNA") of Viet Nam.

A.3. Project participants:

The parties involved in the project are shown in Table A. 1.

Table A. 1 Project participants

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)
Viet Nam (host)	Private entity: Song Giang Hydropower Joint Stock Company (as the Project Entity)	No
Switzerland	Private entity: Vitol S.A. (as the Purchasing Party)	No

For more detailed contact information on participants in the project activities, please refer to Annex 1.

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

Socialist Republic of Viet Nam

[1] See Technical Design 1 (TD1), Main Report, page 3-14, 3-15

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

Khanh Hoa Province

A.4.1.3. City/Town/Community etc.:

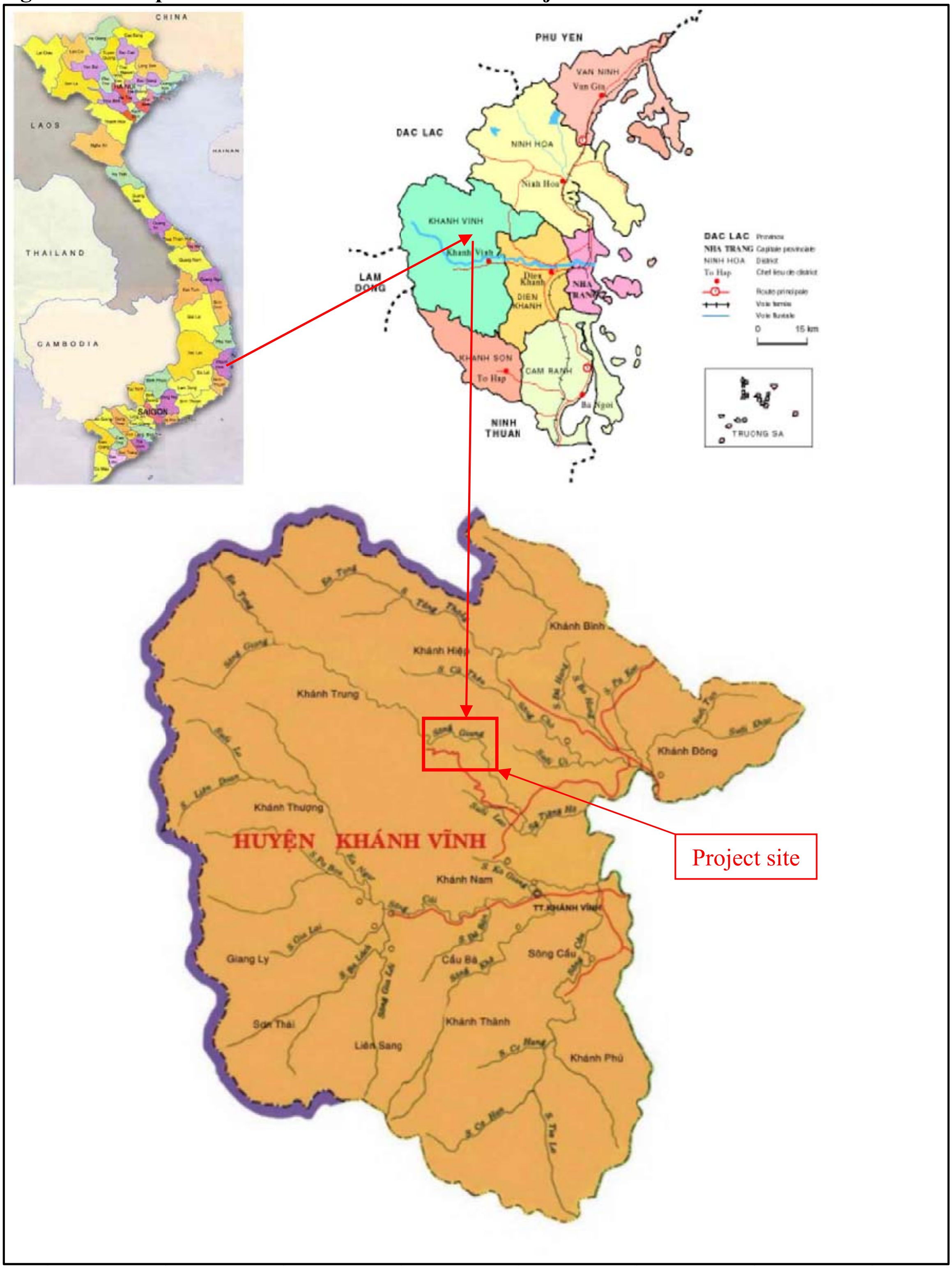
Khanh Trung Commune, Khanh Vinh District

A.4.1.4. Details of physical location, including information allowing the unique identification of this project activity (maximum one page):

The proposed project activity is located on the Giang River, in Khanh Trung Commune, Khanh Vinh District, Khanh Hoa Province. The Giang River, which flows from the northwest to the southeast, is a large tributary of the Cai River system. The project is spread over 7 km along the Giang River. The land occupied by the project is mountainous and consists mainly of natural forest, and, for smaller areas, of farmland and river bed. The nearest major city to the project area is NhaTrang, which is located approximately 50 km to the southeast. The coordinates for the project are:

- Dam: 12^0 22.3305' North latitude, 108^0 50.2535' East longitude
- Powerhouse: 12^0 20.6489' North latitude, 108^0 52.9246' East longitude

Figure A. 1 Map of Khanh Hoa Province and the Project location



A.4.2. Category(ies) of project activity:

The project activity falls within Sectoral Scope 1: Energy industries
Electricity generation from renewable energy (hydropower)

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

Employed technology

The project design has been prepared by the Consultancy Company of University of Civil Engineering. The project design consists of a new diversion-type hydropower facility with a concrete gravity dam, water diversion system, power house, switching station, and reservoir. The facility will have a maximum head of 407.6 meters. The dam will have a maximum height of 20 meters and a total length of 157 meters. The water intake will lead part of the available water flow through a closed water channel, a steel pipe, and a water tunnel with a total length of 4548.12 meters. The tunnel leads the water to a pressure regulating well. The water will then travel through a 1316.28 meter-long penstock to the powerhouse.[2] The surface area of the reservoir is 180,000 m^2 at full capacity and has a power density of 205.56 W/m^2.[3]

The project's total installed capacity will be 37 MW. The expected effective operating time of the project is 3,666 hours annually. Total gross annual power generation is expected to be 135,640 MWh. This value has been identified based on average daily power generation, which, in turn, has been calculated based on the 24 year historical river water flow data.[4] Annual net power to be supplied to the grid is expected to be 134,962 MWh.[5] Power generated by the project will be routed to the National Power Grid.

Two Pelton-type turbine / generator units will be installed in the power plant. The turbines are manufactured by Boving Fouress Limited of India. The manufacturer has experience in manufacturing hydropower turbines and generators which have been installed in many projects around the world.[6] Pelton turbine / generator units are popularly used in hydropower plants in Viet Nam and no adverse impacts on the environment have been reported. Therefore it can be concluded that the project uses safe and sound technology.. The specific technical data of the turbine / generator units are listed below in Table A. 2.

[2] See Technical Design 1, Main Report, page 1-6 and 1-7
[3] Power density is calculated as: capacity / surface area of reservoir = 37,000,000 W / 180,000 m^2 = 205.56 W/m^2
[4] See Technical Design 1, Report of hydrology and financial calculation, table PL-SL.02 and annex of hydrological survey
[5] This is calculated as: 135,640 MWh × (100% - 0.5%)
[6] http://www.bflhydro.com/projects.php

Table A. 2 Technical data of the turbine / generator units[7]

Main technical data		Value (per unit)
Turbine	Units	2
	Type	Vertical Pelton
	Capacity	19.1017 MW
	Maximum water head	407.6 m
	Water flow through turbine inlet ball valve	5.85 m^3/s
	Rated speed	500 rpm
	Technical lifetime	150,000 hours (default value from EB50, Annex 15)
	Average efficiency	88.77 %
Generator	Units	2
	Rated speed	500 rpm
	Average efficiency	≥ 90.05 %
	Capacity	18.5 MW
	Rated voltage	10.5 kV
	Frequency	50 Hz
	Technical lifetime	30 years (default value from EB50, Annex 15)
	Power factor	0.80

Grid connection

Power generated by the project will be routed to the National Power Grid via a single circuit 110 kV transmission line. The line connects an on-site transformer station to Dien Khanh 110 kV transformer station.

Technology transfer

The turbine / generators units are manufactured by Boving Fouress Limited, an experienced manufacturer from India. During equipment installation and initial operation period, experts from Boving Fouress Limited will train O&M staff of the project entity regarding technology, operation and maintenance of the project's equipment.

A.4.4. Estimated amount of emission reductions over the chosen crediting period:

A 7-year renewable crediting period (renewable twice) is selected for the proposed project activity. The estimation of the emission reductions in the crediting period is presented in the table below**Error! Reference source not found.**.

[7] Equipment purchase contract

Table A. 3 Estimation of the Emission Reductions in the Crediting Period

Years	Annual estimation of emission reductions in tonnes of CO_2 e
Year 1: 01/08/2012 – 31/07/2013	73,757
Year 2: 01/08/2013 – 31/07/2014	73,757
Year 3: 01/08/2014 – 31/07/2015	73,757
Year 4: 01/08/2015 – 31/07/2016	73,757
Year 5: 01/08/2016 – 31/07/2017	73,757
Year 6: 01/08/2017 – 31/07/2018	73,757
Year 7: 01/08/2018 – 31/07/2019	73,757
Total estimated reductions (tonnes of CO_2 e)	**516,296**
Total number of creditingyears	7
Annual average over the crediting period of estimated reductions (tonnes of CO_2 e)	73,757

A.4.5. Public funding of the project activity:

There is no public funding from Annex I countries available to the proposed project.

SECTION B. Application of a baseline and monitoring methodology

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

Title: Approved consolidated baseline and monitoring methodology version 12.3.0 of ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources"
Date of approval: 02/03/2012
The methodology draws upon the following tools:

- Version 02.2.1 of the tool to calculate the emission factor for an electricity system;
- Version 06.0.0 of the tool for the demonstration and assessment of additionality;

For more information on the baseline and monitoring methodology relevant tools, please refer to the UNFCCC website:
http://cdm.unfccc.int/methodologies/PAmethodologies/approved

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

This proposed project is a grid-connected renewable power generation that is then applicable to apply version 12.3.0 of ACM0002. More details of the comparison of the project's characteristics and the applicability criteria as specified in version 12.3.0 of ACM0002 is given in the table below:

Applicability conditions in Version 12.3.0 of ACM0002	Characteristics of the project activity	Applicability condition met?
The project activity is the installation, capacity addition, retrofit or replacement of a power plant/unit of one of the following types: hydro power plant/unit (either with a run-of-river reservoir or an accumulation reservoir), wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit.	The project activity is to install a new hydro power plant with a single run-of-river reservoir.	Yes
In case of hydro power plants the project activity results in new single or multiple reservoirs and the power density of each reservoir is greater than 4 W/m^2 After the implementation of the project activity	The power density of the new single reservoir is 205.56 W/m^2.	Yes

This comparison shows clearly that version 12.3.0 of ACM0002 is applicable to the proposed project activity.

B.3. Description of the sources and gases included in the project boundary:

The sources and gases included in the project boundary are described in Table B. 1.

Table B. 1 Inclusion of gases and sources in the calculation of the emission reductions

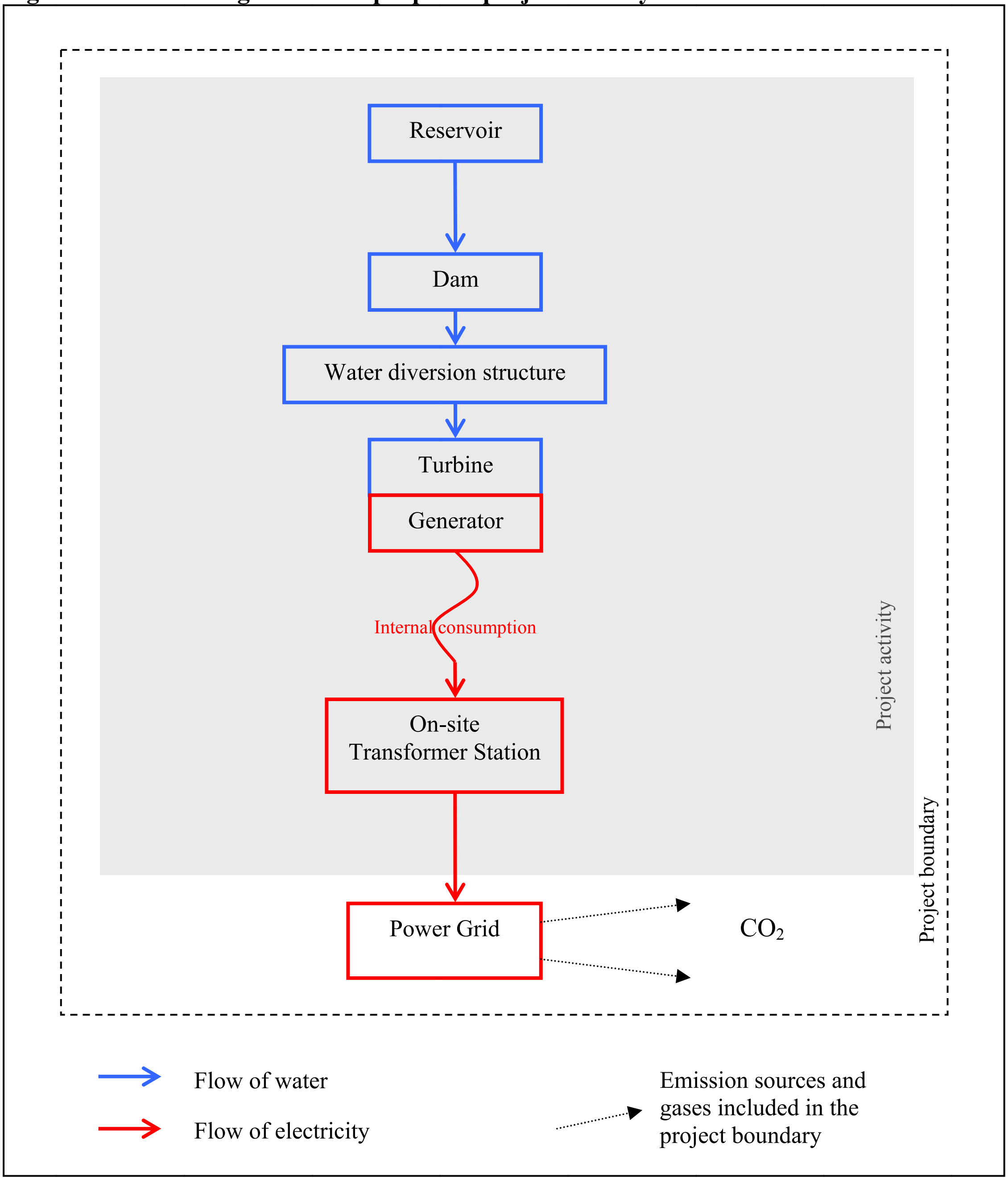
	Source	Gas	Included?	Justification / Explanation
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity	CO_2	Yes	Included as per the ACM0002 methodology.
		CH_4	No	Excluded as per ACM0002.
		N_2O	No	Excluded as per ACM0002.
Project Activity	Emissions of CH_4 from the reservoir	CO_2	No	Excluded as per ACM0002.
		CH_4	No	Excluded as per the ACM0002 methodology.
		N_2O	No	Excluded as per ACM0002.

In line with the methodology, the greenhouse gases accounted for are CO_2 emissions from electricity generation in fossil fuel-fired power plants. Figure B. 1 provides a flow diagram of emissions that potentially need to be taken into account. The project has no significant water storage capacity. In fact, the power station has a power density of approximately 205.56 W/m^2. Therefore, in accordance with the Executive Board decision "Thresholds and criteria for the eligibility of hydroelectric power plants with reservoirs as CDM project activities" (EB23), the project emissions from the reservoir can be ignored (see also section B.6.1).

The spatial extent of the project boundary includes all power plants connected physically to the electricity system that the CDM project power plant is connected to (as defined below), including the project power plant itself, which includes:

- Reservoir created by the project activity;
- Dam structure including flood gates and water intake;
- Water diversion system;
- Power house;
- Switching / transformer station (owned by the project entity); and
- Transmission lines to the grid.

Figure B. 1 Flow diagram of the proposed project activity



B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

The project activity is the installation of a new grid-connected renewable power plant/unit, the baseline scenario is as follows:
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, as reflected in the combined margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system".

The Vietnam national electricity grid, which is operated and monopolized by the EVN and is the unique transmission and distribution line, to which all power plants in Vietnam are physically connected to is the project electricity system. Thus the baseline scenario of the proposed project is the delivery of equivalent amount of annual power output from the Vietnam national grid to which the proposed project is also connected.

Following the EB guidance on the consideration of national and/or sectorial policies and circumstances in baseline scenarios (EB 22, annex 3), two types of policies E+ and E- have been examined.

(a) National and/or sectorial policies or regulations that give comparative advantages to more emissions-intensive technologies or fuels over less emissions-intensive technologies or fuels. Up to date, the government of Vietnam has not implemented any such E+ policies that are available and/or to be accessed publicly.

(b)National and/or sectorial policies or regulations that give comparative advantages to less emissions-intensive technologies over more emissions-intensive technologies (e.g. public subsidies to promote the diffusion of renewable energy or to finance energy efficiency programs): the latest relevant policy is the – National Master Plan on national power development for the period 2006-2015 perspective to 2025 (Master plan VI) approved by the Prime Minister in 2007. According to EB 22, annex 3, it is not needed be taken into account in developing a baseline scenario as it is implemented after 11 November 2001. Furthermore, the main power capacity additions (new power plants) set out in the Master Plan are fossil fuel fired power plants. There are no special incentives for less emission intensive technologies.

So, the baseline scenario of this proposed project refers to a hypothetical situation or the delivery of equivalent amount of annual power output from the Vietnam national grid.

The development of the baseline will be described in section B.6.

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 CDM project activity (assessment and demonstration of additionality):

The additionality of the project activity is demonstrated using the steps described in the "Tool for the demonstration and assessment of additionality" (version 06.0.0) ("Additionality Tool").

Step 1. Identification of alternatives to the project activity consistent with current laws and regulations

According to the Validation and Verification Manual (version 01.2) 105: *"The PDD shall identify credible alternatives to the project activity in order to determine the most realistic baseline scenario,* *unless the approved methodology that is selected by the proposed CDM project activity prescribes the baseline scenario and no further analysis is required."* The project activity is the installation of new grid-connected renewable power plant. The methodology ACM0002 describes the baseline scenario of projects of installation of new grid-connected renewable power plant as "*Electricity delivered to the grid by the project activity that would have otherwise been generated by the operation of the grid connected power plants and by the additional of new generation sources as reflected in the combined margin (CM) calculations described in the tool to calculate the emission factor for an electricity system*", there is no need to further analyze alternatives to the project activity to assess and demonstrate the additionality.

Step 2. Investment analysis

Sub-step 2a: Determine appropriate analysis method
The analysis will be analyzed through Option III of the Additionality Tool - benchmark analysis. This method is applicable because:

- Option I, simple cost analysis, does not apply as the project generates economic returns through the sales of electric power to the grid.
- Option II, investment comparison analysis, is not used since the project entity is not considering investing in the construction of one of the other identified alternatives.
- Option III, benchmark analysis, is used since the project entity is not confronted with a choice between alternative investments. Therefore, the financial returns of the project vis-à-vis a market benchmark return were crucial for the decision to go ahead with the project.

We therefore conclude that option III is applicable to the project activity.

Sub-step 2b – Option III: Apply benchmark analysis
The project faces a barrier to implementation due to poor returns on investment. To illustrate this, the project developer should identify the financial / economic indicator, such as IRR, most suitable for the project type and decision context. As prescribed by the Additionality Tool itself, the project developer has chosen project IRR to demonstrate the additionality.

According to guidance 12 of EB 62, Annex 5 *"Local commercial lending rates or weighted average costs of capital (WACC) are appropriate benchmarks for a project IRR"*. In the PDD published in the global stakeholder process, WACC was chosen by the project entity to compare with the project IRR. However, due to lacking of appropriate data to substantiate the WACC, the local commercial lending rate was adopted as benchmark for comparison with the project IRR. At the time of investment decision in February 2008, the basic interest rate set up by the State Bank of Viet Nam was 8.75%[8]. According to the country's civil code[9], commercial banks may charge up to 150% of the base rate when lending, i.e. 13.13%. The commercial lending rate of 13.13% is therefore chosen as the benchmark. This benchmark is appropriate because:

- The IRR is calculated as a project IRR and according to guidance 12 of EB 62, Annex 5, local commercial lending rate is a appropriate benchmark for a project IRR.
- This commercial lending rate is based on the base rate provided by the State Bank of Viet Nam, which is standard in the Viet Nam market as in the guidance 13 of EB 62, Annex 5, *"In the cases of projects which could be developed by an entity other than the project participant the benchmark should be based on parameters that are standard in the market"*.

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[8] www.sbv.gov.vn
[9] See Civil code no. 33/2005/QH11, dated 14/06/2005

- This commericla lending rate is based on the base rate published by the State Bank of Viet Nam and available at the time of investment decision. Therefore it is official rate at the time of investment decision as required in paragraph 30 of Additionality Tool that benchmarks can be derived from *"Government/official approved benchmark where such benchmarks are used for investment decisions"*.

The commercial lending rate benchmark of 13.13% can also be considered as a conservative benchmark because at the investment decision time some commercial banks in Viet Nam were unofficially charging around 1.25% per month for mid and long term lendings[10]. This equals to 16.1% per annual[11].

In conclusion the commercial lending rate of 13.13% is an appropriate and conservative benchmark for the proposed project.

Sub-step 2c: Calculation and comparison of financial indicators

The project owner's initial idea in feasibility study phase was to install a 30 MW hydro power project. However, in the technical design phase the design institute advised to increase the project capacity to 37 MW by increasing the water head (from 356.22 m in feasibility study phase to 407.6 m). On 25/02/2008 the project owner decided to go on with the project with the installed capacity of 37 MW based on information provided by the design institute. After that the project owner signed a contract for construction of all main components of the project, this is considered as the earliest real action on the proposed project activity. To prepare for this real action, the project owner hired a contractor to build 4 km of the access road, the access road building is considered as minor pre-construction preparation and therefore is not considered as start date. From the start of project development till now, neither contracts are cancelled nor government permits are revocated. The implementation of the project is not ceased for any reasons at any time.

The main parameters for the financial analysis are based on the data in the Main report of Draft Technical Design 1 document prepared in February 2008 provided by the design institute. This data source is available at the investment decision date (25/02/2008) and therefore an appropriate source for financial analysis. The parameters used in the calculation of the IRR are presented in Table B. 2.

Table B. 2 Parameters used in the calculation of the IRR

Assumptions	Value	Unit	Basis
Project parameters			
Installed capacity	37.00	MW	Draft Technical Design 1 (" Draft TD1"), Main report, page 3-14
Annual operation hour	3,666	Hour	Draft TD1, Main report, page 3-14
Plant load factor	41.8	%	Computed by dividing operation hours by total hours per year
Gross annual generation	135,640	MWh	Draft TD1, Main report, page 3-14
Aux.Consumption & Grid Outages	0.5	%	Draft TD1, Main report, page 3-18
Annual net generation available for sale	134,962	MWh	Computed

[10] http://vietnamnews.vnagency.com.vn/Economy/Banking-Finance/173805/banks-mired-in-deposit-interest-rate-war.html

[11] This is compound interest rate calculated as: $(1+ \text{monthly rate})^{12} – 1 = (1+0.0125)^{12} - 1 = 16.1\%$

Financial parameters			
Tariff for calculation of electricity revenue (VAT excluded)	595	VND/kWh	Power purchase agreement
O&M costs	0.50	%	Draft TD1, Main report, page 3-18
Investment cost	689,882	million VND	Draft TD1, Main report, page 3-15
Residual value (on equipment + construction cost)	5	%	Assumed
CER price in VND	382,239	VND/CER	Computed
CER price in EUR	16.5	EUR/CER	Price of 04/02/2008 (source: http://carbonpositive.net/viewarticle.aspx?articleID=1011)
Exchange rate	23,166	VND/EUR	Average of January 2008 (source: http://www.gocurrency.com)
Project life	40	year	Draft TD1, Main report, page 3-15
Natural resource tax rate	2	%	Circular No. 42/2007/TT-BTC
Tariff for calculation of natural resources tax	750	VND/kWh	Circular No. 42/2007/TT-BTC

The following table provides a breakdown of the total investment costs.

Table B. 3 Total investment costs (all units in millions of VND)[12]

Details		Breakdown
1. Construction costs		342,943
1.1 main construction	*312,078*	
1.2 support for main construction	*27,435*	
1.3 temporary housing during construction	*3,429*	
2. Equipment costs		235,645
2.1 hydrotechnical equipment	*68,808*	
2.2 hydraulic equipment	*165,894*	
2.3 training cost	*943*	
3. Compensation costs		675
4. Administration costs		6,490
5. Investment consultancy cost		25,369
6. Other costs		10,394
7. Contingency		68,367
7.1 contingency cost for unexpected extra works	*30,765*	
7.2 contingency for material price escalation	*37,602*	
Total investment costs		**689,882**

Comparison to benchmark

The results of the analysis for the project are provided in Table B. 4 below.

[12] See Draft Technical Design 1, Main Report, page 3-15

Table B. 4 Results of economic analysis

Internal Rate of Return (IRR)	Without CDM revenues	9.82%
	With CDM revenues	13.14%
Benchmark		13.13%

The IRR without CDM is below the benchmark.This result is examined via the sensitivity analysis.

Sub-step 2d: sensitivity analysis
The "Tool for the demonstration and assessment of additionality" requires that a sensitivity analysis is conducted to check whether the financial attractiveness remains unaltered for reasonable variations in the critical assumptions. The following parameters were used as critical assumptions:

- Total investment cost
- Electricity Tariff
- Annual O&M costs
- Annual power generation

The IRR of the project depends mainly on its revenues and cost. The main revenue for this project is from electricity output and feed in tariff while the main costs of the project are investment cost and O&M cost. These parameters are therefore appropriate for the sensitivity analysis.

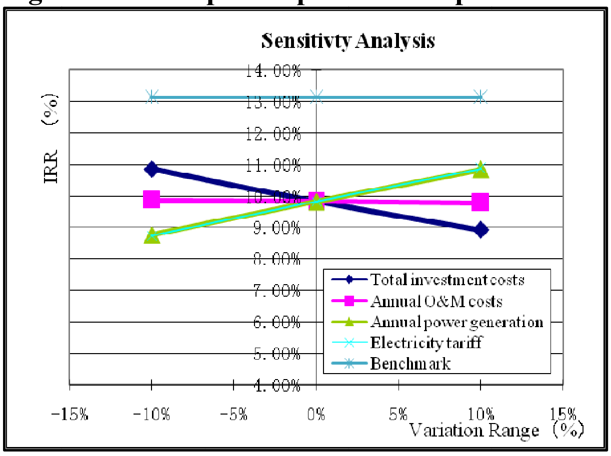
In the sensitivity analysis, variations of ±10%[13] have been considered in the critical assumptions. The results of the sensitivity analysis for the IRR are shown in Table B. 5, while Figure B. 2 provide a graphic depiction.

[13] ±10% is selected according to the Decision No. 2014/QD – BCN issued by the Ministry of Industry, dated 13/06/2007 to provide temporary guidelines for conducting the economic, financial and investment analysis. ±10% is also a common practice rate for sensitivity analysis of a CDM project.

Table B. 5 Impact of variations in assumptions on the IRR without CDM revenues

No.	Parameter	Variation	Project IRR	Likelihoods
1	Total investment costs	-10%	10.85%	Below benchmark
		10%	8.92%	Below benchmark
		-27.65%	13.13%	The probability of a 27.65% decrease in the total investment cost is not likely to happen because the actual cost[14] is higher than estimated. This is due to high inflation in Viet Nam from 2007 till now.[15]
2	Electricity tariff	-10%	8.74%	Below benchmark
		10%	10.86%	Below benchmark
		32.6%	13.13%	The probability of an increase of 32.6% is not likely because the PPA with EVN is signed with a fixed feed in tariff for the whole project life.[16]
3	Annual O&M costs	-10%	9.86%	Below benchmark
		10%	9.77%	Below benchmark
		-758%	13.13%	This option will be discarded, because decrease of 758% is not realistic
4	Annual power generation	-10%	8.77%	Below benchmark
		10%	10.84%	Below benchmark
		33.4%	13.13%	The probability of a 33.4% increase in annual Power generation is very unlikely. This is because the potential hydrology has been surveyed in long term basis[17]. The current estimates is the most likely scenario and an increase of 33.4% is not possible.

Figure B. 2 Graphic depiction of impact on IRR without CDM revenues



[14] Actual cost report has been submitted to the DOE for review
[15] http://www.indexmundi.com/g/g.aspx?c=vm&v=71
[16] See Power purchase agreement, Article 02
[17] See Technical Design 1, Report of hydrology and financial calculation, table PL-SL.02 and annex of hydrological survey

The sensitivity analysis confirms that the project's IRR without CDM benefits is substantially below the benchmark. Therefore, the proposed project activity faces an investment barrier due to its commercial unattractiveness.

Step 3. Barrier analysis
The project does not face other barriers besides the low economic returns. Therefore step 3 of the Additionality Tool is skipped.

Step 4. Common practice analysis
The proposed project is a renewable energy project. As per the additionality tool the common practice analysis for the proposed project will be done following stepwise approach.

Step 4a: Calculate +/-50% output range
The proposed project has a capacity of 37 MW. The output range as +/-50% of the design capacity of the proposed project activity is 18.5 – 55.5 MW.

Step 4b: Identify N_{all}
N_{all} is defined as plants that is located in the applicable geographical area, deliver the same output or capacity, within the applicable output range calculated in Step 4a, have started commercial operation before the start date of the project and has not been registered as CDM project activities.

The proposed project is located in Viet Nam and has the start date as of 04/04/2008. Therefore N_{all} in this case includes projects:

- Located in Viet Nam
- Not registered as CDM projects,
- With a capacity within the range 18.5 – 55.5 MW, and
- Started commercial operation before 04/04/2008.

A research was done, among 238 projects identified from different sources, three fall into N_{all} (**N_{all} = 3**).

Table B. 6 List of N_{all} projects

Project name	Province	CDM	Capacity	Year of operation start
Srok Phu Mieng[18]	Binh Phuoc	No	51	2006
Ea Krong Rou[19]	Khanh Hoa	No	28	2007
Dray H'linh 2[20]	Dak Nong	No	16	2007

Step 4c: Identify N_{diff}
N_{diff} are plants applying different technology to the technology applied for the proposed project activity. Different technologies are technologies that deliver the same output and differ by at least one of the following (as appropriate in the context of the measure applied in the proposed CDM project and applicable geographical area):

[18] http://vietbao.vn/Xa-hoi/Thuy-dien-Srok-Phu-Mieng-chinh-thuc-hoa-luoi-dien-quoc-gia/45212685/157/
[19] http://songda.com.vn/info/Chitiet/tabid/181/ItemID/2728/View/Details/Default.aspx
[20] http://www.cpc.vn/cpc/Home/Ttuc_Detail.aspx?pm=ttuc&sj=HD&id=79

(i) Energy source/fuel;
(ii) Feed stock;
(iii) Size of installation (power capacity):
  - Micro (as defined in paragraph 24 of Decision 2/CMP.5 and paragraph 39 of Decision 3/CMP.6);
  - Small (as defined in paragraph 28 of Decision 1/CMP.2);
  - Large;
(iv) Investment climate in the date of the investment decision, inter alia:
  - Access to technology;
  - Subsidies or other financial flows;
  - Promotional policies;
  - Legal regulations;
(v) Other features, inter alia:
  - Unit cost of output (unit costs are considered different if they differ by at least 20 %);

To compare plants in N_{all} with the proposed project, investment climate, i.e. subsidies. In comparison with private owned companies, State-owned companies operate on budget from the State and serve other State's purposes such as socio-economic and infrastructure development, national defence. Since being responsible for State's purposes, these companies can receive special supports from the State:

- Srok Phu Mieng is invested by the Viet Nam Urban and Industrial Zone Development Investment Corporation (IDICO), a State corporation playing a major role in the construction and economic development of Viet Nam[21]. In Srok Phu Mieng project, one of the supports from the Vietnamese Government for IDICO is "allowing the Ministry of Finance on behalf of the Government to sign the guarantee letter for the loan from the Export-Import Bank of China"[22]. This guarantee from the Ministry of Finance was the key for IDICO to get the loan from the Export-Import Bank of China.
- Dray H'linh 2 is invested by Power Company No. 3 (now known as Central Power Corporation), a member of Electricity of Viet Nam ("EVN"). EVN is the State company in charge of operating the only grid in Viet Nam and also investment in electricity generation projects. As stated in Decision 95/2001/QD-TTg dated 22/06/2001 by the Prime Minister, EVN plays the main role in generating electricity for socio-economic development and the country's daily activities. EVN can mobilize capital from all sources to invest in electricity generation and grid projects (including ODA, domestic and foreign loan, export-import loan…).
- Ea Krong Rou is invested by the Mien Trung Power Investment and Development Joint Stock Company, a joint venture of largest State corporations; Song Da Holdings and Power Company No. 3. This project received a Official Development Assistant (ODA) loan and preferential loan interest rate from the Viet Nam Development Bank.[23]

As proved above, the owners of Srok Phu Mieng, Dray H'linh 2 and Ea Krong Rou projects are State-owned and received special supports from the Viet Nam Government. The project owner of Song Giang 2 is a purely private company and has not received any of such supports. Therefore it is concluded that all three projects in N_{all} applied different technology to the proposed projects or $N_{diff} = 3$.

Step 4c: Calculate factor $F = 1 – N_{diff}/N_{all}$ and $N_{all} - N_{diff}$

[21] http://idico.com.vn/?Bcat=1&lg=eg&start=0
[22] Document no. 4846/VPCP-KTTH dated 13/09/2004 by the Vietnamese Government Office
[23] http://www.mientrungpid.com.vn/?page=13

As indentified in Step 4b and 4c, N_{all} = 3 and N_{diff} = 3 respectively. F and $N_{all} - N_{diff}$ is calculated as follow:

$F = 1 – 3/3 = 1 – 1$
F = 0

$N_{all} - N_{diff} = 3 - 3$
$N_{all} - N_{diff} = 0$

Conclusion:
F = 0 is smaller than threshold of 0.2 and $N_{all} - N_{diff} = 0$ is smaller than threshold of 3, therefore it can be concluded that the proposed project activity is not a "common practice".

Impact of CDM registration
Registration of the project under CDM would result in additional revenues, thus significantly improving its economic attractiveness. This is the most important contribution of CDM to the project's realization, and would remove a prohibitive barrier.

Serious CDM consideration
The project owner was aware of the possibilities of CDM at a very early stage of the project development. The project entity corresponded with a CDM advisor and potential CER buyers in 2005. Below is a timeline describing the main events in the project's development.

Table B. 7 Overview of key events in the development of the project

Date	Event
23/02/2005	Investment permit granted by Khanh Hoa People's Committee
02/2005	Issuance of EIA report
04/2005	Issuance of Feasibility Study Report ("FSR") (30 MW)
15/04/2005	Project entity contacted CDM advisor, RCEE for cooperation in CDM development
10/05/2005	Environmental Impact Assessment approved by Department of Natural Resources and Environment of Khanh Hoa province
10/08/2005	FSR approved by Ministry of Industry
15/08/2005	***1st Board Decision:*** Board of Directors decided to invest in the project with serious consideration of CDM revenues
09/03/2006	Pre-construction preparation: Contract for the construction of 4 km of the access road for the Project; value: 7,080,271,000 VND (1% of total investment cost)
17/11/2006	Initial ERPA with Government of Denmark signed
12/2006	30 MW PDD submitted for validation
24/07/2007	Vietnam CDM letter of approval granted
02/2008	Technical Design (37 MW) drafted
25/02/2008	***Final Board decision on project design (37MW):*** Board of Directors approved the increasing of installed capacity to 37 MW. Based on the available information, the board decided to continue persuing CDM to ensure project's feasibility
04/04/2008	***CDM Starting date on proposed 37MW project***: General construction contract signed to build the project

05/2008	Official issuance of the Technical Design Document (37 MW)
18/09/2008	ERPA between PE and Danish government cancelled
29/09/2008	Equipment purchase contract signed: electro-mechanical equipment and technical services for the Project (37 MW)
10/10/2008	Project entity contacted Hanam Carbon/CVDT for CDM cooperation
11/2008	Construction start date as per the project's Implementation Report
10/07/2009	ERPA signed between Project Entity and Vitol S.A., the current CER buyer
13/08/2009	Approval by the Khanh Hoa Department of Industry and Trade regarding the adjustment of the project's capacity to 37 MW
05/2010	The PDD (37MW) is published for global stakeholder comments
25/03/2011	Swiss CDM letter of approval granted
16/05/2011	Vietnam CDM letter of approval revised

Early CDM consideration:

On 15/08/2005, the Board of Directors decided to invest in the 30 MW project with consideration the CDM revenue 30MW due to the poor economic return. Subsequently, the initial ERPA was signed and PDD was published for collecting global stakeholder comments in December 2006. In February 2008, following proposals of qualified design institute, the project design was requested to change the installed capacity to 37MW finally. Based on information provided by the design institute, the Board of Directors made the final investment decision to pursuit CDM support due to the poor financial return.

CDM Starting Date:

There were no real actions of proposed project activity until the construction contract was signed on 04/04/2008, which is considered the CDM Starting Date as an earliest date. Compare to the available contracts, it is worthy to note that 'Contract for the construction of 4 km of the access road' on 09/03/2006 was regarded as the Pre-construction Preparation and is not considered as a real action of proposed project. Therefore, 04/04/2008 is CDM starting date in this regard. The implementation of the proposed project activity was never ceased; neither contracts were cancelled nor government permits were revocated.

Continuous CDM Activities:

On 18/09/2008, Danish government cancelled the ERPA with PE. Because CDM revenue is highly important for the project, the project owner decided to look for another buyer and engaged Hanam Carbon in the development of the project in 2009. Consequently, Vitol S.A. signed ERPA with the project owner on 10/07/2009.

With all the changes in involving parties and the installed capacities of the project, Hanam Carbon decided to develop the project from scratch and collected all relevant documents from the project owner to prepare the PDD. The PDD was uploaded in May 2010 for global stateholder comments. After that the Swiss CDM letter of approval and revised Vietnam CDM letter of approval were issued respectively in March and May of 2011.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

In accordance with the ACM0002 methodology (version 12.3.0), emission reductions are calculated as follows:

Equation B. 1

$$ER_y = BE_y - PE_y$$

where:

ER_y	=	Emission reductions in year *y* (tCO_2e)
BE_y	=	Baseline emissions in year *y* (tCO_2)
PE_y	=	Project emissions in year *y* (tCO_2e)

Below we describe in detail the methodological choices made in the calculation of the above parameters.

Baseline emissions:
For the calculation of the combined margin CO_2 emission factor ($EF_{CM, grid,y}$), the methodology refers to the "Tool to calculate the emission factor for an electricity system" (Version 02.2.1) ("Emission Factor Tool"). In accordance with the Emission Factor 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 emission factors are calculated *ex ante* and will not be updated during the first crediting period.

The grid boundary has been determined in accordance with the Emission Factor Tool as the National Power Grid. (see section B.3).

Description of the calculation process
The key methodological steps are:
STEP 1. Identify the relevant electricity system;
STEP 2. Choose whether to include off-grid power plants in the project electricity system (optional).
STEP 3. Select a method to determine the operating margin (OM).
STEP 4. Calculate the operating margin emission factor according to the selected method.
STEP 5. Calculate the build margin (BM) emission factor.
STEP 6. Calculate the combined margin (CM) emission factor.

Step 1. Identify the relevant electricity system
The proposed project will be connected to the Vietnam national grid, therefore the relevant electric system is Viet Nam National Grid.

Step 2. Choose whether to include off-grid power plants in the project electricity system (optional)
The Emission Factor Tool allows project participants to choose between two options to calculate the operating margin and build margin emission factors. The two options are:

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 calculations.

This PDD chooses Option I. Therefore, only grid power plants are included in the calculation.

Step 3. Select a method to determine the operating margin (OM)
The Emission Factor Tool offers several options for the calculation of the OM emission factor:
(a) Simple OM, or
(b) Simple adjusted OM, or

(c) Dispatch data analysis OM, or
(d) Average OM

According to the Emission Factor Tool, the simple OM method (option a) can only be used if low-cost/must-run resources constitute less than 50% of total grid generation in: 1) average of the five most recent years, or 2) based on long-term averages for hydroelectricity production. The Emissions Factor Tool defines "low-cost/must run" resources as "power plants with low marginal generation costs or power plants that are dispatched independently of the daily or seasonal load of the grid. They typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation."

The Simple OM is applicable to this project since it involves hydropower which has low marginal generation costs. And as Table B. 8 shows below, hydropower resources constitute less than 50% of Viet Nam's total grid generation on average over five recent years. Therefore, as per the Emission Factor Tool, simple OM can be used in the calculation of the OM emission factor.

Table B. 8 Electricity generation of the National Power Grid of Viet Nam, 2004-2008

Generation source	2004	2005	2006	2007	2008	5-year average
Hydropower (MWh)	17,858,651	16,365,438	19,508,244	22,385,232	25,933,762	102,051,327
Total grid (MWh)	44,974,169	50,330,468	57,160,493	66,348,589	74,689,636	293,503,355
Low-cost/Must-run ratio	39.71%	32.52%	34.13%	33.74%	34.72%	34.77%

Data source: The Vietnamese DNA Grid Emission Factor calculation issued on 26/03/2010[24]

Data vintage selection
In accordance with the Emission Factor Tool, the OM is calculated according to the "*ex-ante* option": a three-year generation-weighted average, based on the Grid Emission Factor calculation issued by the Vietnamese DNA on 26/03/2010. The Vietnamese DNA used the data from 2006 to 2008 to calculate the emission factor of the grid.

Justification for using the EF calculation provided by DNA: It is the latest available official data issued by the DNA.

Step 4. Calculate the operating margin emission factor according to the selected method
According to the simple OM method, the OM emission factor is calculated as the generation-weighted average tCO_2 emissions per unit of net electricity generation (tCO_2/MWh) of all generating power plants serving the system, excluding the low-cost/must-run power plants/units. We calculate the OM emission factor according to option B of the simple OM method, since:

a. Neccessary data required for option A (CO_2 emission factor of each power unit) is not available.
b) Only renewable power generation are considered as low-cost/must-run power sources and the quantity of electricity supplied to the grid by these sources is known; and
c) Off-grid power plants are not included in the calculation (i.e. if Option I has been chosen in Step 2).

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

Option B - Calculation based on total fuel consumption and electricity generation of the system

Where option B is used, the simple OM emission factor is calculated based on the net electricity supplied to the grid by all power plants serving the system, not including low-cost/must-run power plants/units, and based on the fuel type(s) and total fuel consumption of the project electricity system, as follows:

Equation B. 2

$$EF_{grid,OMsimple,y} = \frac{\sum_i (FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y})}{EG_y}$$

Where:

$EF_{grid,OMsimple,y}$	=	Simple operating margin CO_2 emission factor in year y (tCO_2/MWh)
$FC_{i,y}$	=	Amount of fossil fuel type i consumed in the project electricity system 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_y	=	Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost/must-run power plants/units, in year y (MWh)
i	=	All fossil fuel types combusted in power sources in the project electricity system in year y
y	=	The relevant year as per the data vintage chosen in Step 3

Data selection:

- The amount of fossil fuel consumption ($FC_{i,y}$) and net electricity generated and delivered to the grid (EG_y) are obtained from Grid emission factor calculation issued by Vietnamese DNA on 26/03/2010.
- The net calorific value ($NCV_{i,y}$) and CO_2 emission factor of fossil fuel ($EF_{CO2,i,y}$) are default values at the lower limit of the uncertainty at 95% confidence interval as provided in chapter 1 of volume 2 (energy) of the *2006 IPCC Guidelines for National Greenhouse Gas Inventories.*

Calculation of the OM emission factor as a three-year full generation weighted average

The data of the year 2006, 2007 and 2008 has been used for the calculation. The three-year average is calculated as a full-generation-weighted average of the emission factors. The OM emission factor has been calculated as 0.6125 tCO_2/MWh. See Annex 3 and table below for more details.

Table B. 9 Result of OM calculation

Year	Total electricity supply to grid (MWh)	CO_2 emission (tCO_2)	Weighted average OM emission factor (tCO_2/MWh)
	A	B	***(ΣB/ΣA)***
2006	37,618,199	24,612,431	
2007	43,921,501	27,427,972	
2008	48,719,874	28,912,371	
Total	**130,259,574**	**80,952,774**	**0.6125**

The calculation of the OM emission factor is done once (*ex-ante*) and will not be updated during the first crediting period.

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 first crediting period, the BM emission factor is calculated *ex-ante* based on the most recent information available. For the second crediting period, the BM emission factor will be updated based on most recent data available at the time of submission of the request for renewal of the crediting period. For the third crediting period, the BM emission factor calculated for the second crediting period will be used.

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

(a) Identify 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}[25] ($SET_{\geq 20\%}$) and determine their annual 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. Ignore steps (d), (e) and (f).

Table B. 10 shows $SET_{5\text{-units}}$ and $SET_{\geq 20\%}$ of the national electricity grid, their annual generation and the time each power unit started to supply electricity to the grid.

Table B. 10 Overview of most recently-built power units

Plant	Commissioning year	Electricity supply to grid (MWh)
Five power units started to supply electricity to the grid most recently ($SET_{5\text{-units}}$)		
A Vương	2008	168,103.50
Tuyên Quang	2008	1,136,112.18
Đại Ninh	2008	1,145,108.50
Nhơn Trạch	2008	544,808.60
Cà Mau 1&2	2007	2,106,807.24
		2,728,872.00
Annual electricity generation of $SET_{5\text{-units}}$ ($AEG_{SET\text{-}5\text{-units}}$)		**7,829,812.02**

[25] If 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation

Power units started to supply electricity to the grid most recently and that comprise 20% of the project electricity system ($SET_{\geq 20\%}$)		
A Vương	2008	168,103.50
Đại Ninh	2008	1,145,108.50
Nhơn Trạch	2008	544,808.60
Tuyên Quang	2008	1,136,112.18
Cao Ngạn	2007	708,693.00
Quảng Trị	2007	250,804.40
Uông Bí extension	2007	532,000.00
Cà Mau 1&2	2007	2,106,807.24
		2,728,872.00
CÁI LÂN - VINASHIN	2007	90,465.01
SÊ SAN 3	2006	1,131,614.00
SÊ SAN 3A	2006	394,895.70
SROC Phu Mieng IDICO	2006	241,556.00
Đạm Phú Mỹ	2006	4,716.00
Na Dương	2005	627,930.00
Formosa	2004	560,295.00
Phú Mỹ 2.2[26]	2004	4,141,980.00
Annual electricity generation of $SET_{\geq 20\%}$ ($AEG_{SET-\geq 20\%}$)		**16,514,761.13**

Data source: The Vietnamese DNA Grid Emission Factor calculation issued on 26/03/2010

From Table B. 10, we can see that $AEG_{SET-\geq 20\%} > AEG_{SET-5-units}$ and none of the power units in $SET_{\geq 20\%}$ started to supply electricity to the 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.

According to the Emission Factor Tool, the BM emission factor is calculated as the generation-weighted average emission factor (measured in tCO_2/MWh) of all power units *m* during the most recent year *y* for which data is available:

Equation B. 3

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \cdot EF_{EL,m,y}}{\sum_m EG_{m,y}}$$

Where:

$EF_{qrid,BM,y}$	=	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)

[26] Since 20% of Total domestic electricity generation of Vietnam national grid in 20008 falls on part of the generation of Phu My 2.2 plant, the total generation of Phu My 2 .2 plant is fully included in the calculation.

$EF_{EL,m,y}$	=	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

Calculation of the BM emission factor according to Equation B. 3. For more details please refer to Annex 3.

Table B. 11 Calculation Result of Build Margin Emission Factor

Result of BM calculation	
Total CO_2 emission	7,786,329 (tCO_2)
Total electricity to grid	16,514,761.13 (MWh)
BM_{2008}	**0.4715 (tCO_2/MWh)**

The calculation of the BM emission factor for the first crediting period is done once (*ex-ante*) and will not be updated during the first crediting period.

Step 6. Calculate the combined margin (CM) emission 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 weighted average CM method (option A) should be used as the preferred option.

The simplified CM method (option b) can only be used if:

- The project activity is located in a Least Developed Country (LDC) or in a country with less than 10 registered projects at the starting date of validation; and
- The data requirements for the application of step 5 above cannot be met.

The project activity is located in Viet Nam with more than 10 registered projects. The Baseline Emission Factor is therefore calculated using method (a) weighted average CM as follows:

Equation B. 4

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM}$$

Where:

$EF_{grid,BM,y}$	=	Build Margin CO_2 emission factor in year *y* (tCO_2/MWh)
$EF_{grid,OM,y}$	=	Operating Margin CO_2 emission factor in year *y* (tCO_2/MWh)
w_{OM}	=	Weighting of the Operating Margin emissions factor (%)
w_{BM}	=	Weighting of the Build Margin emissions factor (%)

The Emission Factor Tool provides the following default weights: Operating Margin, w_{OM} = 0.5; Build Margin, w_{BM} = 0.5

Applying the default weights and the calculated emission factors, we calculate a combined margin Baseline Emission Factor of **0.5465** tCO_2e/MWh.

The combined margin emission factor calculated above is lower than the one published by the Viet Nam DNA (0.5764 t CO_2e/MWh) in its letter no. 151/KTTVBDKH dated 26/03/2010. The reason for such difference is the default NCV and CO_2 emission factor applied; the calculation by the project entity above has applied lower limit values while the calculation published by Viet Nam DNA has applied the upper limit values.

Therefore the combined margin emission factor of 0.5465 tCO_2e/MWh calculated by the project entity has been applied for the proposed project for conservativeness.

Calculation of Baseline Emissions

According to the methodology, baseline emissions include only CO_2 emissions from electricity generation in fossil fuel-fired power plants that are displaced due to the project activity. The methodology further assumes that all project electricity generation above baseline levels would have been generated by existing grid-connected power plants and the addition of new grid-connected power plants.

Baseline emissions are calculated by multiplying the Baseline Emission Factor by the net quantity of electricity supplied to the grid by the project according to Equation B. 5 below:

Equation B. 5

$$BE_Y = EG_{PJ,y} \bullet EF_{grid,\,\mathrm{CM},,\mathrm{y}}$$

Where:

BE_y	=	Baseline emissions in year *y* (tCO_2)
$EG_{PJ,y}$	=	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year *y* (MWh)
$EF_{grid,\,\mathrm{CM},,\mathrm{y}}$	=	Combined margin CO_2 emission factor for grid connected power generation in year *y* calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (tCO_2/MWh)

Calculation of $EG_{PJ,y}$

The ACM0002 methodology provides three options for the calculation of $EG_{PJ,y}$:

(a) greenfield renewable energy power plants;
(b) retrofits and replacements; and
(c) capacity additions.

The proposed project activity is a greenfield plant - it involves the installation of a new grid-connected renewable power plant at a site where no renewable power plant was operated prior to the implementation of the project activity. The project does not involve any retrofits and replacements of an existing renewable energy power plant (option b). It does not involve a capacity addition to an existing renewable energy power plant (option c). Therefore option (a), "greenfield renewable energy power plants", is applicable.

For greenfield plants, the ACM0002 methodology prescribes the following equation to be used to calculate baseline emissions:

Equation B. 6

$$EG_{PJ,y} = EG_{facility,y}$$

where:

$EG_{PJ.,y}$	=	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year *y* (MWh)
$EG_{facility, y}$	=	Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y* (MWh)

<u>Project emissions</u>
According to the methodology, project emissions are accounted for using the following equation:

Equation B. 7

$$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y}$$

where:

PE_y	=	Project emissions in year *y* (tCO_2e)
$PE_{FF,y}$	=	Project emissions from fossil fuel consumption in year *y* (tCO_2)
$PE_{GP,y}$	=	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO_2e)
$PE_{HP,y}$	=	Project emissions from water reservoirs of hydropower plants in year *y* (tCO_2e)

The methodology provides procedures to calculate the project emissions from the following sources:

- fossil fuel combustion;
- emissions of non-condensable gases from the operation of geothermal power plants; and
- emissions from water reservoirs of hydropower plants.

The third source, emissions from water reservoirs of hydropower plants, applies to the proposed project activity since it is a hydropower plant. The first source, fossil fuel combustion, applies to the proposed project since it uses diesel generators as emergency backup power source. The second source involves geothermal power plants. The proposed project activity does not utilize geothermal power. Therefore, the second source does not apply.

Emissions from water reservoirs of hydropower plants ($PE_{HP,y}$)
According to the methodology, for hydropower project activities that result in new reservoirs and hydropower project activities that result in the increase of existing reservoirs, project proponents shall account for CH_4 and CO_2 emissions from the reservoirs when the power density of the project activity (*PD)* is greater than 4 W/m^2 and less than or equal to 10 W/m^2. In the event that the power density of the project activity is greater than 10 W/m^2, the project emissions are equal to zero.

The proposed project activity involves a new reservoir, so it must be determined whether project emissions are taken into account. This is based on the power density.

The power density is calculated as follows:

Equation B. 8

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

where:

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

In the case of the proposed project activity:

- Installed power generation capacity (Cap_{PJ}) = 37,000,000 Watts
- Installed capacity before the implemen'ation of the project activity (Cap_{BL}) = 0 (since the proposed project activity is a new plant)
- Surface area of the reservoir after the implementation of the project activity (A_{PJ}) = 180,000 m^2
- Surface area of the reservoir before the implementation of the project activity (A_{BL}) = 0 (since the reservoir for the proposed project activity is new).

$$PD = \frac{37{,}000{,}000 watts - 0}{180{,}000 m^2 - 0}$$

PD = 205.56 W/m^2

We conclude that at 205.56 W/m^2, the project has a power density that is significantly above the 10 W/m^2 threshold. Therefore, project emissions from the reservoir can be ignored.

Emissions from fuel consumption ($PE_{FF,y}$)

The project will install three on-site diesel generators at dam site, intake gate and powerhouse with total capacity of 350 kW which will be maintained for emergency purpose in case the power line which sends the power from the grid is cut off. Once the emissions of the diesel generators are less than 1% of total emission reductions and are considered negligible. In case of the proposed project, the emission reduction of 1% is 737.57 tonnes. For the emission factor of the diesel generators, we refer to the AMS-I.F (version 01) methodology which provides emission factors for diesel generator systems. We apply the highest value listed in the methodology which is 2.4 kgCO_2e/kWh (generator below 15kW), which is conservative considering the generator used on-site of 100kW. If emissions of diesel generators are 737.57 tonnes, the power of 307,319 kWh is generated. In this case, the diesel generator of installed capacity 350 kW should be operated at least 878 hours annually. It is not possible to happen at all as the diesel generators is only operated in case of cut-off or emergency. Thus, the GHG emission caused by the diesel generators will not contribute more than 1% of the overall expected average annual emission reductions. The emissions of the diesel generator are therefore neglected.

Leakage

As per ACM0002, no leakage emissions are considered. The main emissions potentially giving rise to leakage in the context of electric sector projects are emissions arising due to activities such as power plant construction and upstream emissions from fossil fuel use (e.g. extraction, processing, transport).These emissions sources are neglected.

Calculation of emission reductions

Emission reductions are calculated in accordance with the ACM0002 methodology as follows:

$ER_y = BE_y - PE_y$

where:

ER_y	=	Emission reductions in year *y* (t CO_2e)
BE_y	=	Baseline emissions in year *y* (t CO_2)
PE_y	=	Project emissions in year *y* (t CO_2e)

To summarize:

$BE_y = EG_{PJ,y} \bullet EF_{grid, CM,,y}$

where:

BE_y	=	Baseline emissions in year *y* (tCO_2)
$EG_{PJ,y}$	=	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year *y* (MWh)
$EF_{grid, CM,,y}$	=	Combined margin CO_2 emission factor for grid connected power generation in year *y* calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (tCO_2/MWh)

and

$EG_{PJ,y} = EG_{facility,y}$

where

$EG_{PJ,y}$	=	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year *y* (MWh)
$EG_{facility, y}$	=	Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y* (MWh)

The quantity of net electricity generation fed into the grid by the project activity ($EG_{facility, y}$) is 134,962 MWh. Therefore, $EG_{PJ.,y}$ = 134,962 MWh.

$BE_y = EG_{PJ,y} \bullet EF_{grid, CM,,y}$

BE_y=134,962 MWh • 0.5465

BE_y= 73,757 tCO_2

As concluded above, project emissions (PE_y) are zero and therefore emission reductions can be calculated as follows:

$$ER_y = BE_y - PE_y$$

ER_y= 73,757 tCO_2 – 0

Emission reductions = 73,757 tCO_2

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

Data / Parameter:	**$EF_{CM,grid,y}$**
Data unit:	tCO_2e/MWh
Description:	Combined Margin Grid Emission Factor
Source of data used:	Calculated ex-ante based on the OM emission factor and BM emissions factor.
Value applied:	0.5465
Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculated ex-ante based on the OM emission factor and BM emissions factor. See Annex 3 for details of calculation.
Any comment:	-

Data / Parameter:	**$EF_{grid,OMsimple,y}$**
Data unit:	tCO_2/MWh
Description:	Simple Operating Margin CO_2 Emission Factor in year *y*
Source of data:	Calculated ex-ante (See Annex 3 for details of calculation.)
Value applied:	**0.6125**
Justification of the choice of data or description of measurement methods and procedures actually applied:	Calculated ex-ante (See Annex 3 for details of calculation.).
Any comment:	-

Data / Parameter:	**$EG_{m,y}$**
Data unit:	GWh
Description:	Net electricity generated and delivered to the grid by power unit *m* in year *y*.
Source of data used:	The Vietnamese DNA Grid Emission Factor calculation issued on 26/03/2010
Value applied:	For detailed values, see Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	This data is the best data available and has been provided by the Vietnamese DNA.
Any comment:	-

Data / Parameter:	**$EF_{CO2,i,y}$**
Data unit:	tCO_2/GJ
Description:	CO_2 emission factor of fossil fuel type *i*used in power unit *m* in year *y*.

Source of data:	Data used are IPCC default values at the lower limit of the uncertainty at a 95% confidence interval. See 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Chapter 1, Volume 2 (Energy), Table 1.4.
Value applied:	For detailed values, see Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied:	This data is the best data available as no reliable regional or national emission factor data or values provided by the fuel supplier could be obtained.
Any comment:	-

Data / Parameter:	$\mathbf{EF_{grid,BM,y}}$
Data unit:	tCO_2e/MWh
Description:	Build Margin Grid Emission Factor
Source of data:	Calculated ex-ante (See Annex 3 for details of calculation.)
Value applied:	**0.4715**
Justification of the choice of data or description of measurement methods and procedures actually applied:	Calculated ex-ante (See Annex 3 for details of calculation.).
Any comment:	-

Data / Parameter:	$\mathbf{Cap_{BL}}$
Data unit:	W
Description:	Installed capacity of the hydropower plant before the implementation of the project activity. For new hydropower plants the value is zero.
Source of data:	Project site
Value applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied:	The proposed CDM project activity involves a new hydropower station and hence Cap_{BL} is zero.
Any comment:	-

Data / Parameter:	$\mathbf{A_{BL}}$
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:	Project site
Value applied	0
Justification of the	A_{BL} is determined ex-ante; the size of the reservoir before implementation of

choice of data or description of measurement methods and procedures actually applied:	the project cannot be monitored after implementation of the project activity.
Any comment:	-

Data / Parameter:	$NCV_{diesel,y}$
Data unit:	kg/GJ
Description:	The net calorific value (energy content) of diesel in year y
Source of data:	IPCC default value
Value applied	20.2
Justification of the choice of data or description of measurement methods and procedures actually applied:	See Annex 3
Any comment:	For calculation of $PE_{FF,\ y}$

Data / Parameter:	$EF_{CO2,diesel,y}$
Data unit:	$kgCO_2/TJ$
Description:	CO_2 emission factor of diesel in year y
Source of data:	IPCC default value
Value applied	74,800
Justification of the choice of data or description of measurement methods and procedures actually applied:	See Annex 3
Any comment:	For calculation of $PE_{FF,\ y}$

B.6.3. Ex-ante calculation of emission reductions:

The annual net power supply from the project activity to the National Power Grid is estimated to be 134,962 MWh.

Application of the equations presented in Section B to the baseline data presented in Section B.6.1 yields the following results:

EF_{OM} = 0.6125 tCO_2/MWh
EF_{BM} = 0.4715 tCO_2/MWh
EF_y = 0.5×0.6125+ 0.5×0.4715 = 0.5465 tCO_2/MWh

By multiplying the emission factor with the annual power supply we calculate annual baseline emissions BE_y to be 73,757 tCO_2 as follow:
BE_y = 0.5465 tCO_2/MWh × 134,962 MWh = 73,757 tCO_2

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

TABLE B. 12 provides the annual emission reductions in tabular form.

Table B. 12 Annual emission reductions

Year	Estimation of project activity emissions (tonnes of CO_2 e)	Estimation of baseline emissions (tonnes of CO_2 e)	Estimation of leakage (tonnes of CO_2 e)	Estimation of overall emission reductions (tonnes of CO_2 e)
Year 1: 01/08/2012 – 31/07/2013	0	73,757	0	73,757
Year 2: 01/08/2013 – 31/07/2014	0	73,757	0	73,757
Year 3: 01/08/2014 – 31/07/2015	0	73,757	0	73,757
Year 4: 01/08/2015 – 31/07/2016	0	73,757	0	73,757
Year 5: 01/08/2016 – 31/07/2017	0	73,757	0	73,757
Year 6: 01/08/2017 – 31/07/2018	0	73,757	0	73,757
Year 7: 01/08/2018 – 31/07/2019	0	73,757	0	73,757
Total (tonnes of CO_2 e)	**0**	**516,296**	**0**	**516,296**

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

B.7.1 Data and parameters monitored:

Data / Parameter:	**$EG_{facility,y}$**
Data unit:	MWh/yr
Description:	Quantity of net electricity generation supplied by the project plant to the grid in year *y*.
Source of data to be used:	Directly measured at the grid connection point
Value of data applied for the purpose of calculating expected emission reductions in section B.5	134,962
Description of measurement methods and procedures to be applied:	The net supply of power to the grid by the proposed project activity is measured through national standard electricity metering instruments. The measurement of electricity will be in accordance with the following standard *"02/2007/QD-BCN (Ministry of Industry) standard IEC 62053-22"*. The net amount of power supplied to the grid by the project will be continuously measured and recorded monthly.
QA/QC procedures to	Electricity metering instruments should be in compliance with national

be applied:	standard. The metering instruments will be calibrated annually. The records of the grid company (evidenced by sales records) will be archived.
Any comment:	See also Section B.7.2 for more details

Data / Parameter:	**$EG_{export,y}$**
Data unit:	MWh/yr
Description:	Electricity exported to the grid by the project plant/unit in year *y*
Source of data to be used:	Directly measured at the grid connection point
Value of data applied for the purpose of calculating expected emission reductions in section B.5	134,962
Description of measurement methods and procedures to be applied:	The net supply of power to the grid by the proposed project activity is measured through national standard electricity metering instruments.
QA/QC procedures to be applied:	Electricity metering instruments should be complied with national and industry standards. The metering instruments will be calibrated at least once every two years.
Any comment:	

Data / Parameter:	**$EG_{import,y}$**
Data unit:	MWh/yr
Description:	Electricity imported from the grid by the proposed project in year y (in case of backup)
Source of data to be used:	Data for ex ante calculation is assumed as zero. Data will be obtained from on-site measurement.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0
Description of measurement methods and procedures to be applied:	The imported electricity will be continuously measured by the separate meter(s) of the grid company. Data will be monthly recorded and receipts will be archived.
QA/QC procedures to be applied:	Meter(s) will be calibrated periodically based on the relevant national and industrial standards.
Any comment:	

Data / Parameter:	**Cap_{pj}**
Data unit:	W
Description:	Installed capacity of the hydro power plant after implementation of the project activity.

Source of data to be used:	Measured at the project site
Value of data applied for the purpose of calculating expected emission reductions in section B.5	37,000,000
Description of measurement methods and procedures to be applied:	The installed capacity of the proposed project is measured annually in accordance with recognized national and international standards. Technical documents from genset supplier will be available for double check.
QA/QC procedures to be applied:	This will be monitored annually.
Any comment:	-

Data / Parameter:	$\mathbf{A_{PJ}}$
Data unit:	m^2
Description:	Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full.
Source of data to be used:	Measured at the project site
Value of data applied for the purpose of calculating expected emission reductions in section B.5	180,000
Description of measurement methods and procedures to be applied:	The level of the water reservoir will be measured after which the surface area of the reservoir will be calculated using the design schematics and area maps, when the project becomes operational to check whether the actual reservoir does not deviate substantially from the design.
QA/QC procedures to be applied:	Refer Annex 4
Any comment:	-

B.7.2. Description of the monitoring plan:

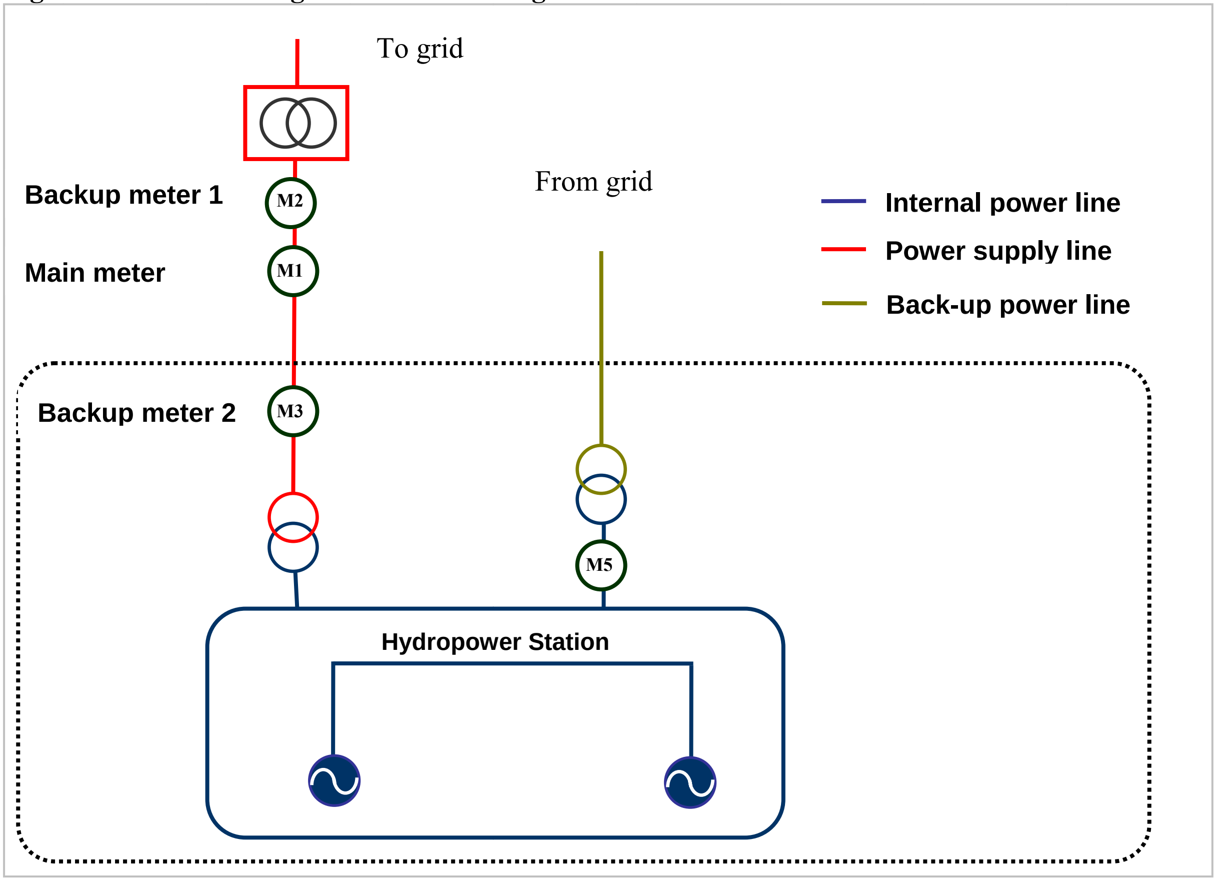
This monitoring plan outlines the principles which shall be followed in the monitoring of the parameters listed in section B.7.1.

Monitoring of net electricity supplied by the project to the grid

The proposed project activity will be connected to the National Power Grid via a single circuit 110 kV transmission line to EVN's Dien Khanh 110 kV transformer station. The main power supply for the project's own use will be from two transformers with an individual capacity of 400 kVA. One of the transformers will be connected to two generators equipped with automatic transfer switches. The other transformer will be connected to a 35 kV busbar on each of the turbine/generator units.

An indicative grid connection diagram is provided in Figure B. 3. The solid lines indicate connection lines that are currently intended. The grid connection diagram indicates the principles for positioning of metering instruments that will be used in the monitoring of emission reductions. A separate detailed grid connection diagram will be prepared which is updated on the basis of the actual implementation of the project's grid connection and which will serve as the basis for periodic verification.

Figure B. 3 Indicative grid connection diagram



The project entity will meter electric power according to the following principles:

- **Power supplied to the grid through main power lines** **($EG_{export,y}$):**
  As indicated in Figure B. 3, the project is connected to grid by one main power supply line (indicated in red), which will deliver power generated by the project to the grid. Net power supplied to the grid is metered as below:
  - Project entity: The power supplied to the grid is metered by the project entity at a point after power has been transformed to high voltage at an on-site booster station. Therefore, no further transformer losses will occur before the project is connected to the grid. The power supply of the project to the grid will be metered with standard electricity meters in accordance with national regulations. The metering instruments may record either a net figure of power delivered to the grid or two readings, i.e. power delivered to the grid and power received from the grid.
  - Grid company: The grid company, EVN, will meter the power supply at a point before the power connected to the Dien Khanh 110 kV transformer station with its own metering equipment.

- Calibration: Calibrations are carried out at least once every two years by the grid company or by a certified company. If there are any substantial discrepancies between the readings of the metering instruments throughout the year, both instruments will be recalibrated.

- **Power received through back-up power lines ($EG_{import,y}$):**
  As indicated in Figure B. 3 the project is connected by one back-up emergency power lines (indicated in brown) which will deliver power from the grid to the project in case of emergencies or when the turbines of the proposed project activity are not in operation. Net power received from the grid is metered as below:
  - Metering:
    The power supplied to the project will be metered at the project site with standard meters.
  - Calibration:
    Calibrations are carried out by the grid company or by a certified company.

- **Determination of net power supply to grid ($EG_{facility,y}$):**
  Net electricity supplied to the grid by the project ($EG_{facility,y}$ in section B.7.1.) is calculated on a monthly basis as:

$$EG_{facility,y} = EG_{export,y} - EG_{import,y}$$

Installed capacity of the hydropower plant (Cap_{PJ}):
In addition to the above, the installed capacity of the hydropower plant will be monitored yearly. The project entity will annually prepare photographic evidence of the installed equipment on the basis of the nameplates, which will be in accordance with domestic and international standards.

Surface area of the reservoir(A_{PJ}):
The level of the water reservoir will be measured after which the surface area of the reservoir after the implementation of the project activity will be calculated annually using the design schematics and area maps, to check whether the actual reservoir does not deviate substantially for the design.

The project entity will collect internal records, sales receipts for power supplied to the grid and billing receipts for power received from the grid as evidence. The net supply (i.e. gross supply minus supply by the grid to the project) will be used in the calculations of emission reductions. In case of discrepancies between the readings of the grid company and the project entity, the readings of the grid company will prevail. All records of generation, power delivered to the grid, sales receipts and the results of calibration will be collected in a central place by the project entity.

Reporting, archiving and preparation for periodic verification
The project entity will in principle report the monitoring data annually but may deviate to report at intervals corresponding to agreed verification periods and will ensure that these intervals are in accordance with CDM requirements. The project entity will ensure that all required documentation is made available to the verifier. Data record will be archived for a period of 2 years after the crediting period to which the records pertain.

PROCEDURES IN CASE OF DAMAGED METERING EQUIPMENT / EMERGENCIES

Damage to metering equipment

In case metering equipment is damaged and no reliable readings can be recorded the project entity will estimate net supply by the proposed project activity according to the following procedure:

1. **In case the main meter operated by the grid company is damaged only:**
   The metering data logged by the backup meter of the grid company will be used as record of net power supplied to the grid for the days for which no record could be recorded.
2. **In case both metering equipment operated by the grid company are damaged:**
   The metering data logged by the backup meter located at the project plant will be used as record of net power supplied to the grid for the days for which no record could be recorded.
3. **In case all metering equipment operated by the grid company and the project entity are damaged:**
   The project entity and the grid company will jointly calculate a conservative estimate of power supplied to the grid. A statement will be prepared indicating:
   ► the background to the damage to the metering equipment;
   ► the assumptions used to estimate net supply to the grid for the days for which no record could be recorded; and,
   ► the estimation of power supplied to the grid. The statement will be signed by both a representative of the project entity as well as a representative of the grid company.

The project entity will furthermore document all efforts taken to restore normal monitoring procedures.

Emergencies
In case of emergencies, the project entity will not claim emission reductions due to the project activity for the duration of the emergency. The project entity will follow the below procedure for declaring the emergency period to be over:

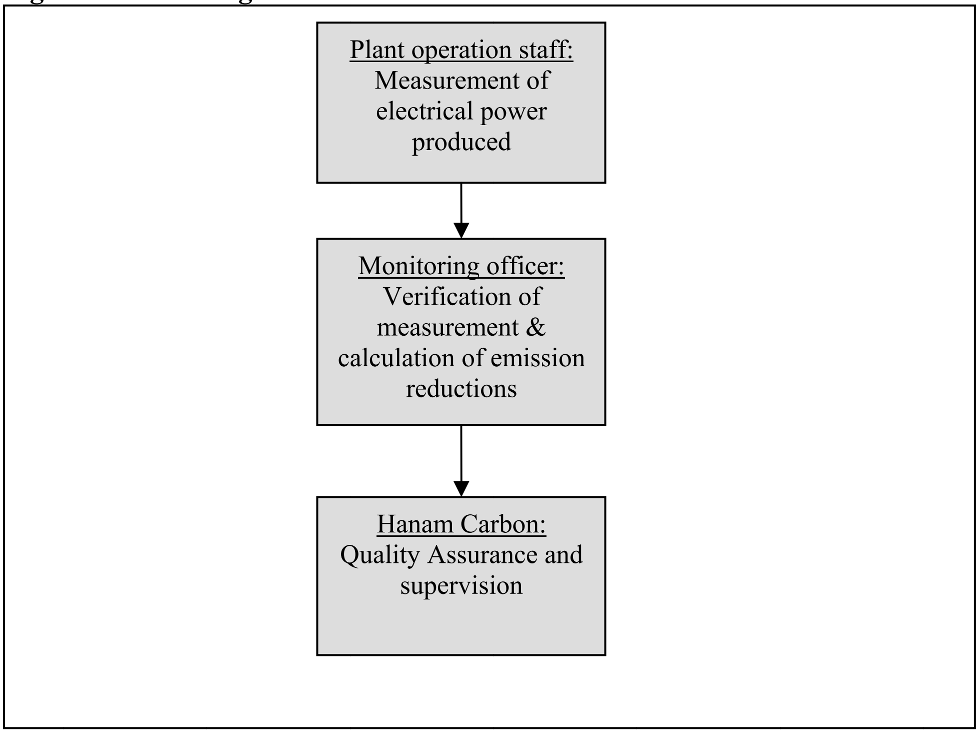
1. The project entity will ensure that all requirements for monitoring of emission reductions have been re-established.
2. The monitoring officer and the head of operations of the hydropower station will both sign a statement declaring the emergency situation to have ended and normal operations to have resumed.

Operational and management structure for monitoring

The monitoring of the emission reductions will be carried out according to the scheme shown in Figure B. 4. The project entity will engage its CDM advisor, Hanam Carbon, to assure that all monitoring requirements are met. Within the project entity, a monitoring officer is appointed who will carry the day-to-day supervision responsibility. The first step is the measurement of the electrical energy supplied to the grid and reporting of daily operations, which will be carried out by the plant operation staff.

The monitoring officer who will be responsible for verification of the measurement, collection of sales receipts, collection of billing receipts of the power supplied by the grid to the hydropower plant and the calculation of the emissions reductions. The monitoring officer will prepare operational reports of the project activity, recording the daily operation of the hydropower station including operating periods, power delivered to the grid, equipment defects, etc. The selection procedure, tasks and responsibilities of the monitoring officer are described in detail in Annex 4. Finally, the monitoring reports will be reviewed by Hanam Carbon.

Figure B. 4. Management structure in order to monitor emission reductions



Training

Training sessions for the operation and maintenance staff of the project were held from June 2008 through November 2009 at the Central Electricity College, in Hoi An City, Quang Nam Province. Upon graduation, students received a "Certificate in Hydropower Plant Operation". When the project comes into operation, the monitoring officer will be trained for accurate implementation of the monitoring plan.

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

Date of completion of the baseline study and monitoring methodology: 01/12/2011

Name of persons determining the baseline study and the monitoring methodology:

Hanam Carbon / Caspervandertak Consulting Viet Nam
Mr. Thai Tran thaitran@hanamcarbon.com
Mr. Hung Vu hungvu@hanamcarbon.com

Hanam Carbon / Caspervandertak Consulting Viet Nam is not a project participant.

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:

04/04/2008
After board meeting on final design (37MW), this date is the earliest date to start the real action of project activity, when the project owner signed the construction contract.

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

40 years 00 months

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

C.2.1. Renewable crediting period:

A 3 x 7 years renewable crediting period has been selected

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

01/08/2012 (or date of completion of submission for registration, whichever is later)

C.2.1.2. Length of the first crediting period:

7 years

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

Not applicable; a renewable crediting period will be applied.

C.2.2.2. Length:

Not applicable; a renewable crediting period will be applied.

SECTION D. Environmental impacts

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

The project entity drafted a document called “Application for meeting environmental standards”, a brief environment impact assessment report (the “EIA”) in 02/2005 and submitted to the Department of Natural Resources and Environment on 6/05/2005. The document was approved by the provincial Department of Natural Resources and Environment on 10/05/2005.

Summary of Environmental Impacts

<u>Impact on the water environment</u>
The main impacts on the water environment during construction include waste water from workers, construction, and machine-cleaning. Rain water will also wash waste material from construction site to the river. During water storage and operation of the facility, the water flow within the reservoir and between the dam and discharge channel of the Giang River will be changed in the following ways:

- The water level will fluctuate between 410 meters to 415 meters, and can possibly reach 420.86 meters if there is a flood.
- Changes in the water conditions from a running stream to more still water will create deposits of sand and mud in the reservoir.However, the Giang River’s water is clean, and vegetation is healthy. Overall, the amount of sand and mud deposited in the reservoir will not be large.
- The water level between the dam and discharge channel (which measures 7.5 kilometers) will be lower than before implementation of the project. The main water sources for this area are small streams such as the Lanh, Ca Me, and Ca Con streams. However, area is located in forest land, and there are no people living along the banks. Moreover, no people use this water. Therefore, there will be no impact on the living conditions of any residents.
- The quality of the water will change. Flooded area of 3.52 ha comprises of river, small areas of rocks and slopes along this part of the river. Flooded vegetation is mainly bushes and small trees. The reservoir area will be cleaned up before water storage; quality of water will be changed after joining the reservoir.
- After a certain period, the reservoir will become stable, and humidity around the area will increase. As a result, vegetation will grow and animals will come to live there. The ecosystem around the reservoir will gradually become more diverse.

<u>Impact on the air environment</u>
During construction, waste gases, smoke, dust and noise will emanate into the air. However, there are no residents living within the project area. During operation, the reservoir will have a positive impact on the climate conditions within the area. Humidity will be increase and the temperature around the reservoir area will become cooler. The range in temperature will narrow. However, the reservoir small, and these impacts will be minor.

Impact on vegetation

3.52 hectares of forest land and river will be flooded (where 2.68 ha is natural forest (76.14%), 0.84 ha is river, rock (23.86%). 2 hectares of natural forest land will be taken for the construction of the power house and discharge channel.42.1ha of natural forest land will be taken for construction of the penstock and water diversion channel. The penstock will be underground, so its negative impacts to the forest are minor.26.76hectares of forest land will be taken for construction of the management house, road within construction site, and disposal site. An access road will be built based on a pre-existing small road; the construction will also impact on some forest areas. Overall, the forest affected by the reservoir and water diversion system has a low wood reserve. Thus, the damage to vegetation will be minor. After a certain period, the reservoir will become stable, and humidity will rise, allowing for vegetation to grow.

Impact on animals

There are no big or rare animals living in the project area, but small animals, like forest pigs and monkeys are occasionally found. During construction, small animals will migrate to forests of higher altitude. During water storage, some small insects and reptiles will be killed. The project's reservoir is small.There are many whirlpools and rocks in the reservoir area, and fishand other aquatic creatures can live there. Moreover, the streams joining the Giang River are small and on high slopes. Overall, the project will have a minor impact on aquatic animals. As the reservoir becomes more stable, the increased humidity around it will cause more vegetation and animals to live there.

Impact on ecological appearance

During construction, activities such as chopping down trees and digging will change the ecological appearance of the project area. However, this will happen during the construction period only and within a small area.

Impact on land use

- 2.68 ha of forest landwill be flooded after water storage
- 44.1 ha of forest land will be used for other purposes
- 26.76 ha of forest land will be taken for temporary usage.

Impacts on socio-economic conditions in the area

The project will not have an effect on residents since none live in the area. A large number of people will stay at the project site during the construction period, and it is possible that they will deforest and hunt animals if the management is not good. The project will also generate jobs during construction. During operation, the power supply to Khanh Vinh and Dien Khanh districts will be more stable. This will facilitate the construction of infrastructure and encourage industrialization and modernization in the area.

Mitigation measures

Construction period

- Waste water will be collected in a digestion tank before being discharged to the environment.
- A water sprayer will be used to reduce dust in the air along roads in project site.
- Trucks transporting materials will be covered by canvas.
- Noises and vibrations will be strictly monitored strictly.Components will be constructed as soon as possible.

- Posters propagating against deforestation and hunting will be placed along the road to project site and places of high potential.
- Workers will be educated on safety, forest fire prevention and forest and environmental protectionthrough posters.
- Solid wastes will be collected and treated during construction. Solid wastes will be sent to a disposal site and will be used as much as possible for construction, avalanche prevention, erosion prevention, and levelling after construction.
- 158.5 ha of land for the project's construction will be checked for bombs, dynamite and toxic chemical to assure safety and protect the environment.
- Workers at the project site will be trained on labor safety and be well equipped.
- Drugs will be reserved to make sure there are sufficient supplies for the control of common diseases such as digestion problems, fever, malaria, etc.

Operation period

- All domestic waste water generated by staff will be collected in a digestion tank before discharged to the environment.
- Trees will be planted around the facility.

Compensation

The proposed project activity will occupy a certain amount of farmland. However, the land before the project's construction was illegally used as farmland by some members of the local population (i.e. it was not designated as agricultural land). However, the project owner has compensated the local farmers in accordance with the compensation standards that apply to regular farmland and . The total compensation amount was 748,062,376 VND[27]. The project does not lead to the occupation of any residential land.

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:

The environmental impacts of the project are not considered significant by the Vietnamese government and the project participants. The Application for meeting environmental standards/EIA was approved by the Department of Natural Resources and Environment on 10/05/2005.

[27] See compensation approvals

SECTION E. Stakeholders' comments

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

A meeting was held on 25/10/2006 to discuss the project's impact on stakeholders. The attendants of the stakeholder consultation meeting are listed in an attachment available to the validator. A report of the main comments and outcomes of the meeting is provided in section E.2. A complete list of all attendees of the meeting is listed below.

Representatives of Khanh Trung Commune's people and administration

1. Mr. Cao XuanQuang – President of the commune
2. Mr. Nguyen Ngoc Huong – Vice-president of the commune
3. Mr. Cao Ty Den – Secretary of the commune
4. Mr. Cao Xuan Thuy – Deputy secretary of the commune

Representatives of the project owner

1. Mr.DinhXuan Hai Sang – Director
2. Mr. Tran Van Nghia –Manager of Finance - Accounting Department
3. Ms. Tran Thi Thanh Hai – Manager of General Department

E.2. Summary of the comments received:

Comments and opinions received at stakeholder consultation meeting:

Socioeconomic influences of the project

- Since there are no residential areas in the project location, the project will have no direct impact to residents.
- There will be an improvement in the cultural life, education, and intellectual standards of the commune's residents.
- The project will create jobs for local people.
- The project will create a model for local infrastructure, thus facilitating industrialization and modernization.
- The surge in workers building the project may lead to negative actions, such as hunting wild animals, stealing, and social evils, if management is poor.

Environmental influences

- The project will have very limited influence on the local climate.
- Following water storage, the reservoir's hydrogeological system will be stable. Also, humidity will improve and become stable. As a result, botanical systems that favour humidity will improve and create good conditions for animals living near the reservoir.
- The project can improve the area's biodiversity, and create a scenic landscape which could develop eco-tourism.
- During construction, there will be increased amounts of waste water from the workers, and construction machines.
- The water quality may change.
- During construction, there will be increased exhaust emissions, smoke, dust, and noise.

- The project will cause 2.68 ha of forest land to be sunk.

Overall, the representatives of the Commune supported the construction of the facility.

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

Given the generally positive or neutralnature of the comments received, no action will been taken to solve the comments received.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

The project entity

Organization:	Song Giang Hydropower Joint Stock Company
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State/Region:	Khanh Hoa province
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Telephone:	
FAX:	+84-58-3 512 473
E-Mail:	
URL:	
Represented by:	Dinh Xuan Hai Sang
Title:	Managing Director
Salutation:	Mr.
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Middle name:	
First name:	Sang
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The purchasing party

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E-Mail:	
URL:	
Represented by:	David Fransen
Title:	Managing Director
Salutation:	Mr.
Last name:	Fransen
Middle name:	
First name:	David

Department:	
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

The Project does not receive any public funding.

Annex 3

BASELINE INFORMATION

Below is the data and detailed calculation of the baseline emission factor.

IPCC Default Values:

Annex Table 1. IPCC default values

Type of Fuel	Carbon content (kg/GJ)			NET CALORIFIC VALUES (NCV) (TJ/Gg)			Effective CO_2 emission factor (kg/TJ)		
	Default value	95% confidence interval		Default Value	95% confidence interval		Default Value	95% confidence interval	
		Lower	Upper		Lower	Upper		Lower	Upper
Coal (Anthracite)	26.8	25.8	27.5	26.70	21.60	32.20	98,300	94,600	101,000
Other Bituminous Coal	25.8	24.4	27.2	25.80	19.90	30.50	94,600	89,500	99,700
Tail Gas	-			-	-	-	-	-	-
Gas/Diesel Oil	20.2	19.9	20.4	43.00	41.40	43.30	74,100	72,600	74,800
Residual Fuel Oil	21.1	20.6	21.5	40.40	39.80	41.70	77,400	75,500	78,800
Natural Gas	15.3	14.8	15.9	48.00	46.50	50.40	56,100	54,300	58,300

Source: IPCC, Volume 2: Energy, Chapter 1

Low Cost / Must Run Ration:

Annex Table 2. Low cost / must run ratio

Generation source	2004	2005	2006	2007	2008	5-year average
Hydropower (MWh)	17,858,651	16,365,438	19,508,244	22,385,232	25,933,762	102,051,327
Total grid (MWh)	44,974,169	50,330,468	57,160,493	66,348,589	74,689,636	293,503,355

Low-cost/Must-run ratio	39.71%	32.52%	34.13%	33.74%	34.72%	34.77%

Source: Grid emission factor calculation issued by the Vietnamese DNA on 26/03/2010.

Calculation of Operating Margin Emission Factor:

Annex Table 3. Electricity supply and emission of group plants

Group plants	Fuel consumption	Electricity supplied to grid	Type of fuel	Net calorific value (NCV)	Effective CO_2 emission factor	Amount of CO_2 emission
	Coal, Oil : kton Gas: 10^3 m^3	MWh		TJ/Gg	kg/TJ	t CO_2
Year 2006						
Coal power plant	5,645.86	8,989,230	Coal (Anthracite)	21.60	94,600	11,536,524
Gas Turbine		26,542,978				0
Gas Turbine powered by gas	*5,743,235.28*	*18,838,764*	Natural Gas	46.50	54,300	11,601,106
Gas Turbine powered by oil	*70.14*	*233,582*	Gas/Diesel Oil	41.40	72,600	210,816
Tail gas	*0*	*7,470,632*	Tail Gas	-		0
Oil thermal power plant	397.65	1,043,991	Residual Fuel Oil	39.80	75,500	1,194,898
Diesel using FO	16.6	80,000	Residual Fuel Oil	39.80	75,500	49,881
Diesel using DO	6.39	25,000	Gas/Diesel Oil	41.40	72,600	19,206
Imported		937,000				
Total		**37,618,199**				**24,612,431**
Year 2007						
Coal power plant	6,386.09	9,836,548	Coal (Anthracite)	21.60	94,600	13,049,081
Gas Turbine		29,474,918				0
Gas Turbine powered by gas	*5,910,941.84*	*20,023,591*	Natural Gas	46.50	54,300	11,939,866
Gas Turbine powered by oil	*163.27*	*557,880*	Gas/Diesel Oil	41.40	72,600	490,731
Tail gas	*0*	*8,893,447*	Tail Gas	-		0

Oil thermal power plant	614.06	1,834,409	Residual Fuel Oil	39.80	75,500	1,845,189
Diesel using FO	25.15	104,626	Residual Fuel Oil	39.80	75,500	75,573
Diesel using DO	9.16	42,000	Gas/Diesel Oil	41.40	72,600	27,532
Imported		2,629,000				
Total		**43,921,501**				**27,427,972**
Year 2008						
Coal power plant	6,483.99	10,055,394	Coal (Anthracite)	21.60	94,600	13,249,126
Gas Turbine		33,857,135				0
Gas Turbine powered by gas	*6,839,114.84*	*22,396,231*	Natural Gas	46.50	54,300	13,814,738
Gas Turbine powered by oil	*54.35*	*183,088*	Gas/Diesel Oil	41.40	72,600	163,357
Tail gas	*0*	*11,277,816*	Tail Gas	-		0
Oil thermal power plant	534.59	1,481,880	Residual Fuel Oil	39.80	75,500	1,606,389
Diesel using FO	22.48	90,465	Residual Fuel Oil	39.80	75,500	67,550
Diesel using DO	3.73	15,000	Gas/Diesel Oil	41.40	72,600	11,211
Imported		3,220,000				
Total		**48,719,874**				**28,912,371**

Data source: Grid emission factor calculation issued by Vietnamese DNA on 26/03/2010

Annex Table 4. Calculation of Operating Margin Emission Factor

Year	**Total electricity supplied to grid**	**CO2 emission**	**Weighted average OM emission factor**
	(MWh)	(tCO_2)	(tCO_2/MWh)
	A	B	ΣB/ΣA
2006	37,618,199	24,612,431	
2007	43,921,501	27,427,972	
2008	48,719,874	28,912,371	
Total	**130,259,574**	**80,952,774**	**0.6215**

<u>Calculation of Build Margin Emission Factor:</u>

Annex Table 5. Calculation of 20% of domestic electricity generation of Vietnam National Grid in 2008

Generation source	Value
Total grid generation in 2008 (MWh)	**74,689,636.00**
20% of grid generation in 2008 (MWh)	**14,937,927.20**

Annex Table 6. Calculation of electricity supply and emission of $SET_{5\text{-units}}$ and $AEG_{SET\text{-}\geq 20\%}$)

Plant	Commissioning year	Electricity supply to grid (MWh)	Type of fuel	Fuel consumption	Net calorific value	Emission factor of fuel	Amount of emission
				Coal, DO, FO: kton; Gas: 10^6 m^3	TJ/Gg	kg/TJ	t CO_2
Five power units started to supply electricity to the grid most recently ($SET_{5\text{-units}}$)							
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	Natural Gas	166.38	46.50	54,300	336,081
Cà Mau 1&2	2007	2,106,807.24	Natural Gas	647.24	46.50	54,300	1,307,399
		2,728,872.00	Tail Gas				0
Annual electricity generation of $SET_{5\text{-units}}$ ($AEG_{SET\text{-}5\text{-units}}$)		**7,829,812.02**					**1,643,480**
Power units started to supply electricity to the grid most recently and that comprise 20% of the project electricity system ($SET_{\geq 20\%}$)							
A Vương	2008	168,103.50	Hydropower				
Đại Ninh	2008	1,145,108.50	Hydropower				
Nhơn Trạch	2008	544,808.60	Natural Gas	166.38	46.50	54,300	336,081

Tuyên Quang	2008	1,136,112.18	Hydropower				
Cao Ngạn	2007	708,693.00	Coal (Anthracite)	526.00	21.60	94,600	1,074,807
Quảng Trị	2007	250,804.40	Hydropower				
Uông Bí extension	2007	532,000.00	Coal (Anthracite)	281.76	21.60	94,600	575,735
Cà Mau 1&2	2007	2,106,807.24	Natural Gas	647.24	46.50	54,300	1,307,399
		2,728,872.00	Tail Gas				0
CÁI LÂN - VINASHIN	2007	90,465.01	Residual Fuel Oil	22.48	39.80	75,500	67,550
SÊ SAN 3	2006	1,131,614.00	Hydropower				
SÊ SAN 3A	2006	394,895.70	Hydropower				
SROC Phu Mieng IDICO	2006	241,556.00	Hydropower				
Đạm Phú Mỹ	2006	4,716.00	Natural Gas	56.15	46.50	54,300	113,421
Na Dương	2005	627,930.00	Coal (Anthracite)	532.00	21.60	94,600	1,087,068
Formosa	2004	560,295.00	Other Bituminous Coal	495.00	19.90	89,500	881,620
Phú Mỹ 2.2*	2004	4,141,980.00	Natural Gas	1,159.75	46.50	54,300	2,342,649
Annual electricity generation of $SET_{\geq 20\%}$ ($AEG_{SET-\geq 20\%}$)		**16,514,761.13**					**7,786,329**

** Since 20% of Total domestic electricity generation of Vietnam national grid in 20008 falls on part of the generation of Phu My 2.2, the total generation of Phu My 2 .2 is fully included in the calculation.*

Data source: Grid emission factor calculation issued by Vietnamese DNA on 26/03/2010

Annex Table 7. Build Margin Emission Factor 2008

Emission factor	Value (tCO_2/MWh)	Weight	Weighted value (tCO_2/MWh)
A	*B*	*C*	*D = B*C*
EF_{BM}	0.4715	0.5	0.2357
EF_{OM}	0.6215	0.5	0.3107
EF_{CM}			**0.5465**

Calculation of Combined Margin Emission Factor 2008:

Annex Table 8. Build Margin Emission Factor 2008

Emission factor	Value (tCO_2/MWh)	Weight	Weighted value (tCO_2/MWh)
A	*B*	*C*	*D = B*C*
EF_{BM}	0.4715	0.5	0.2357
EF_{OM}	0.6215	0.5	0.3107
EF_{CM}			**0.5465**

Annex 4

MONITORING INFORMATION

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Selection procedure:

The monitoring officer will be appointed by the project entity's management. The monitoring officer will be selected from among the senior technical or managerial staff.

Tasks and responsibilities:

The monitoring officer will be responsible for carrying out the following tasks:

- **Supervise and verify metering and recording**
  Themonitoring officer will coordinate with the plant manager to ensure and verify adequate metering and recording of data, including power delivered to the grid.
- **Collection of additional data, sales / billing receipts**
  The monitoring officer will collect sales receipts for power delivered to the grid, billing receipts for power delivered by the grid to the hydropower station and additional data such as the daily operational reports of the hydropower station.
- **Calculation of emission reductions**
  The monitoring officer will calculate the annual emission reductions on the basis of net power supply to the grid. The monitoring officer will be provided with a calculation template in electronic form by the project's CDM advisors.
- **Preparation of monitoring report**
  The monitoring officer will annually prepare a monitoring report which will include, among other things, a summary of daily operations, metering values of power supplied to and received from the grid, copies of sales/billing receipts, a report on calibration and a calculation of emission reductions.

Support:

The monitoring officer will receive support from Hanam Carbon in his/her responsibilities through the following actions:

- Initial training on CDM, monitoring methodology, monitoring procedures and requirements and archiving;
- Provide the monitoring officer with a calculation template in electronic form for calculation of annual emission reductions;
- Continuous advice to the monitoring officer on a need basis; and
- Review of monitoring report.