Project design document form for CDM project activities

(Version 05.0)

Complete this form in accordance with the Attachment "Instructions for filling out the project design document form for CDM project activities" at the end of this form.

PROJECT DESIGN DOCUMENT (PDD)	
Title of the project activity	A Luoi Hydro Power Project
Version number of the PDD	1.6
Completion date of the PDD	01/01/2015
Project participant(s)	Central Hydropower Joint Stock Company; Vattenfall Energy Trading Netherlands N.V.
Host Party	Viet Nam
Sectoral scope and selected methodology(ies), and where applicable, selected standardized baseline(s)	**Sectoral scope** Scope 01: Energy industries (Renewable sources) **Selected methodology:** ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources", version 13.0.0
Estimated amount of annual average GHG emission reductions	389,763 t CO_2 e

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

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The A Luoi Hydro Power Project (hereinafter referred to “the project” or “the proposed project”) involves the construction of a newly established diversion type of hydro power project. The reservoir of the project is located on A Sap river while the powerhouse is located 600 meters away from Bo river in A Luoi district, Thua Thien Hue province, Viet Nam.

The project’s purpose is to generate electricity from a clean and renewable source (hydropower of the A Sap river) for the contribution to the sustainability of electricity generation to Viet Nam national electricity grid. By displacing fossil fuel-fired electricity generation with clean and renewable energy, the project leads to the reduction of CO_2 emission into the atmosphere. Total annual GHG emission reduction is estimated to be of 389,763 tCO_2e annually.

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 electricity 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, as the project is the construction of a new power plant.

Project scenario:
The project scenario falls within Sectoral Scope 1 - Energy Industries (hydropower generation). 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 electricity grid. The project is a diversion-type hydropower plant with a dam, intake, tunnel, penstock, power house, tailrace and a distribution station. A reservoir will be created with an area of 8,200,000 m^2 at full water level and a power density of 20.7 W/m^2. The project's installed capacity is 170 MW and the annual effective operation hours are 4,038 hours. Two Pelton turbine / generator units, 85 MW each, manufactured by a Consortium of two manufacturers, Dongfang Electric Corporation of People’s Democratic Republic of China and Voith Siemens Hydro Kraftwerktechnik GmbH & Co. KG (now known as Voith Hydro) of Germany, have been installed. The average annual gross power generation is estimated 686,500 MWh. After considering the power loss of the system, the estimated net power generation to the grid is 676,203 MWh, which will be supplied to the national electricity grid via the 220kV double-circuit transmission line and a 220 kV on site booster station. The Pelton technology will be transferred to O&M staffs of the proposed project’s plant. The O&M staffs of the projects were sent to the Central Electricity College, Da Nhim – Ham Thuan – Da Mi Hydropower Joint Stock Company and A Vuong Hydropower Joint Stock Company for general training on operation, maintenance and reparation of a hydropower plant. Before operation start of the project’s plant, technical experts from equipment suppliers will train the O&M staffs on operation and maintenance of the specific equipment of the project.

The project’s contributions to the sustainable development of the local area as well as the host country are as follows:

- 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 emissions of greenhouse gases to combat global climate change;
- Promotion of local economic development through the creation of transport infrastructure and employment;
- Removing of the environmental pollution and the unexploded shell caused by Viet Nam war; and

- Prevention of destruction to natural environment by facilitating farming of the minority races in the fixed farming area through the compensation work with the local government.

A.2. Location of project activity

A.2.1. Host Party

>>
Viet Nam

A.2.2. Region/State/Province etc.

>>
Thua Thien Hue province

A.2.3. City/Town/Community etc.

>>
Hong Ha commune, Phu Vinh commune, Hong Thuong commune, Hong Thai commune, Son Thuy commune, Hong Quang commune, Nham commune and Huong Phong commune in A Luoi district

A.2.4. Physical/Geographical location

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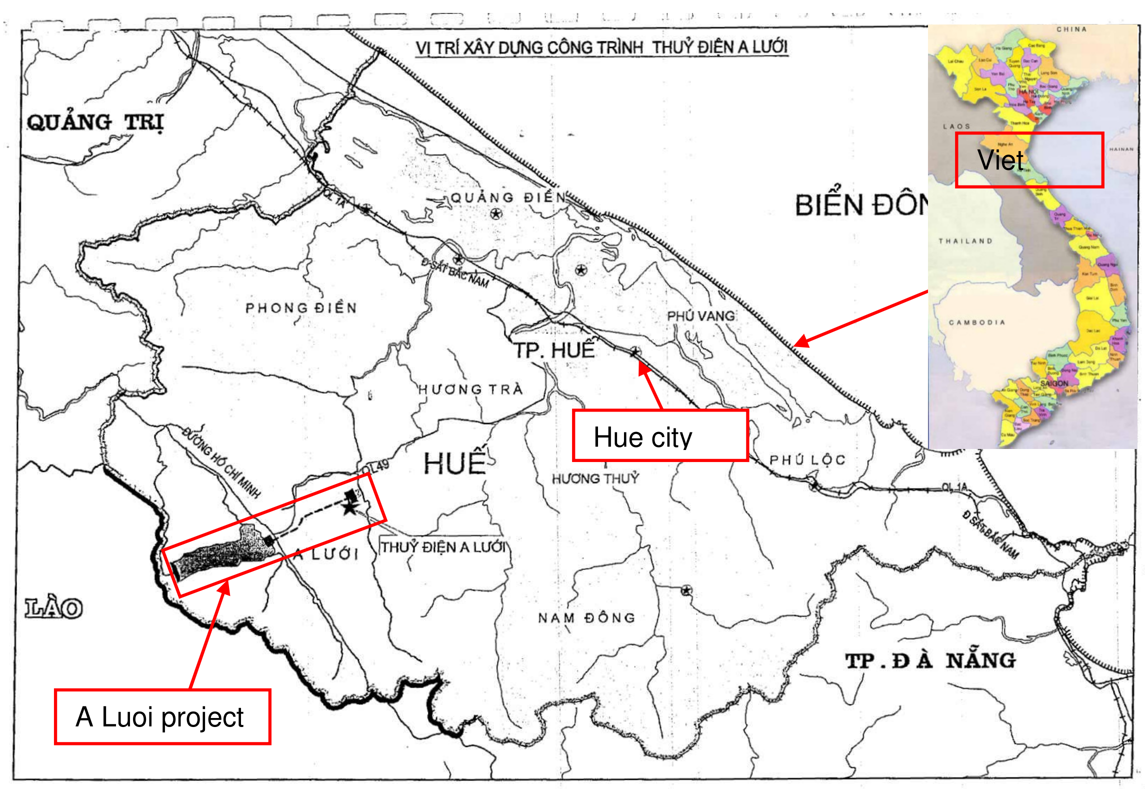
The proposed project is located in A Luoi district, Thua Thien Hue province. The project area is located 70 km southwest of Hue city. The approximate coordinates for the project are demonstrated as below:

- Dam site: 16° 11' 55'' North latitude, 107° 09' 42'' East longitude
- Powerhouse: 16° 17' 02'' North latitude, 107° 21' 32'' East longitude

Figure A. 1 Map of Thua Thien Hue province and the project location



A.3. Technologies and/or measures

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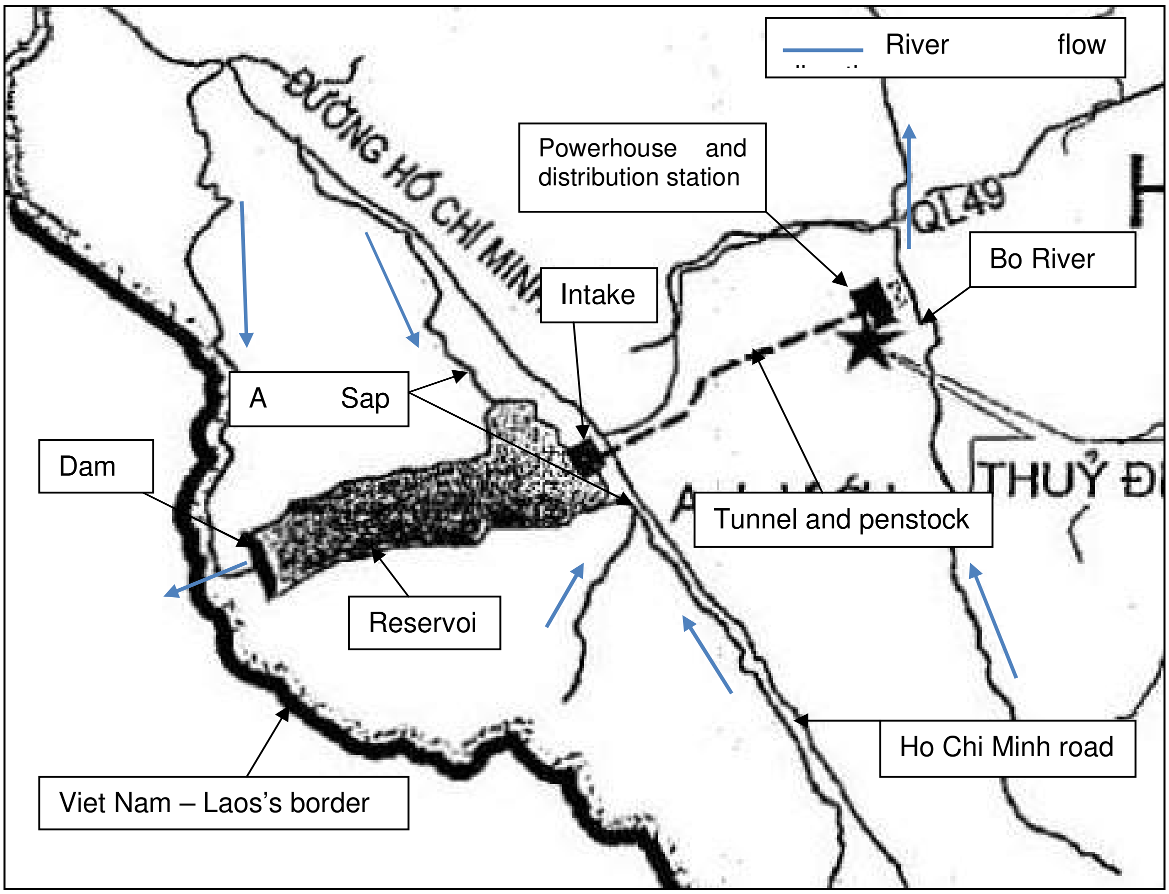
Employed technology

The project design consists of a new diversion-type hydropower facility with a reservoir, dam, water diversion system, powerhouse and distribution station. The facility will have a maximum head of 485.6 meters. The dam will have a maximum height of 49.5 meters and a total length of 208 meters. The water intake will lead part of the available water flow through an 11620-meter-long tunnel. The water will then go through a 1330-meter-long penstock to the powerhouse.[1] The surface area of the reservoir is 8,200,000 m^2 at full water level and has a power density of 20.7 W/m^2. Figure below illustrates the layout of the proposed project.

Figure A. 2. Layout of the proposed project



The project's total installed capacity will be 170 MW. The expected effective operating time of the project is 4038 hours annually. Total gross annual power generation is expected to be 686,500 MWh. Annual power supply to national electricity grid is expected to be 676,203 MWh. Power generated by the project will be routed to the national electricity grid via a 220 kV double-circuit transmission line.

Two Pelton turbine/generator units will be installed in the power plant. The maximum generation capacity of the plant will be 170 MW. The turbine/generator units are supplied by a Consortium of two manufacturers, Dongfang Electric Corporation of People's Democratic Republic of China and Voith Siemens Hydro Kraftwerktechnik GmbH & Co. KG (now known as Voith Hydro) of Germany. These manufacturers have manufactured hydro turbines and generators, which have been

[1] Technical Design (TD), Volume 1, Table 1.10

installed worldwide, including in China and Viet Nam. Pelton turbine/generator units are popularly used in hydropower plants in Viet Nam. Therefore it can be concluded that the project uses state of art technology. The specific technical data of the turbine/generator units are listed below in table below:

Table A. 1 Technical data of the turbine/generator units[2]

Main Technical Data		Value (per unit)
Turbines	Units	2
	Type	TIV-disposal of bucket vertical shaft, 6 spray and 6 break
	Lifetime	150,000 hours (default value from EB50, Annex 15)
	Average efficiency	91.325%
Generators	Units	2
	Type	SF85-18 / 5850
	Lifetime	30 years (default value from EB50, Annex 15)
	Capacity	85 MW / 100 MVA
	Rated voltage	13.8 kV
	Power factor	0.85

The Pelton technology will be transferred to O&M staffs of the proposed project's plant. The O&M staffs of the projects were sent to the Central Electricity College, Da Nhim – Ham Thuan – Da Mi Hydropower Joint Stock Company and A Vuong Hydropower Joint Stock Company for general training on operation, maintenance and reparation of a hydropower plant. Before operation start of the project's plant, technical experts from equipment suppliers will train the O&M staffs on operation and maintenance of the specific equipment of the project.

In accordance with the applied methodology, the greenhouse gases involved in the project activity consist of CO_2 emissions from electricity generation in fossil fuel fired power plants that is displaced due to the project activity.

As a new project, the baseline scenario of the proposed project is the same as the scenario existing prior to the start of the implementation of the above proposed project activity. The spatial boundary of the proposed project involves the project itself and the power plants connected to the national electricity grid. Detailed information on the installed capacity and annual power generation of national electricity grid is in Appendix 4.

A.4. Parties and project participants

The table below provides name of Parties and project participants involved in the project activity.

Table A. 2 List of Parties and project participants

Party involved (host) indicates host Party	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)

[2] Equipment purchase agreement

Viet Nam (host)	Central Hydropower Joint Stock Company	No
Sweden	Vattenfall Energy Trading Netherlands N.V.	No

Contact information of project participants is provided in Appendix 1.

A.5. Public funding of project activity

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

SECTION B. Application of selected approved baseline and monitoring methodology and standardized baseline

B.1. Reference of methodology and standardized baseline

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Title: ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (Version 13.0.0)
Date of approval: 11/05/2012
The methodology draws upon the following tools:

- Tool to calculate the emission factor for an electricity system (Version 02.2.1);
- Tool for the demonstration and assessment of additionality (Version 06.0.0);
- Tool to calculate project or leakage CO_2 emission from fossil fuel combustion (Version 02);

Please refer the UNFCCC website for more information on the baseline and monitoring methodology and tools: http://cdm.unfccc.int/goto/MPappmeth

B.2. Applicability of methodology and standardized baseline

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This proposed project is a grid-connected renewable electricity generation project with an installed capacity of 170 MW. Version 13.0.0 of ACM0002 is chosen as selected methodology for the proposed project activity. Details of the comparison of the project's characteristics and the applicability criteria as specified in the selected methodology is given in the table below:

Table B. 1 Comparison of project's characteristics and applicability criteria of the selected methodology

Applicability criteria of the selected methodology	Characteristics of the project activity	Applicability criteria 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 reservoir.	Yes
In the case of capacity additions, retrofits or replacements (except for wind, solar, wave or tidal power capacity addition projects which use Option 2: on page 10 to calculate the parameter $EG_{PJ,y}$): the existing plant started commercial operation prior to the start of a minimum historical reference period of five	The project activity is to install a new hydro power plant.	Not applicable

years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity expansion or retrofit of the plant has been undertaken between the start of this minimum historical reference period and the implementation of the project activity.		
In case of hydro power plants: • The project activity is implemented in an existing single or multiple reservoirs, with no change in the volume of any of reservoirs, or	The project activity constructs a new reservoir.	Not applicable
• The project activity is implemented in an existing or multiple reservoirs, where the volume of any of reservoirs is increased and the power density of each is greater than 4 W/m^2.	The project activity constructs a new single reservoir.	Not applicable
• The project activity results in new single or multiple reservoirs and the power density of each reservoir is greater than 4 W/m^2.	The power density of the new single reservoir is 20.7 W/m^2.	Yes
In case of hydro power plants using multiple reservoirs where the power density of any of the reservoirs is lower than 4 W/m^2 all the following conditions must apply: • The power density calculated for the entire project activity using equation 5 is greater than 4 W/m^2;	The project uses a new single reservoir and its power density is 20.7 W/m^2.	Not applicable
• Multiple reservoirs and hydro power plants located at the same river and where are designed together to function as an integrated project1 that collectively constitute the generation capacity of the combined power plant;	The project uses a new single reservoir and its power density is 20.7 W/m^2.	Not applicable
• Water flow between multiple reservoirs is not used by any other hydropower unit which is not a part of the project activity;	The project uses a new single reservoir and its power density is 20.7 W/m^2.	Not applicable
• Total installed capacity of the power units, which are driven using water from the reservoirs with power density lower than 4 W/m^2, is lower than 15MW;	The project uses a new single reservoir and its power density is 20.7 W/m^2.	Not applicable
• Total installed capacity of the power units, which are driven using water from reservoirs with power density lower than 4 W/m2, is less than 10% of the total installed capacity of the project activity from multiple reservoirs.	The project uses a new single reservoir and its power density is 20.7 W/m^2.	Not applicable
This methodology is not applicable to project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site.	It is a renewable energy project with no fuel-switch involved.	Not Applicable
This methodology is not applicable to biomass fired power plant.	The project activity is to install a new hydro power plant.	Not Applicable

This methodology is not applicable to hydro power plants that result in the creation of a new single reservoir or in the increase in an existing single reservoir where the power density of the power plant is less than 4 W/m^2.	The power density of the new reservoir is 20.7 W/m^2.	Not Applicable

This comparison clearly shows that the selected methodology is applicable to the proposed project activity.

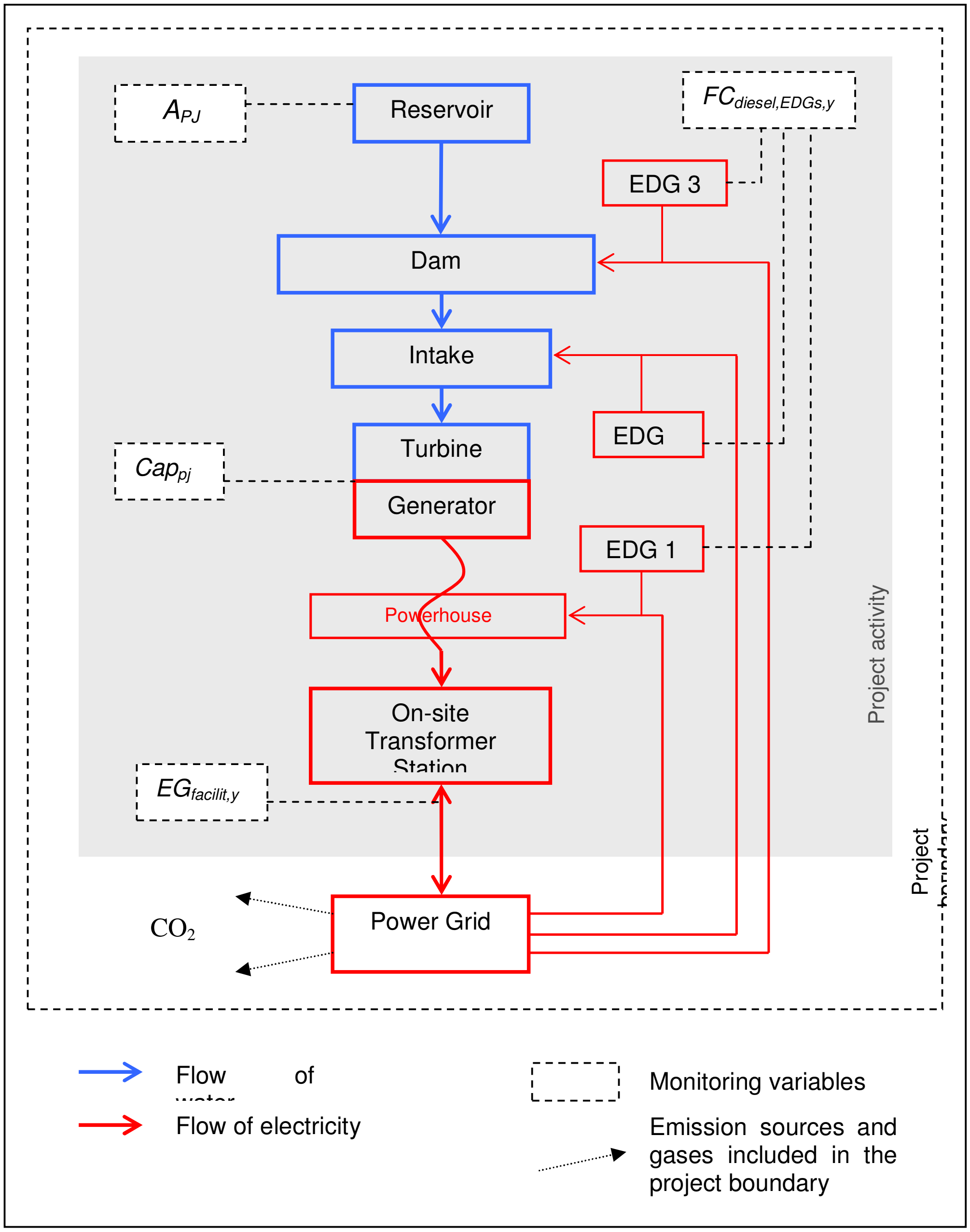
B.3. Project boundary

Table B. 2 Emission sources and GHGs included in the project boundary

Source		GHGs	Included?	Justification/Explanation
Baseline scenario	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
Project scenario	For hydro power plants, emissions of CH_4 from the reservoir	CO_2	No	Minor emission source
		CH_4	No	As the power density of the project is 20.7 W/m2, which is larger than 10 W/m^2, CH_4 emissions from the reservoir can be ignored according to ACM0002.
		N_2O	No	Minor emission source

According to version 13.0.0 of ACM0002, the spatial extent of the project boundary includes the A Luoi hydro power plant and all power plants connected physically to the national electricity grid to which the proposed project is also connected. The flow diagram of the project boundary is shown in the figure below.

Figure B. 1 Flow diagram of the proposed project activity



B.4. Establishment and description of baseline scenario

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The project activity is the installation of a new grid-connected renewable power plant/unit, the baseline scenario is the electricity delivered to the grid by the project activity that otherwise would have 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".

B.5. Demonstration of additionality

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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) (hereinafter referred to "Additionality Tool").

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

<u>Sub-step 1a: Define alternatives to the project activity</u>

According to the Validation and Verification Standard (version 02), paragraph 115 *"Where the baseline scenario is prescribed in the approved methodology, 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*". This is the baseline scenario of the project activity and this baseline scenario is a realistic and credible alternative to the project activity. Moreover, according to paragraph 4 of the Additionality Tool *"Project activities that apply this tool in context of approved consolidated methodology ACM0002, only need to identify that there is at least one credible and feasible alternative that would be more attractive than the proposed project activity".* Therefore there is no need to further analyze alternatives to the project activity to assess and demonstrate the additionality.

Step 2. Investment analysis

<u>Sub-step 2a: Determine appropriate analysis method</u>

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 benchmark return were crucial for the decision to go ahead with the project.

Furthermore, following Guidance 19 in *EB 62, Annex 5, Guidelines on the assessment of Investment Analysis", version 05 (*hereinafter referred to *"EB 62, Annex 5")*, as the alternative to the proposed project activity is the supply of electricity from a grid this is not to be considered an investment, a benchmark approach is considered appropriate.

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

<u>Sub-step 2b – Option III: Apply benchmark analysis</u>

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. The project IRR then is compared to an appropriate benchmark.

<u>**Determination of benchmark:**</u>
According to guidance 12 of the *EB 62, Annex 5*, "Local lending rates or weighted average costs of capital (WACC) are appropriate benchmarks for a project IRR". The project IRR was chosen by the project entity, the WACC were therefore an appropriate benchmark for comparison. The WACC can be calculated on the basis of the equation below:

Equation B. 1

$$WACC = \frac{E}{K} \cdot R_e + \frac{D}{K} \cdot R_d \cdot (1 - T_c)$$

Where:

- K is the total capital invested
- E is total equity
- D is total debt
- R_e is the required rate of return on equity (i.e. cost of equity)
- R_d is the required rate of return on borrowings (i.e. cost of debt)
- T_c is the corporate income tax rate

Determination of cost of debt
According to guidance 16 of *EB 62, Annex 5*, "If the benchmark is based on parameters that are standard in the market, the cost of debt should be calculated as the cost of financing in the capital markets (e.g. commercial lending rates and guarantees required for the country and the type of project activity concerned), based on documented evidence from financial institutions with regard to the cost of debt financing of comparable projects. In cases where this data is not available, use the commercial lending rate in the host country to calculate the cost of debt." Since the data on cost of debt financing of comparable projects is not available, the long-term commercial lending interest rate in Viet Nam prevailed at the time of making the investment decision is used as cost of debt. The project participant chooses the lowest value of the range from 10.8% to 13.8% of the interest rates for long-term loans published in the Annual Report of the State Bank of Viet Nam for the year 2005. This kind of report is published on the website of the State Bank of Viet Nam annually (*www.sbv.gov.vn*). The applied cost of debt is 10.8% at the date of making the investment decision on 22/12/2006, which is available and conservative official value for the cost of debt used for benchmark derivation.

Determine the cost of equity
According to guidance 15 of of *EB 62, Annex 5*, "the cost of equity should be determined either by: (a) selecting the values provided in Appendix A; or by (b) calculating the cost of equity using best financial practices, based on data sources which can be clearly validated by the DOE, while properly justifying all underlying factors".
The cost of equity for the proposed project is taken from the Ibbotson Associates, Inc.'s report on international cost of capital for the year 2006, which is available when making investment decision. Ibbotson Associates, Inc. is a wholly owned subsidiary of Morningstar Inc., a leading provider of independent investment research in North America, Europe, Australia, and Asia.[3] Therefore, it can be concluded that the cost of debt was calculated using best financial practices. The report provides two expected rates of return on equity in Viet Nam from an investor's point of view, 24.63% and 25.57%. These two values were derived based on application of two different models. The lower value of 24.63% was chosen at the date of making the investment decision. This is a conservative value.

Determine corporate income tax rate
The project entity uses Project IRR to demonstrate additionality. According to guidance 11 of EB 62 Annex 5, "when a project IRR is calculated to demonstrate additionality a pre-tax benchmark be applied". Therefore WACC should be derived as pre-tax. This means that corporate income tax is zero in pre-tax WACC derivation in Equation B. 1.

The values applied to calculate the WACC are stated in the table below:

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[3] http://en.wikipedia.org/wiki/Morningstar,_Inc.

Table B. 3 Calculation of WACC

Parameter	Value	Units	Source
Total capital invested	100	%	N/A
Total debt	70	%	Decision 709/QD-NLDK
Total equity	30	%	Decision 709/QD-NLDK
Required rate of return on equity (i.e. cost of equity)	24.63	%	According to Ibbotson in 2006 (lower value of 24.63% and 25.57% was applied, this is a conservative value)
Required rate of return on borrowings (i.e. cost of debt)	10.8	%	Annual report of State Bank of Viet Nam for 2005 (lowest value of the range from 10.8% to 13.8% as stated in page 38, this is a conservative value.)
Corporate income tax rate	0.00	%	Kept at zero due to pre-tax benchmark derivation as recommended in guidance 11 of EB 62 Annex 5
Pre-tax WACC	**14.95**	**%**	**Calculated**

Sub-step 2c: Calculation and comparison of financial indicators
The key inputs used to calculate the Project IRR of the proposed project are presented in the table below:

Table B. 4 Parameters used in the calculation of the IRR

Input	Value	Unit	Basis
Installed capacity	170	MW	TD, Additional Volume
Gross electricity generation	686,500	MWh	TD, Additional Volume
generation in rainy season	148,500	MWh	TD, Additional Volume
generation in dry season	538,000	MWh	TD, Additional Volume
Internal consumption and loss	1.5	%	TD, Volume 5
Net electricity generation	676,203	MWh	Calculated
Revenue tariff in VND	656	VND/kWh	Calculated
revenue tariff in USD	0.041	USD/kWh	TD, Additional Volume
exchange rate	16,000	USD/VND	Average rate of 11/2006 from www.oanda.com / TD, Volume 5
Annual O&M cost	0.5	%	Decision 709/QD-NLDK / TD, Volume 5
Insurance cost (on construction + equipment cost)	1.12	%	TD, Volume 7
Project lifetime	40	year	Decision 709/QD-NLDK / TD, Volume 5
Equipment refurbishment cost			TD, Volume 5
in year 19	294,600	million VND	
in year 20	294,600	million VND	
Natural resource tax (NRT) rate	2.0	%	Circular 05/2006/TT-BTC
Electricity tariff for NRT calculation	700	VND/kWh	Circular 05/2006/TT-BTC
Total investment costs	2,849,904	million VND	TD, Volume 7
construction cost	1,286,895	million VND	
equipment cost	844,020	million VND	

administration and other cost		222,669	million VND	
compensation and environment cost		141,337	million VND	
transmission line		108,750	million VND	
contingency		246,233	million VND	
Investment expenditure				TD, Volume 7
construction year 1	8%	232,425	million VND	
construction year 2	15%	427,331	million VND	
construction year 3	32%	912,854	million VND	
construction year 4	45%	1,277,294	million VND	

Comparison to benchmark
The results of the analysis for the project are provided in the table below:

Table B. 5 Results of economic analysis

Project IRR (Pre-tax)	12.14%
Benchmark (Pre-tax)	14.95%

The project IRR is below the benchmark. This result is examined via the sensitivity analysis.

Sub-step 2d: sensitivity analysis
As per guidance 20 of *EB 62, Annex 5*, only variables, including the initial investment cost, that constitute more than 20% of either total project costs or total project revenues should be subjected to reasonable variation (all parameters varied need not necessarily be subjected to both negative and positive variations of the same magnitude). Following this guidance, a sensitivity analysis has been conducted with variations of the 4 parameters:

- Total investment costs
- Revenue tariff in VND
- Annual O&M cost
- Net electricity generation

Though the annual O&M cost does not constitute more than 20% of total project cost, it is also applied respectively as one of the 4 parameters for reference. In the sensitivity analysis, variations of ±10%[4] have been considered in the critical assumptions. The variation of parameters when project IRR crosses benchmark value of 14.95% is also analyzed. The results of the sensitivity analysis for the IRR are shown in table B. 6 and figure B. 2 provides a graphic depiction.

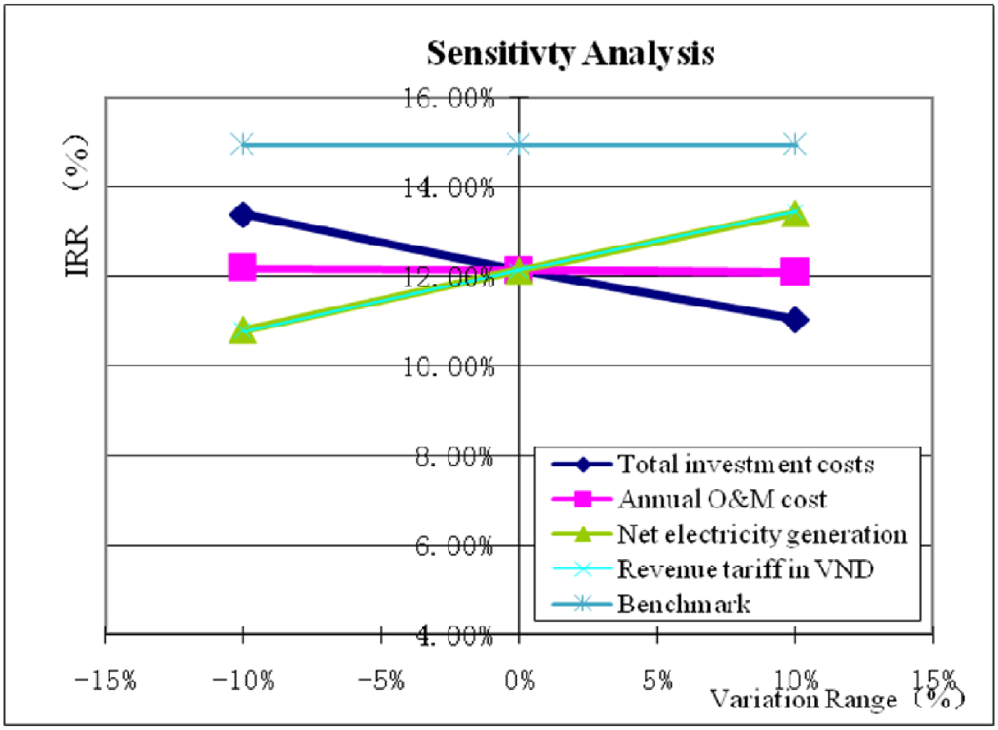
[4] ±10% variation range is selected according to the Decision No. 709/QD–NLDK issued by the Ministry of Industry, dated 13/04/2004

Table B. 6 Impact of variations in assumptions on the IRR

No	Parameter	Variation of parameter	Project IRR	Likelihoods
1	Total investment costs	-10%	13.39%	Below benchmark
		10%	11.04%	Below benchmark
		-20.75%	14.95% (benchmark)	The probability of a 20.75% decrease in the total investment cost is not likely to happen because the trend of statistic CPI in Vietnam is upward for the last decade.[5]
2	Annual O&M cost	-10%	12.18%	Below benchmark
		10%	12.09%	Below benchmark
		-680%	14.95% (benchmark)	This option will be discarded, because a decrease of 680% is not realistic.
3	Net electricity generation	-10%	10.8%	Below benchmark
		10%	13.42%	Below benchmark
		22.3%	14.95% (benchmark)	The probability of a 22.3% increase in annual power generation is very unlikely. This is because the potential hydrology has been surveyed on long term basis (from 1977 to 2005)[6]. The current estimate is the most likelihood.
4	Revenue tariff in VND	-10%	10.78%	Below benchmark
		10%	13.45%	Below benchmark
		21.8%	14.95% (benchmark)	The probability of an increase of 21.8% (to 4.99 US cent/kWh or 799 VND/kWh) is not likely because: • EVN is the only purchaser of electricity generated by projects in Vietnam and according to Decree 45/2001/ND-CP dated 02/08/2001, electricity tariff of a project is negotiated by a project owner and EVN. An owner of Independent Power Plants (IPPs) like the proposed project is always in an unfavourable position in tariff negotiations with EVN – the monopolist in power sector. Therefore, an IPP owner has not many chances to get a high tariff offer from EVN. • Decision 709/QD–NLDK by the Ministry of Industry dated 13/04/2004 regulate the tariff range for the projects with a capacity above or equal to 30 MW as 2.50 – 4.50 US cent/kWh. It is not likely EVN would break the law to sign a PPA with a tariff higher than 4.50 US cent/kWh. • A PPA with EVN is signed with a fixed feed in tariff for the whole contract period of around 25 years.[7]

[5] http://data.worldbank.org/indicator/FP.CPI.TOTL.ZG
[6] See TD, Volume 5, Table TN.01
[7] Evidence of PPA fixed tariff and PPA period of three projects has been provided to the validation DOE for review

Figure B. 2 Graphic depiction of impacts by variations in critical assumptions on IRR



The sensitivity analysis confirms that the project IRR 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. A stepwise approach for common practice is applied.

Sub-step 1: Calculate +/-50% output range
The proposed project has a capacity of 170 MW. The output range as +/-50% of the design capacity of the proposed project activity is 85 – 255 MW.

Sub-step 2: 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 Sub-step 1, have started commercial operation before the start date of the project but on or after 17/08/2001 and has not been registered as CDM project activities.
On 02/08/2001 the Government of Vietnam issued Decree 45/2001/ND-CP regarding power generation and consumption, which became effective 15 days after the issuance date (17/08/2001). The Decree allowed non-State-owned entities to invest in and operate power plants for the first time. The projects started operation before 17/08/2001 are not subjected to this analysis because they had been invested and operated based on different premises. Specifically, before the date of

17/08/2001, only State-owned entities were allowed to invest in and operate power plants and all power plants had been invested with the State's budget and operated by state owned companies.

The proposed project is located in Viet Nam and has the start date as of 29/06/2007. Therefore N_{all} in this case includes non-CDM project plants in Viet Nam as default with a capacity within the range 85 – 255 MW and starting commercial operation from 17/08/2001 to 29/06/2007. A research was done; among 279 projects identified from different sources, 1 of them fall into N_{all} (**N_{all} = 1**).

Sub-step 3: 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):

(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 on 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 %);

The only one plant of N_{all} is Se San 3A hydropower project ("Se San 3A project"). In comparison with the proposed project, Se San 3A differs by (iv) investment climate at the time of investment decision and (v) other features, i.e. unit cost of output:

Investment climate:

Se San 3A project has an installed capacity of 108 MW and started commercial operation in 2006. Se San 3A project is located in Gia Lai, a province in Central Highlands region of Viet Nam.[8] According to Resolution 10-NQ/TW dated 18/01/2002 by the Central Committee of the Socialist Party of Viet Nam ("the Resolution 10-NQ/TW"), Central Highlands is a strategic region of highly importance in terms of social-economics and national security. Because of its importance, the Socialist Party of Viet Nam set the target to develop the Central Highlands provinces as a wealthy region by "*mobilizing all resources, mainly domestic as well as taking of potential and advantages of the region in the most effectively ways for its fast, highly effective and sustainable socio-economic development*". The Resolution 10-NQ/TW also further states that *"investment for industry development of the region is a basic and long term strategy. The investment will be focused on the sectors of its advantages such as* ***hydropower****, processing of agricultural and forestry products, mining… The State will invest in big projects of key importance such as hydropower, paper production and processing of agricultural and forestry products, mining".* Receiving special regards from the Socialist Party of Viet Nam and the State, the Central Highlands region is expected to become the biggest hydropower generation centre of the country in 2010.[9]

Specifically the Se San 3A project has received at least the following supports from the Vietnamese Government:

As per the Decision 898/QD-TTg by the Prime Minister dated 07/10/2002 as approval of the Se

[8] http://songda.com.vn/info/C%C3%B4ngtr%C3%ACnhd%E1%BB%B1%C3%A1n/Th%E1%BB%A7y%C4%91i%E1%BB%87n/CTho%C3%A0nth%C3%A0nh/tabid/189/ctl/Details/mid/673/ItemID/1107/Default.aspx

[9] http://www.sggp.org.vn/daututaichinh/2007/4/97019/

San 3A project:

- The Se San 3A project is invested by Song Da Corporation, a state company under management of the Ministry of Construction: The fund for investment in Se San 3A project is from the State. Se San 3A hydropower station was the build-operate (BO) project of Song Da Corporation.[10]
- The Bank for Commercial and Trade of Viet Nam and other commercial banks are allowed to provide Song Da Corporation with loans for investment in Se San 3A hydropower project that can exceed 15% of own equity of each bank: As per article 18 of Decision 1627/2001/QD-NHNN dated 31/12/2001 by the State Bank of Viet Nam, a credit institution is not allowed to provide a client with loans that exceed 15% of its own equity unless specifically approved by the Prime Minister.

The proposed project has not received any of such supports from the Government.

Unit cost of output:
The Se San 3A project is further compared with the proposed project on unit cost of output. The table below shows unit cost of Se San 3A and the proposed project:

Table B. 7 Unit cost of output comparison

No.	Plant name	Start operation	Output (MWh/year)	Investment cost (million VND)	Unit cost of output (million VND/MWh)	Difference with the proposed project (%)
	A	B	C	D	E = D/C	$F = (E_2-E_1)/E_1$
1	Se San 3A[11]	2006	479,300	1,864,600	3.890	21.13%
2	Proposed project	Project Start Date **29/06/2007**	686,500	3,234,782[12]	4.712	N/A

As shown in the table above, the unit cost of Se San 3A is 21.13% which is larger than 20% threshold.

With difference in investment climate and unit cost of output as proved above, it can be concluded that the technology applied by Se San 3A project is different from the one applied by the proposed project. This means N_{diff} is equal to one (1).

Sub-step 4: Calculate factor $F = 1 – N_{diff} / N_{all}$ and $N_{all} - N_{diff}$
As indentified in Sub-step 2 and 3, N_{all} = 1 and N_{diff} = 1 respectively. Therefore F and $N_{all} – N_{diff}$ is calculated as follow:
$F = 1 – N_{diff}/N_{all}$
$F = 1 – 1/1 = 1 – 1$
F = 0
And
$N_{all} – N_{diff} = 1 – 1$
$N_{all} – N_{diff} = 0$

Conclusion:

[10] http://www.songda.vn/info/en/tabid/179/ItemID/1/View/Details/Default.aspx
[11] http://songda.com.vn/info/C%C3%B4ngtr%C3%ACnhd%E1%BB%B1%C3%A1n/Th%E1%BB%A7y%C4%91i%E1%BB%87n/CTho%C3%A0nth%C3%A0nh/tabid/189/ctl/Details/mid/673/ItemID/1107/Default.aspx
[12] TD, Volume 7 (The investment cost of the proposed project in this table includes VAT and interest during construction. These are included for comparison purpose. In Viet Nam, investment cost of hydropower projects are stated with VAT and interest during construction included.)

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

Serious CDM consideration

The project owner (“PO”) was aware of the possibilities of CDM at a very early stage of the project development. The prospect of CDM revenues has been a crucial factor in the decision to implement the project. After the FSR is completed and approved, the PO heard of CDM via public media. To learn more about CDM, PO contacted and met the first CDM advisor. On 26/07/2006, PO requested the first CDM to assess the CDM eligibility for the project. After the assessment, the project owner requested for and received the CDM recommendation from Provincial People’s Committee of Thua Thien Hue (“PPC of Thua Thien Hue”) on 21/08/2006 and 21/11/2006 respectively. After that the project owner signed the CDM development agreement with the first CDM advisor on 05/12/2006. After receiving the CDM recommendation from the PPC of Thua Thien Hue, signing CDM agreement and completion of Technical Design on 20/12/2006, the project owner’s Board of Directors met and decided to invest in the project with consideration of the CDM revenues. All these events occurred prior to the project starting date of 29/06/2007.

Table B. 8 Overview of key events in the development of the project

Date	Event
08/2005	Local stakeholder consultation meetings organized
05/2006	EIA report completed
26/05/2006	EIA report approved
28/06/2006	Feasibility Study Report (“FSR”) completed
30/06/2006	FSR approved
07/2006	PO learnt about CDM via internet
26/07/2006	PO requested the first CDM advisor to assess the project’s CDM eligibility
21/08/2006	PO requested PPC of Thua Thien Hue for CDM recommendation
21/11/2006	PPC of Thua Thien Hue recommended CDM for the project
05/12/2006	CDM agreement between PO and the first CDM advisor signed
20/12/2006	Technical Design completed
22/12/2006	**Board decision:** Board of Directors decided to invest in the project with serious consideration of CDM revenues
26/06/2007	Technical Design approved
29/06/2007	**Project start date:** Contract for construction of intake, auxiliary tunnel and water tunnel signed
14/08/2007	Term sheet with Carbon Asset Management Sweden AB signed
28/09/2007	PO requested for Host Country CDM Letter of Approval
22/01/2008	Meeting minutes of CDM agreement performance assessment
13/02/2008	Host Country CDM Letter of Approval granted
07/05/2008	CDM agreement with the first CDM advisor terminated
10/06/2008	Term sheet with Vattenfall signed
19/01/2009	ERPA countersigned by Vattenfall
29/02/2009	Equipment purchase contract signed
06/2009	Additional EIA report completed
30/06/2009	Additional EIA report approved
10/01/2010	Due Diligence report issued
29/03/2011	PO accepted new CER price for CERs delivered post-2012
15/08/2011	ERPA amendment agreement signed
01/09/2011	Vattenfall contracted Hanam Carbon for carrying out next steps of CDM development
27/02/2012	PDD submitted for validation

05/2012	Commissioning of unit 1
06/2012	Commissioning of unit 2

The table of key events above shows that there is less than two years of a gap between the CDM events. Therefore, it can be concluded that CDM was serious considered by the project owner and the project owner has taken continuing and real actions to secure the CDM status for the project.

B.6. Emission reductions

B.6.1. Explanation of methodological choices

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In accordance with the ACM0002 methodology (version 13.0.0), emission reductions are calculated as follows:

Equation B. 2

$ER_y = BE_y - PE_y$

Where:

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

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 electricity grid (See section B.3).

<u>Description of the calculation process</u>

The key methodological steps are:

1. Identify the relevant electric power system;
2. Choose whether to include off-grid power plants in the project electricity system (optional).
3. Select a method to determine the operating margin (OM).
4. Calculate the operating margin emission factor according to the selected method.
5. Calculate the build margin (BM) emission factor.
6. Calculate the combined margin (CM) emission factor.

<u>Step 1. Identify the relevant electric power system</u>

The proposed project will be connected to the Viet Nam National Grid, therefore the relevant electric system is Viet Nam National Grid.

<u>Step 2. Choose whether to include off-grid power plants in the project electricity system (optional)</u>

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 in the table 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. 9 Electricity generation of the National Power Grid of Viet Nam, 2004-2008[13]

Year	2004	2005	2006	2007	2008	Average
Generation by hydropower plants (MWh)	17,858,651	16,365,438	19,508,244	22,385,232	25,933,762	102,051,327
Total electricity generation by grid (MWh)	44,974,169	50,330,468	57,160,493	66,348,589	74,689,636	293,503,355
Low cost/must run percentage	39.71%	32.52%	34.13%	33.74%	34.72%	34.77%

Data vintage selection and justification

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. The data is the latest public information.

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 A of the simple OM method, since data required for option A (net electricity and a CO_2 emission factor of each power unit is available.

Option A – Calculation based on average efficiency and electricity generation of each plant
Where option A is used, the simple OM emission factor is calculated based on the net electricity

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

generation of each power unit and an emission factor for each power unit, as follows:

Equation B. 3

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

Where:

$EF_{grid,OMsimple,y}$	=	Simple operating margin CO_2 emission factor in year *y* (tCO_2/MWh)
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
$EF_{EL,m,y}$	=	CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
m	=	All power units serving the grid in year y except low-cost / must-run power units
y	=	The relevant year as per the data vintage chosen in step 3

Determination of $EF_{EL,m,y}$

To estimate the emission factor of each power unit *m* ($EF_{EL,m,y}$), option A1 is applied since data on fuel consumption and electricity generation is available.

Equation B. 4

$$EF_{EL,m,y} = \frac{\sum_i FC_{i,m,y} \cdot NCV_{i,y} \cdot EF_{CO2,i,y}}{EG_{m,y}}$$

Where:

$FE_{EL,m,y}$	=	CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
$FC_{i,m,y}$	=	Amount of fossil fuel type *i* consumed by power plant/unit *m* in year *y* (mass or volume unit)
$NC_{Vi,y}$	=	Net calorific value (energy content) of fossil fuel type *i* in year *y* (GJ/mass or volume unit)
$EF_{CO2,i,y}$	=	CO_2 emission factor of fossil fuel type *i* in year *y* (tCO_2/GJ)
$EG_{m,y}$	=	Net electricity generated and delivered to the grid by power plant/unit *m* in year *y* (MWh)
m	=	All power plants/units serving the grid in year *y* except low-cost/must-run power plants/units
i	=	All fossil fuel types combusted in power plant/unit *m* in year *y*
y	=	Either the three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option)

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

Determination of $EG_{m,y}$

In accordance with the Emission Factor Tool, for grid power plants, $EG_{m,y}$ can be determined by government records or official publications. The data is drawn from DNA Emission factor calculation dated 26/03/2010, and so is an appropriate source. See Appendix 4 for details.

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

The DNA uses the data of the year 2006, 2007 and 2008. The three-year average is calculated as a full-generation-weighted average of the emission factors. The DNA calculates the OM emission factor as 0.6465 tCO_2/MWh. See Appendix 4 for more details.

Table B. 10 Result of OM calculation

Year	Total electricity supply to grid (MWh)	CO_2 emission (tCO_2)	OM_{2008} (tCO_2/MWh)
2006	37,618,119	25,702,918	
2007	43,921,501	28,544,283	
2008	48,719,794	29,963,699	
Total	**130,259,414**	**84,210,900**	**0.6465**

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 on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation. 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}[14] ($SET_{\geq 20\%}$) 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).

The below 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. 11 Overview of most recently-built power units[15]

Plant	Commissioning year	Fuel consumption (Coal diesel: k tons Gas: mm^3)		Power supply to grid (MWh)	CO_2 emission (tCO_2)
Five power units started to supply electricity to the grid most recently ($SET_{5\text{-units}}$)					
A Vương	2008	HPP		168,103.50	
Tuyên Quang	2008	HPP		1,136,112.18	
Đại Ninh	2008	HPP		1,145,108.50	
Nhơn Trạch	2008	Gas	166.38	544,808.60	378,023
Cà Mau 1&2	2007	Gas	647.24	2,106,807.24	1,431,048

[14] If 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation
[15] Data source: Grid emission factor calculation issued by Vietnamese DNA on 26/03/2010

		WHR		2,728,872.00	
Annual electricity generation of $SET_{5\text{-units}}$ ($AEG_{SET\text{-}5\text{-units}}$)				**7,829,812.02**	
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	HPP		168,103.50	
SROC Phu Mieng IDICO	2006	HPP		241,556.00	
SÊ SAN 3A	2006	HPP		394,895.70	
Tuyên Quang	2008	HPP		1,136,112.18	
Đại Ninh	2008	HPP		1,145,108.50	
SÊ SAN 3	2006	HPP		1,131,614.00	
Quảng Trị	2007	HPP		250,804.40	
Uông Bí 2	2007	Coal	281.759	532,000.00	581,017.63
Na Dương	2005	Coal	532	627,930.00	883,846.37
Cao Ngạn	2007	Coal	526	708,693.00	1,081,145.84
Formosa	2004	Coal	495	560,295.00	1,291,302.96
Nhơn Trạch	2008	Gas	166.38	544,808.60	378,023.07
Cà Mau 1&2	2007	Gas	647.24	2,106,807.24	1,431,047.61
		WHR		2,728,872.00	
Phú Mỹ 2,2	2004	Gas	1,159.75	4,141,980.00	2,510,751.14
Đạm Phú Mỹ	2006	Gas	56.15	4,716.00	133,868.48
CÁI LÂN - VINASHIN	2007	FO	22.48	90,465.01	71,384.99
Annual electricity generation of $SET_{\geq 20\%}$ ($AEG_{SET\text{-}\geq 20\%}$)				**16,514,761.12**	**8,362,386.09**

From table above, we can see that $AEG_{SET\text{-}\geq 20\%}$ > $AEG_{SET\text{-}5\text{-units}}$ 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 electricity generation is available:

Equation B. 5

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

Where:

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

Table B. 12 Calculation of the BM emission factor

Result of BM calculation	
Total CO_2 emission	8,362,386.09 (tCO_2)
Total electricity to grid	16,514,761.12 (MWh)

BM_{2008}	**0.5064 (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 CDM 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 CDM projects. The Baseline Emission Factor is therefore calculated using method (a) weighted average CM as follows:

Equation B. 6

$$EF_{grid,CM,y} = EF_{grid,OM,y} \cdot W_{OM} + EF_{grid,BM,y} \cdot W_{BM}$$

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 0.5764 tCO_2e/MWh.

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 the equation below:

Equation B. 7

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

Where:

BE_y	=	Baseline emissions in year y (tCO_2/yr)

$EG_{PJ,,y}$	=	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/yr)
$EF_{grid,CM,,y}$	=	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)

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. 8

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

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/yr)
$EG_{facility,\,y}$	=	Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y* (MWh/yr)

Project emissions

According to the methodology, project emissions are accounted for using the following equation:

Equation B. 9

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

Where:

PE_y	=	Project emissions in year *y* ($tC0_2e$/yr)
$PE_{FF,y}$	=	Project emissions from fossil fuel consumption in year *y* ($tC0_2e$/yr)
$PE_{GP,y}$	=	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO_2e/yr)
$PE_{HP,y}$	=	Project emissions from water reservoirs of hydropower plants in year *y* (tCO_2e/yr)

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 than10 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. 10

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

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}) = 170,000,000 Watts
- Installed capacity before the implementation 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}) = 8,200,000 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).

$$PD = \frac{170{,}000{,}000 - 0}{8{,}200{,}000 - 0}$$

PD = 20.7 W/m^2

We conclude that at 20.7 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 ($PE_{FF,y}$)

As per the applied methodology, the $PE_{FF,y}$ shall be calculated as per the latest version of the “Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion”. The $PE_{FF,y}$ can be calculated using the following formula:

$$PE_{FC,j,y} = \sum_{i} FC_{i,j,y} \times COEF_{i,y}$$

Where:

$PE_{FC,j,y}$	=	Are the CO_2 emissions from fossil fuel combustion in process *j* during the year *y* (tCO_2/yr);
$FC_{i,j,y}$	=	Is the quantity of fuel type i combusted in process *j* during the year *y* (mass or volume unit/yr);
$COEF_{i,y}$	=	Is the CO_2 emission coefficient of fuel type *i* in year *y* (tCO_2/mass or volume unit)
i	=	Are the fuel types combusted in process *j* during the year *y*

The CO_2 emission coefficient $COEF_{i,y}$ can be calculated using one of the following two Options, depending on the availability of data on the fossil fuel type *i*, as follows:

Option A: The CO_2 emission coefficient $COEF_{i,y}$ is calculated based on the chemical composition of the fossil fuel type *i*

Option B: The CO_2 emission coefficient $COEF_{i,y}$ is calculated based on net calorific value and CO_2 emission factor of the fuel type *i*

In Viet Nam, it is common practice that chemical composition of the fuel is not available in the fuel purchase documents, therefore Option B is chosen.

As per Option B, $COEF_{i,y}$ can be calculated using the following formula:

$$COEF_{i,y} = NCV_{i,y} \times EF_{CO2,i,y}$$

Where:

$COEF_{i,y}$	=	Is the CO_2 emission coefficient of fuel type i in year y (tCO_2/mass or volume unit)
$NCV_{i,y}$	=	Is the weighted average net calorific value of the fuel type *i* in year *y* (GJ/mass or volume unit)
$EF_{CO2,i,y}$	=	Is the weighted average CO_2 emission factor of fuel type *i* in year *y* (tCO2/GJ)
i	=	Are the fuel types combusted in process *j* during the year *y*

The project will install three emergency diesel generators (EDGs) at the dam, intake and powerhouse with total capacity of 560 kW (700 kVA) which will be maintained for emergency purpose. By combusting diesel, the EDGs will emit CO_2. The EDGs' emissions will be calculated using the formulae presented above. However, the input data (i.e. $FC_{diesel,EDGs,y}$) for the calculation is not available and it is expected that the EDGs will be operated for only 10 hours per year for maintenance purpose. Therefore $FC_{diesel,EDGs,y}$ is assumed as zero ex-ante and as a result the $PE_{FC,EDGs,y}$ or $PE_{FF,y}$ is calculated as zero ex-ante.

During the operation period, the project entity will monitor the $FC_{diesel,EDGs,y}$, $NCV_{diesel,y}$ and $EF_{CO2,diesel,y}$ for calculation of the project's actual $PE_{FC,EDGs,y}$ or $PE_{FF,y}$ in compliance with the procedure presented above.

We therefore conclude that the project emission PE_y is zero ex-ante.

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 (tCO_2e/yr)
BE_y	=	Baseline emissions in year y (tCO_2/yr)
PE_y	=	Project emissions in year y (tCO_2e/yr)

To summarize:

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

Where:

BE_y	=	Baseline emissions in year y (tCO_2/yr)
$EG_{PJ,.,y}$	=	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/yr)
$EF_{grid,CM,,y}$	=	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/yr)
$EG_{facility,y}$	=	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y (MWh/yr)

The quantity of net electricity generation fed into the grid by the project activity ($EG_{facility,y}$) is 676,203 MWh. Therefore, $EG_{PJ.,y}$ = 676,203 MWh.

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

BE_y = 676,203 MWh · 0.5764 tCO_2/MWh

BE_y = 389,763 tCO_2/year

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 = 389,763 tCO_2/year – 0

Emission reductions = 389,763 tCO_2/year

B.6.2. Data and parameters fixed ex ante

Data / Parameter	$FC_{i,m,y}$
Unit	Mass or volume unit
Description	Amount of fossil fuel type *i* consumed by power plant/unit *m* in year *y*
Source of data	Grid emission factor calculation issued by Vietnamese DNA on 26/03/2010
Value(s) applied	For detailed values see Appendix 4.
Choice of data or Measurement methods and procedures	This data is the best data available and has been provided by the Vietnamese DNA.
Purpose of data	Calculation of baseline emissions
Additional comment	

Data / Parameter	$EG_{m,y}$
Unit	GWh
Description	Net electricity generated and delivered to the grid by power unit *m* in year *y*.
Source of data	Grid emission factor calculation issued by Vietnamese DNA on 26/03/2010
Value(s) applied	For detailed values see Appendix 4.
Choice of data or Measurement methods and procedures	This data is the best data available and has been provided by the Vietnamese DNA.
Purpose of data	Calculation of baseline emissions
Additional comment	

Data / Parameter	Cap_{BL}
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(s) applied	0
Choice of data or Measurement methods and procedures	The proposed CDM project activity involves a new hydropower station and hence Cap_{BL} is zero.
Purpose of data	For calculation of power density
Additional comment	

Data / Parameter	A_{BL}
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).
Source of data	Project site
Value(s) applied	0

Choice of data or Measurement methods and procedures	For new hydropower projects, this value is zero.
Purpose of data	For calculation of power density
Additional comment	

B.6.3. Ex ante calculation of emission reductions

>>
The annual net power supplied to the grid by the project is estimated to be 676,203 MWh. According to Section B.6.1, the baseline emission factor of the project is 0.5764 tCO_2e/MWh during the first crediting period. Therefore, ER_y during the first crediting period is to be calculated as follows:

$ER_y = BE_y = EG_{facility, y} \times EF_{grid, CM,y} = 676{,}203 \times 0.5764 = 389{,}763\ tCO_2e$

The total emission reductions of the project are 2,728,341 tCO_2e during the first crediting period.

B.6.4. Summary of ex ante estimates of emission reductions

Year	Baseline emissions ($t\ CO_2e$)	Project emissions ($t\ CO_2e$)	Leakage ($t\ CO_2e$)	Emission reductions ($t\ CO_2e$)
Year 1: 01/02/2013 - 31/01/2014	389,763	0	0	389,763
Year 2: 01/02/2014 - 31/01/2015	389,763	0	0	389,763
Year 3: 01/02/2015 - 31/01/2016	389,763	0	0	389,763
Year 4: 01/02/2016 - 31/01/2017	389,763	0	0	389,763
Year 5: 01/02/2017 - 31/01/2018	389,763	0	0	389,763
Year 6: 01/02/2018 - 31/01/2019	389,763	0	0	389,763
Year 7: 01/02/2019 - 31/01/2020	389,763	0	0	389,763
Total	**2,728,341**	0	0	**2,728,341**
Total number of crediting years	7			
Annual average over the crediting period	389,763	389,763	389,763	389,763

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

>>

Data / Parameter	$EG_{facility,y}$
Unit	MWh/yr
Description	Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y*
Source of data	Calculation
Value(s) applied	676,203
Measurement methods and procedures	Calculating by subtracting $EG_{import,y}$ from $EG_{export,y}$. Data will be archived within the crediting period and 2 years after the end of the crediting period.
Monitoring frequency	Calculated monthly
QA/QC procedures	This value is calculated value, therefore no need for QA/QC procedures.
Purpose of data	For calculation of project baseline emissions
Additional comment	

Data / Parameter	$EG_{export,y}$
Unit	MWh/yr
Description	Electricity exported to the grid by the project plant/unit in year *y*
Source of data	Directly measured at the project site
Value(s) applied	676,203
Measurement methods and procedures	The electricity exported to the grid by the proposed project activity through the export – import lines is measured using national standard electricity metering instruments.
Monitoring frequency	Continuous measurement and at least monthly recording
QA/QC procedures	The technical requirements of electricity meters will be in accordance with the following standard: *Decision 02/2007/QD-BCN dated 09/01/2007 by the Ministry of Industry.* The uncertainty level of data is low. Meters will be calibrated at least once every two years based on the relevant national regulations. Electricity sale records will be used for cross-check. Data will be archived within the crediting period and 2 years after the end of the crediting period.
Purpose of data	For calculation of $EG_{facility,y}$
Additional comment	

Data / Parameter	$EG_{import,y}$
Unit	MWh/yr
Description	Total electricity imported from the grid by the proposed project in year *y*
Source of data	Data for ex ante calculation is assumed as zero. Actual data will be calculated.
Value(s) applied	0
Measurement methods and procedures	The total imported electricity will be calculated monthly as total of imported electricity metered by main meters and import meters installed at the project site.
Monitoring frequency	Total electricity imported will be calculated monthly. Electricity imported via each import line will be continuously measured and at least monthly recorded.
QA/QC procedures	The technical requirements of electricity meters will be in accordance with the following standard: *Decision 02/2007/QD-BCN dated 09/01/2007 by the Ministry of Industry.* The uncertainty level of data is low. Meters will be calibrated at least once every two years based on the relevant national regulations. Electricity purchase records will be used for cross-check. Data will be archived within the crediting period and 2 years after the end of the crediting period.
Purpose of data	For calculation of $EG_{facility,y}$
Additional comment	

Data / Parameter	Cap_{PJ}
Unit	W
Description	Installed capacity of the hydro power plant after the implementation of the project Activity
Source of data	Aggregated from generators' nameplate at the project site.
Value(s) applied	170,000,000
Measurement methods and procedures	Photographic evidence of the installed equipment on the basis of the nameplates will be prepared.
Monitoring frequency	Annually
QA/QC procedures	To be verified onsite
Purpose of data	For calculation of reservoir's emissions
Additional comment	

Data / Parameter	A_{PJ}
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	Measured
Value(s) applied	8,200,000
Measurement methods and procedures	The level of the reservoir will be measured. After which the surface area of the reservoir will be calculated using the design schematics and area maps.
Monitoring frequency	Annually
QA/QC procedures	
Purpose of data	For calculation of reservoir's emissions
Additional comment	

Data / Parameter	$FC_{diesel,EDGs,y}$
Unit	m^3/yr
Description	Quantity of diesel combusted by EDGs during the year *y*
Source of data	Data for ex ante calculation is assumed as zero. Actual data will be obtained from on-site measurement.
Value(s) applied	0
Measurement methods and procedures	Diesel will be stored in tanks. A ruler gauge will be employed to each tank to measure the diesel consumption of each emergency diesel generator. The project entity will record the quantity of the diesel oil used for the emergency diesel generator in the operation logs.
Monitoring frequency	Measured and recorded on a monthly basis.
QA/QC procedures	The consistency of metered diesel consumption quantities will be cross-checked with the diesel purchase records.
Purpose of data	For calculation of project emissions from diesel combustion as per the Tool to calculate project or leakage emissions from fossil fuel combustion, version 02.
Additional comment	

Data / Parameter	$NCV_{diesel,y}$
Unit	TJ/Gg
Description	Weighted average net calorific value of diesel in year y
Source of data	IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value(s) applied	43.3
Measurement methods and procedures	-
Monitoring frequency	The value from the latest version of the IPCC Guidelines will be taken into account.
QA/QC procedures	-
Purpose of data	For calculation of CO_2 emission coefficient of diesel in year y as per option B in the Tool to calculate project or leakage emissions from fossil fuel combustion, version 02
Additional comment	

Data / Parameter	$EF_{CO2,diesel,y}$
Unit	$kgCO_2/TJ$
Description	Weighted average CO_2 emission factor of diesel in year y
Source of data	IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value(s) applied	74,800
Measurement methods and procedures	-
Monitoring frequency	The value from the latest version of the IPCC Guidelines will be taken into account.
QA/QC procedures	-
Purpose of data	For calculation of CO_2 emission coefficient of diesel in year y as per option B in the Tool to calculate project or leakage emissions from fossil fuel combustion, version 02
Additional comment	

B.7.2. Sampling plan

>>
N/A

B.7.3. Other elements of monitoring plan

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

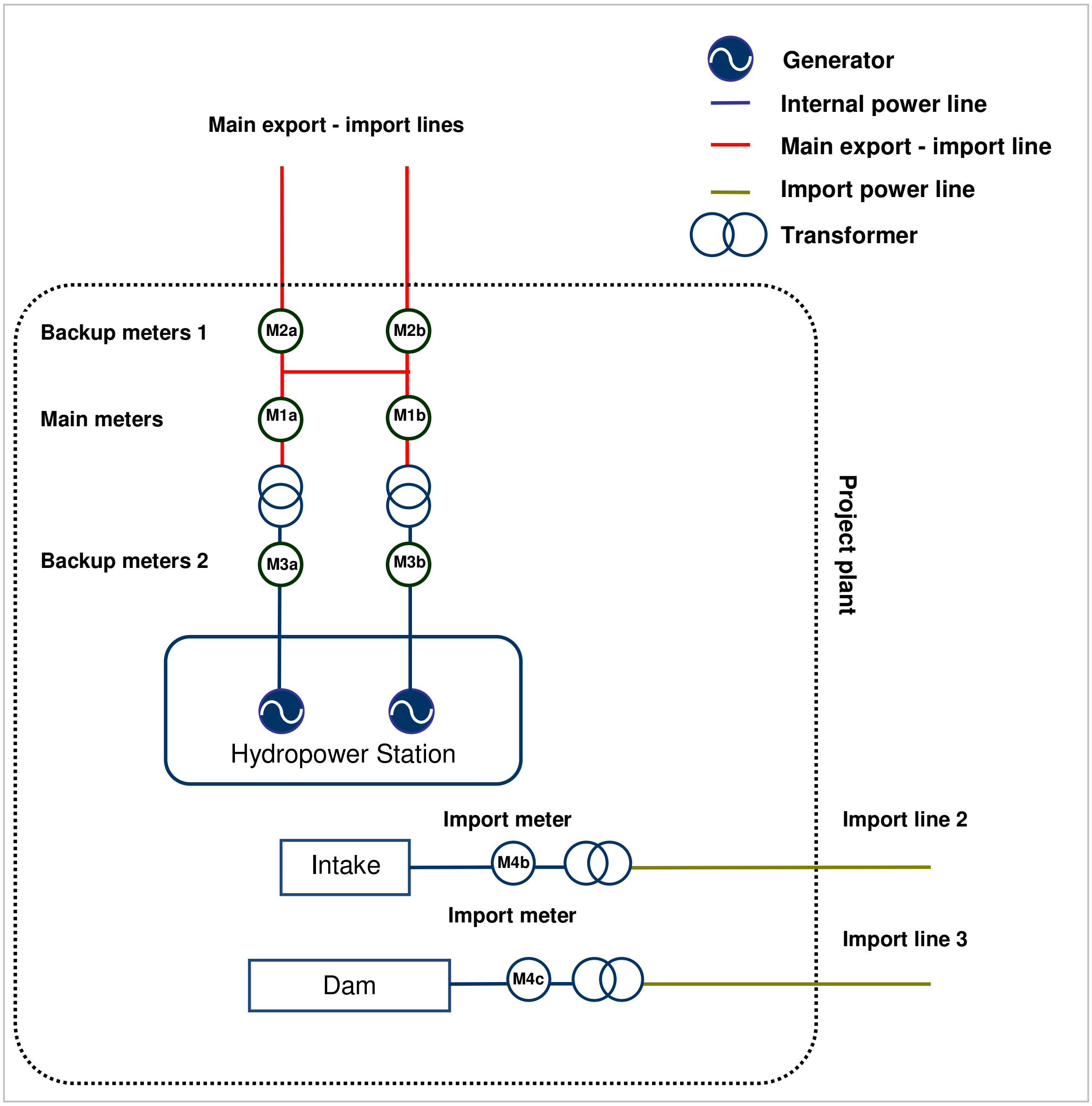
Monitoring of net electricity supplied by the project to the grid ($EG_{facility,y}$):

The proposed project activity is connected to the national electricity grid via two 220 kV transmission lines. The main power supply for the project's own use in powerhouse is from the project's generators. In case the project's generators are not in operation, electricity for internal use in powerhouse is drawn from the 220kV line or an emergency diesel generator. The electricity for

daily operation of dam and intake is drawn from the grid, while the backup electricity is from diesel generators.

An indicative grid connection diagram is provided in Figure B. 3. 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 export - import lines ($EG_{export,y}$):**
  As indicated in Figure B. 3, the electricity generated by the project will be delivered to the grid via two main export - import lines (indicated in red). Electricity supplied to the grid is metered as below:
  - Metering: The electricity supplied to the grid is metered by three set of meters; one main set and two backup sets. Each set consists of two meters. The main set and backup set 1 is located at a point after power has been transformed to high voltage by two transformers at an on-site booster station, the backup set 2 is located before the electricity is transformed to high voltage. The electricity supply by the project to the grid will be metered with standard electricity meters in accordance with national regulations. The meters may record both electricity exported to the grid and electricity imported from the grid via the main export - import lines.
  - Calibration: The relevant regulations require calibration of the metering instruments at least once every two years. Calibrations are carried out at least once every two years by an authorized company in accordance with the relevant national regulations.

- **Power received through import power lines ($EG_{import,y}$):**
  As indicated in Figure B. 3, the project is connected to three import power lines (indicated in brown). The powerhouse might import electricity from the 220kV export – import lines in case of emergencies or when the turbines of the proposed project activity is not in operation. Import line 2 and 3 provide electricity for daily operation of dam and intake. Electricity received from the grid is metered as below:
  - Metering:
    The electricity imported from the grid to the project will be calculated as total of imported electricity metered by main meters and import meters. The meters are in compliance with national industry standard.
  - Calibration:
    Calibrations are carried out at least once every two years by a authorized company in accordance with the relevant national regulations.

Determination of net power supply

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

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

Monitoring of 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.

Monitoring of surface area of the reservoir (A_{PJ}):

The level of the 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 from the design.

Monitoring of quantity of diesel combusted by EDGs ($FC_{diesel,EDGs,y}$):

Diesel will be stored in tanks. A ruler gauge will be employed to each tank to measure the diesel consumption of each emergency diesel generator. The project entity will monthly record the quantity of the diesel oil used for the emergency diesel generator in the operation logs. The consistency of metered diesel consumption quantities will be cross-checked with the diesel purchase records.

Monitoring of net calorific value and weighted average CO_2 emission factor of diesel ($NCV_{diesel,y}$ and $EF_{CO2,diesel,y}$):
The value from the latest version of the IPCC Guidelines will be taken into account.

Data collection
The project entity will collect internal records, sales receipts for power supplied to the grid and billing receipts for electricity 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. All records of generation, electricity 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 the main meter(s) are damaged only, the net supply by the proposed project activity according to the following procedure:

1. The readings logged by the backup meters will be used to determine the net electricity supplied to the grid for the days on which the readings of the main meters are not available or inaccurate.
2. In case both main meters and backup meters are damaged: The project entity and the grid company will jointly calculate a conservative estimate of electricity 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 electricity 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:

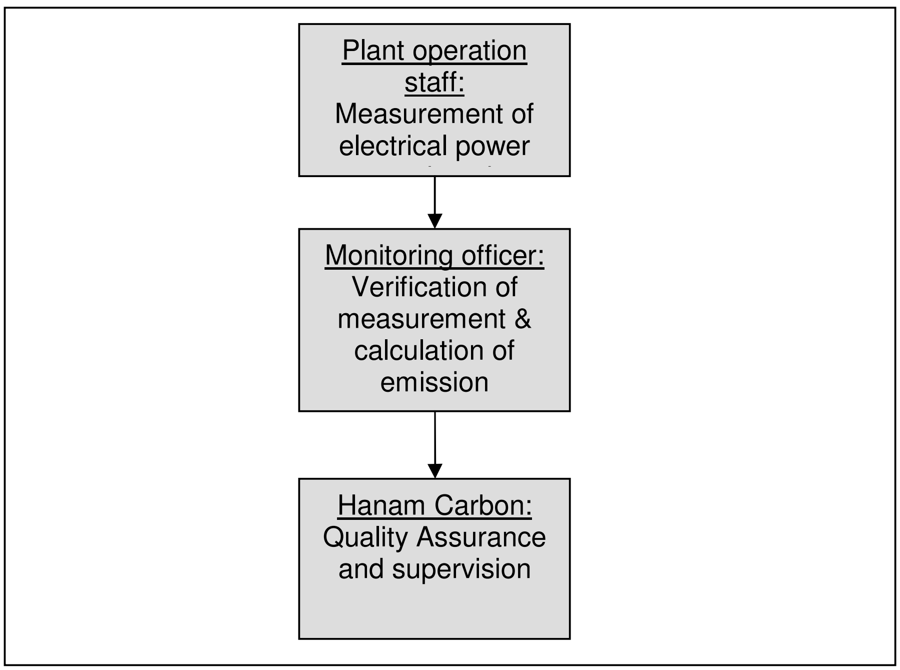
1. The project entity will ensure that all requirements for monitoring of emission reductions have been re-established.
2. The monitoring officer and the head of operations of the hydropower station will both sign a statement declaring the emergency situation to have ended and normal operations to have 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 current CDM advisor, Hanam Environment Consultancy Company Limited ("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 Appendix 5. Finally, the monitoring reports will be reviewed by Hanam Carbon. The figure below show the operation and management structure for monitoring.

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



B.7.4. Date of completion of application of methodology and standardized baseline and contact information of responsible persons/ entities

>>

Date of completion of application of methodology: 22/10/2012

Responsible entity: Hanam Environment Consultancy Co., Ltd ("Hanam Carbon")

Contact persons:

- Mr. Thai Tran, Director, email: thaitran@hanamcarbon.com
- Mr. Hung Vu, Project Manager, email: hungvu@hanamcarbon.com

SECTION C. Duration and crediting period

C.1. Duration of project activity

C.1.1. Start date of project activity

>>
29/06/2007
On this date, the project entity signed the contract for construction of intake, auxiliary tunnel and water tunnel.

C.1.2. Expected operational lifetime of project activity

>>
40 years 00 month

C.2. Crediting period of project activity

C.2.1. Type of crediting period

>>
The chosen type of crediting period is Renewable type. This is the first of three times.

C.2.2. Start date of crediting period

>>
01/02/2013 or the date on which a complete request for registration is submitted, whichever is later.

C.2.3. Length of crediting period

>>
07 years 00 month

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

>>
According to the relevant environmental law and regulations in Viet Nam, two environmental impact assessment (EIA) has been carried out by the Power Engineering and Consulting Joint Stock Company No. 3. In the feasibility study phase, the project's installed capacity was planned as 150 MW. In May 2006, an EIA report was made for impacts by the project of this 150 MW scale, the report was approved by the PPC of Thua Thien Hue on 26/05/2006. In the technical design phase, the project's installed capacity was planned as 170 MW. In June 2009, an additional EIA report was made for the additional impacts by the project. This additional EIA report was approved by the PPC of Thua Thien Hue on 30/06/2009. The impacts and mitigation measures are summarized below:

Air environment
The main pollutants are dust produced in the process of construction preparation, site levelling, explosions, and material transportation. During construction period, the noises and exhaust gases will be mainly produced from construction machines, transportation and explosions.

However these are temporary pollutants in construction period and can be minimized by applying some measures such as: Employing modern and licensed vehicles and machines during the construction period; covering material transportation trucks properly; watering construction site and

transportation roads; avoiding grass and plants burning; informing the time of using dynamite via radio, television and posters; and no dynamite explosions during off-work times

Water environment

During the construction period, the quality of water at the project site will reduce due to wastewater from construction activities and soil erosion, domestic wastewater and decay of vegetation in the reservoir area.

The impacts are minor and mitigation measures will be applied; in rainy season, the construction activities will be arranged to minimize wash-out by rain, concrete block will be used to block the water flow for construction, waste water will be collected to a central place for treating, and oil and lubricant will be stored in a safe place to avoid leakage. The reservoir will be cleared before water storage.

Land environment

The land environment will be affected during the construction period. Domestic waste and construction waste will cause to reduce land quality. Site clearance, levelling and other construction activities will cause to erosion of land surface. The project will temporarily and permanently occupy a certain area of land.

The project owner will carry out the measures to minimize the effects by the project: temporarily occupied land will be recovered after construction activities are completed, tree will be plants, land around the reservoir will be planned to reduce land sliding and aggradations. Local residents with affected land will be compensated in according to applicable local and national regulations.

Ecological environment

The project will have effects on the vegetations, animals and aquatic ecosystem. Vegetations affected by the project include low value species such as grass, bushes, and small areas of natural forest. In the project site there are some types of animal such as birds, reptiles, small animals. None of them is rare animal. The activities in construction period will cause animals living the project area to migrate to neighbour areas. These animals will come back when the affected forest areas are recovered in the operation period. The project will occupy living area of animals in the reservoir area. Water conditions in the project area will change from flowing conditions to stable conditions. This leads to change in living species to stable water species.

The affects of the project to the ecological environment will be minimized by applying measures. The forest around the project site will be protected to avoid chopping down unnecessary forest. Workers in the project site will be educated regarding environment protection. Temporarily affected forest land will be recovered after the construction is finished. Workers will not be allowed to involve in hunting activities around the project site. Wastes will be collected to central places for treatment to minimize effects to the water living environment of aquatic species.

Local socioeconomic environment

Together with investment in the project, infrastructure facilities such as roads, electricity system, water supply system, communication system are constructed by the project owner. These facilities will take part in making the life of local people more convenient. During construction period, a large number of workers will move in to construct the project; together with them are the needs for goods, food and services. This will be the chances for local residents to increase their income. There will be migrations of 201 households. The project owner has built resettlement area for affected households. These households agreed to receive the compensations and moved to the resettlement areas. The compensations are in compliance with applicable local and national rules and regulations.

During construction the project also has negative impacts to the local socioeconomic environment. A number of workers move in the area. Differences in culture and traditions will lead to minor conflicts between these workers and local people. Social evils, labour accidents, fire and explosions are also expected during construction.

However, measures will be applied to minimize these negative impacts. A labour safety unit will be established to monitor the working conditions. Labour regulations will be applied to the construction site. Safety equipment will be equipped. A medical unit will be set up to serve workers and local residents. Traffic signals will be set up where necessary. Dynamite and explosive materials will be stored in safe places.

Transboundary impacts
In addition to EIA reports for impacts in Viet Nam, in March 2006 the project owner also carried out an EIA report for impacts on river part 40 km downstream of A Sap river (survey area) in Laos. The project will have some negative impacts on the environment in Laos. Summary of the impacts is as follow:

<u>Decree in water quality:</u>
During the construction wastewater from workers' daily life and construction activities will flow to the A Sap river to Laos. This will cause to decree the water quality. However, people in the survey area live far from the river and take water from small stream near their places for daily activities. Moreover, the waste water amount from the project is minor in comparison with the A Sap river flow at the dam site; 4 m^3/day in comparison with 19.78 m^3/s. To minimize the impact, the wastewater will be collected to a central place for treatment before discharged to the environment.

<u>Decree in water flow:</u>
In the operation period, part of river flow will be used for electricity generation and then discharged to the Bo river of Viet Nam. However, this part of river flow only account for a minor portion of the river flow in Laos. And the number of vegetation species as well as aquatic species is minor, no migration fish species are found in the river. Therefore the impacts are considered minor. An environmentally safe minimum flow of 1.42 m^3/s will be ensured for the downstream area.

D.2. Environmental impact assessment

>>
The project has no great adverse impact on the local people and environment. The EIA of the Project has been approved by the local government. Strict environmental monitoring and mitigation measures will be carried out during the construction and operation phase of the project. No significant environmental impacts are identified for the project. Please refer to the assessment included in section D.1 above.

SECTION E. Local stakeholder consultation

E.1. Solicitation of comments from local stakeholders

>>
During the project development, different stakeholder consultation meetings were held. Participants were invited by local governments as requests from the project owner. 212 peoples attended these meetings. Participants include local government officers and local residents. Reports of the main comments and outcomes of meetings are summarized in section E.2. Table below provides time, location and number of participants of the meetings:

Table E. 1 Time, location and number of participants in stakeholder consultation meetings

No.	Time	Location	Participants
0	24/08/2005	A Sap village, Hong Thuong commune, A Luoi district	19 + 6
1	25/08/2005	Quang Ngan village, Son Thuy commune, A Luoi district	28
2	25/08/2005	Quang Vinh village, Son Thuy commune, A Luoi district	15
3	26/08/2005	A Den village, Hong Thai commune, A Luoi district	29 + 23
4	26/08/2005	A La and Brah village, Hong Thai commune, A Luoi	9

		district	
5	29/08/2005	Hong Quang commune, A Luoi district	13
6	30/08/2005	Hong Thai commune, A Luoi district	22
7	30/08/2005	Son Thuy commune, A Luoi district	8
8	31/08/2005	Hong Thuong commune, A Luoi district	10
9	01/09/2005	District People's Committee of A Luoi	4
10	14/11/2006	Hong Ha commune, A Luoi district	4
11	26/04/2011	Se Kong province, Laos	22

E.2. Summary of comments received

>>
During stakeholder consultation meetings, the project owner received some comments as follow:

Comments by affected residents and local governments:

- Local residents support the investment in the project by the Central Hydropower Joint Stock Company
- Socioeconomic benefits from the project are remarkable but the project also has negative impacts on local residents. Therefore the compensation package should be reasonable.
- The project owner should inform local residents before carrying out site clearance
- The resettlement area should have facilities such as road, electricity and water and should be suitable for farming
- Affected residents should be moved to resettlement area before site clearance
- Affects by the project should be determined in a transparent manner

Comments by District People's Committee of A Luoi regarding compensation and resettlement:

- The investment in the A Luoi Hydro Power Project was supported by the district and provincial governments.
- A separate compensation board for the project should be established in a way that can meet the project's schedule.
- The district government will work with the project owner to make a compensation plan.
- The project information should be public. Information should be provided to key officers of commune and village governments.
- Rights and benefits of affected residents should be announced via meetings
- The project owner should contact the Natural Resources and Environment Office regarding temporary land transfer to carry out pre-project activities as the project's schedule
- The meeting participants support the indicative compensation plan as follow: The location of centralized resettlement area will be in Hong Van commune; 14 affected households in Son Thuy commune will be relocated to Dong Son commune, commune governments are responsible for arranging resident and farming land for affected households not moving to the centralized resettlement area and the project owner must compensate them with an equivalent compensation package to the others, these households must commit using compensation package to resettle down, not for other purposes.

Comments by representatives of Se Kong province of Laos:

The Se Kong people and government support the construction of A Luoi project on A Sap river in A Luoi district of Thua Thien Hue province, Viet Nam and welcome companies in Thua Thien Hue province to survey and study investment in potential hydropower projects in Ka Lum district of Se Kong province, Laos to improve people's life and promote socioeconomic development in the region.

Overall, the stakeholders support the investment in the project.

E.3. Report on consideration of comments received

>>

The comments by stakeholders are supportive and are addressed in the approved EIA reports. The project owner will take appropriate measures as proposed in the approved EIA reports to minimize the impacts by the project in order to make sure local residents' satisfactory and no extra action will be taken to solve the comments received.

SECTION F. Approval and authorization

>>

At the time of submitting the PDD to the validating DOE for GSC under VVM track, the Host Country Letter of Approval was issued to three entities as:

- Central Hydropower Joint Stock Company,
- Carbon Asset Management Sweden AB, and
- RCEE Energy and Environment Joint Stock Company

However, two of them, Carbon Asset Management Sweden AB and RCEE Energy and Environment Joint Stock Company, have withdrawn from project participants from the proposed project. The proposed project has been further developed by the Central Hydropower Joint Stock Company and Vattenfall Energy Trading Netherlands N.V..

The Viet Nam DNA in its email dated 16/05/2012 has:

- Agreed and acknowledge the voluntary withdrawal of the RCEE Energy and Environment Joint Stock Company and Carbon Asset Management Sweden AB from being project participants to the CDM project activity of A Luoi Hydro Power Project;
- Agreed that Vattenfall Energy Trading Netherlands N.V. has become a project participant to the CDM project activity of A Luoi Hydro Power Project;
- Confirmed the validity of the Letter of Approval No. 113/HTQT dated 13/02/2008 issued by Viet Nam DNA for the CDM project activity of A Luoi Hydro Power Project.

The Letter of Approval from the Annex I country is unavailable at the time of submitting the PDD to the validating DOE.

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Appendix 1. Contact information of project participants and responsible persons/ entities

Project participant and/or responsible person/ entity	☒ Project participant ☐ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	Central Hydropower Joint Stock Company
Street/P.O. Box	Lot 57B, Street No. 6, Da Nang Industrial Zone, Son Tra district
Building	
City	Da Nang
State/Region	
Postcode	
Country	Viet Nam
Telephone	+84 5113703310
Fax	+84 5113935960
E-mail	
Website	www.chp.vn
Contact person	Truong Cong Gioi
Title	General Director
Salutation	Mr.
Last name	Truong
Middle name	
First name	Cong Gioi
Department	
Mobile	
Direct fax	+84 5113935960
Direct tel.	+84 5113703303
Personal e-mail	gioitc@gmail.com

Project participant and/or responsible person/ entity	☒ Project participant ☐ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	Vattenfall Energy Trading Netherlands N.V.
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Building	
City	Amsterdam
State/Region	
Postcode	1096 BA
Country	Netherlands
Telephone	+31 880985455
Fax	+31 880985599
E-mail	

Website	www.vattenfall.com
Contact person	Francisco Grajales
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Salutation	Mr.
Last name	Grajales
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Department	
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Direct fax	+31 880985599
Direct tel.	+31 880985455
Personal e-mail	francisco.grajales@vattenfall.com

Project participant and/or responsible person/ entity	☐ Project participant ☒ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	Hanam Environment Consultancy Co., Ltd ("Hanam Carbon")
Street/P.O. Box	No. 128, 9A street, Trung Son area, Binh Hung ward, Binh Chanh district
Building	
City	Ho Chi Minh
State/Region	
Postcode	
Country	Viet Nam
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E-mail	
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Contact person	Thai Tran
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Salutation	Mr.
Last name	Tran
Middle name	
First name	Thai
Department	
Mobile	+84 (0) 90 3031 083
Direct fax	
Direct tel.	
Personal e-mail	thaitran@hanamcarbon.com

Appendix 2. Affirmation regarding public funding

The project does not receive any public funding.

Appendix 3. Applicability of methodology and standardized baseline

Please refer to section B. 2 of PDD.

Appendix 4. Further background information on ex ante calculation of emission reductions

Below we provide the main data used and the calculation of the baseline emission factor.

I. Calculation of the Operating Margin Emission Factor

Appendix 4 Table 1: IPCC values

Fuel type	Default carbon content (kg/GJ)	Default carbon oxidation factor	Effective CO_2 emission factor (kg/TJ)		
			Default value 3	95% confidence interval	
				Lower	Upper
Gas/Diesel Oil	20.2	1	74.100	72.600	74.800
FO	21.1	1	77.400	75.500	78.800
Anthracite	26.8	1	98.300	94.600	101.000
Bitumen	25.8	1	94.600	89.500	99.700
Natural gas	15.3	1	56.100	54.300	58.300

Appendix 4 Table 2: Low-cost / must run

Year	2004	2005	2006	2007	2008	Average
Generation by hydropower plants (MWh)	17,858,651	16,365,438	19,508,244	22,385,232	25,933,762	102,051,327
Generation by 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 %	39.71%	32.52%	34.13%	33.74%	34.72%	34.77%

Appendix 4 Table 3: Output of power plants (2006-2008)

Power plant group	Fuel consumption (Coal, oil: kton; Gas: mm³)	Electricity supply to grid (MWh)	CO_2 emission (tCO_2)
2006			
Coal thermal power	5,645.86	8,989,230	11,823,610
Gas turbine running by gas	5,743,235.28	18,838,764	12,244,651
Gas turbine running by oil	70.14	233,582	234,927
Waste heat recovery	0	7,470,632	0
Oil thermal power	397.65	1,043,991	1,327,593
diesel generator running by FO	16.60	80,000	51,642
diesel generator running by DO	6.39	25,000	20,495
Import electricity		937,000	0
Total 2006		**37,618,119**	**25,702,918**
2007			
Coal thermal power	6,386.09	9,836,548.00	13,272,897
Gas turbine running by gas	5,910,941.84	20,023,591.00	12,570,669
Gas turbine running by oil	163.27	557,880.00	*545,394*
Waste heat recovery		8,893,447.00	
Oil thermal power	614.06	1,834,409.00	2,046,368
diesel generator running by FO	25.15	104,626.00	79,867
diesel generator running by DO	9.16	42,000.00	29,088
Import electricity		2,629,000.00	
Total 2007		**43,921,501.00**	**28,544,283**
2008			
Coal thermal power	6,483.99	10,055,394.00	13,378,811
Gas turbine running by gas	6,839,114.84	22,396,231.00	14,535,266
Gas turbine running by oil	54.35	183,008.00	181,533
Waste heat recovery		11,277,816.00	1,784,825
Oil thermal power	534.59	1,481,880.00	
diesel generator running by FO	22.48	90,465.00	71,385
diesel generator running by DO	3.73	15,000.00	11,879
Import electricity		3,220,000.00	
Total 2008		**48,719,794.00**	**29,963,699**

Appendix 4 Table 4: OM and total Emission and electricity of the most recent 3 years

Year	Total electricity generation (MWh)	Total emission (tCO_2)	OM_{2008} (tCO_2/MWh)
	A	B	***(ΣB/ΣA)***

2006	37,618,119	25,702,918	
2007	43,921,501	28,544,283	
2008	48,719,794	29,963,699	
Total	**130,259,414**	**84,210,900**	**0.6465**

Sources: The Grid emission factor calculation issued by Vietnamese DNA on 26/03/2010

II. Calculation of the Build Margin Emission Factor

Appendix 4 Table 5: Five most recent power plants

Plant	Commissioning year	Fuel consumption (Coal diesel: k tons Gas: mm^3)		Power supply to grid (MWh)	CO_2 emission (tCO_2)
Five power units started to supply electricity to the grid most recently ($SET_{5-units}$)					
A Vương	2008	HPP		168,103.50	
Tuyên Quang	2008	HPP		1,136,112.18	
Đại Ninh	2008	HPP		1,145,108.50	
Nhơn Trạch	2008	Gas	166.38	544,808.60	378,023
Cà Mau 1&2	2007	Gas	647.24	2,106,807.24	1,431,048
		WHR		2,728,872.00	
Annual electricity generation of $SET_{5-units}$ ($AEG_{SET-5-units}$)				**7,829,812,02**	
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	HPP		168,103.50	
SROC Phu Mieng IDICO	2006	HPP		241,556.00	
SÊ SAN 3A	2006	HPP		394,895.70	
Tuyên Quang	2008	HPP		1,136,112.18	
Đại Ninh	2008	HPP		1,145,108.50	
SÊ SAN 3	2006	HPP		1,131,614.00	
Quảng Trị	2007	HPP		250,804.40	
Uông Bí 2	2007	Coal	281.759	532,000.00	581,017.63
Na Dương	2005	Coal	532	627,930.00	883,846.37
Cao Ngạn	2007	Coal	526	708,693.00	1,081,145.84
Formosa	2004	Coal	495	560,295.00	1,291,302.96
Nhơn Trạch	2008	Gas	166.38	544,808.60	378,023.07
Cà Mau 1&2	2007	Gas	647.24	2,106,807.24	1,431,047.61
		WHR		2,728,872.00	
Phú Mỹ 2,2	2004	Gas	1,159.75	4,141,980.00	2,510,751.14
Đạm Phú Mỹ	2006	Gas	56.15	4,716.00	133,868.48
CÁI LÂN - VINASHIN	2007	FO	22.48	90,465.01	71,384.99
Annual electricity generation of $SET_{\geq 20\%}$ ($AEG_{SET-\geq 20\%}$)				**16,514,761.12**	**8,362,386.09**

Appendix 4 Table 6: Build Margin 2008

Total emission	8,362,386.09 (tCO_2)
Total electricity generation	16,514,761.12 (MWh)
BM_{2008}	**0.5064 (tCO_2/MWh)**

Sources: The Grid emission factor calculation issued by Vietnamese DNA on 26/03/2010

III. Calculation of the Combined Margin Emission Factor

Appendix 4 Table 7: Calculation of the Combined Margin Emission Factor

Emission factor **A**	**Value** (tCO_2/MWh) B	**Weight** **C**	**Weighted value** (tCO_2/MWh) **D = B * C**
EF_{OM}	0.6465	0.5	0.3232
EF_{BM}	0.5064	0.5	0.2532
CM (EF)			**0.5764**

Appendix 5. Further background information on monitoring plan

<u>Selection procedure:</u>
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.

<u>Tasks and responsibilities:</u>
The monitoring officer will be responsible for carrying out the following tasks:

- Supervise and verify metering and recording
  The monitoring 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.

<u>Support:</u>
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.

Appendix 6. Summary of post registration changes

Summary of post registration changes is presented below:

- Corrections:

Parameter	Value in registered PDD version 1.5 dated 22/10/2012	Value in revised PDD version 1.6 dated 01/01/2015	Reason(s) of change
Type of turbine in Table A.1	QF580-WY-160	TIV-disposal of bucket vertical shaft, 6 spray and 6 break	Correction of typo
Purpose of data $EG_{facility,y}$ in Section B.7.1	For calculation of project's emission reductions	For calculation of project baseline emissions	Correction of typo
Unit of $NCV_{diesel,y}$ in Section B.7.1	GJ/m^3	TJ/Gg	Correction of typo
Unit of $EF_{CO2,diesel,y}$ in Section B.7.1	tCO_2/GJ	$kgCO_2/TJ$	Correction of typo

- Permanent changes from registered monitoring plan:

Parameter	Value in registered PDD version 1.5 dated 22/10/2012	Value in revised PDD version 1.6 dated 01/01/2015	Reason(s) of change
Location of meters for monitoring of electricity imports for the powerhouse	Meters M1a, M1b (backed up by M2a, M2b, M3a, M3b) and M4a	Meters M1a and M1b (backed up by M2a, M2b, M3a, M3b)	As agreed in the power purchase agreement for electricity exchange at the powerhouse between the project owner and the grid company

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Document information

Version	Date	Description
05.0	25 June 2014	Revisions to: • Include the Attachment: Instructions for filling out the project design document form for CDM project activities (these instructions supersede the "Guidelines for completing the project design document form" (Version 01.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for the application of the methodology (ies) to the project activity in B.7.4 and Appendix 1; • Change the reference number from *F-CDM-PDD* to *CDM-PDD-FORM;* • Editorial improvement.
04.1	11 April 2012	Editorial revision to change version 02 line in history box from Annex 06 to Annex 06b
04.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the project design document form for CDM project activities" (EB 66, Annex 8).
03.0	26 July 2006	EB 25, Annex 15
02.0	14 June 2004	EB 14, Annex 06b
01.0	03 August 2002	EB 05, Paragraph 12 Initial adoption.

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