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	Khe Bo Hydropower Project
Version number of the PDD	06
Completion date of the PDD	12/03/2015
Project participant(s)	Viet Nam Power Development Joint Stock Company (EVNPD)
Host Party	Viet Nam
Sectoral scope and selected methodology(ies), and where applicable, selected standardized baseline(s)	Energy Industries (renewable energy) ACM0002, version 13.0.0
Estimated amount of annual average GHG emission reductions	242,416 tCO_2

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

>>

The proposed Khe Bo Hydropower Project in Nghe An Province (hereinafter referred to as "the Project") is developed by Viet Nam Power Development Joint Stock Company. Khe Bo Hydropower Project is developed on the Ca River, in Tuong Duong District, Nghe An Province in central Viet Nam.

The project is implemented to generate renewable electricity by utilizing water resource of the Ca River, which will be transmitted to the Viet Nam National Electricity Grid.

The Project is a new-built accumulation reservoir hydropower plant that involves the construction of a dam, intake, penstock, power house, and tailwater. The total installed capacity of the Project is 100 MW and the reservoir surface area at full level of the project is 9.6 km^2. Therefore, the power density is estimated to be 10.4 W/m^2. Annual expected gross electricity generation of the Project is 442,800 MWh for a net[1] annual supply to the Grid of 436,158 MWh. The plant load factor of this project is 50.55%.

Prior to the implementation of the proposed project activity, the electricity that will be supplied by the proposed project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources. The baseline scenario is the same as the scenario existing prior to the implementation of the proposed project activity. In the project scenario, the electricity generated from the Khe Bo HPP (Hydropower Plant) will displace more emission-intensive electricity and will therefore result in a reduction of greenhouse gas (GHG) emissions of approximately 242,416 tCO_2e per annum. The total emissions reduction during the ten years fixed crediting period are 2,424,160 tCO_2e.

The Project satisfies the *sustainability, additionality and feasibility* criteria[2] set by Viet Nam DNA for contributing to sustainable development of Viet Nam (the Host Country).

1. Economic sustainability criteria:

- Stimulating local economy development by providing electricity to meet the increasing energy demand in Nghe An province and in Viet Nam;
- This project, producing clean energy, fits into the development priority of Viet Nam and is encouraged by national policies. Its construction provides local people more job opportunities, improves local economy development and benefits for local government's financial revenue. The project will promote development of local industry and contribute to rural area electrification program.
- Electricity generated from the project will meet the increasing energy demand for production and living purposes in Nghe An province and in Viet Nam. As a result, it will promote the development of local industry and contribute to the rural area electrification program.
- The project will increase local government's financial revenue via taxes, the sale of electricity

2. Environmental sustainability criteria:

- Reduction of air pollution and GHG emissions resulting from the power generation industry in Viet Nam, compared to a business-as-usual scenario;

3. Social sustainability criteria:

[1] Net annual supply is estimated after deducting 1.5% for transmission losses and self-consumption as per revised FSR in Feb 2007

[2] http://www.noccop.org.vn/Data/vbpq/Airvariable_ldoc_40vnThong%20tu%20CDM.doc [3] Sighted during verification site visit and also confirmed by PP. Evidence has been provided to DOE for verification.

- Creating new job opportunities: A large amount of jobs will be created during the project construction and also permanent jobs during the operation period;
- Improved road access as a result of project development and enhanced local transport networks;

Furthermore, the project met the exclusive criteria and priority criteria which resulted in an approval letter from the host country.

A.2. Location of project activity

A.2.1. Host Party

>>
Viet Nam

A.2.2. Region/State/Province etc.

>>

Nghe An Province

A.2.3. City/Town/Community etc.

>>

Tam Quang, Yen Thang, Tam Dinh, Tam Thai, Thach Giam, Xa Luong Communes and Hoa Binh town, Tuong Duong District.

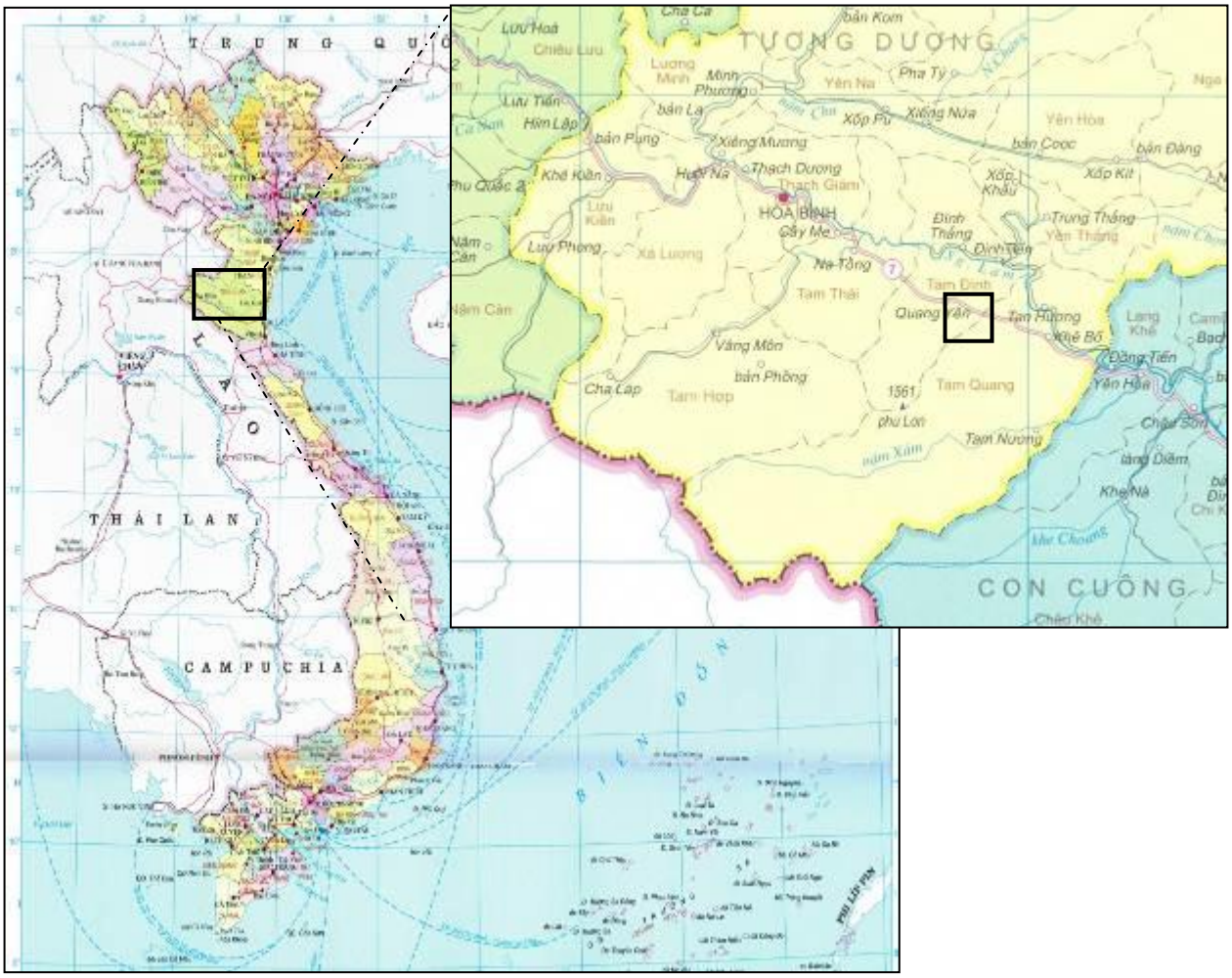
A.2.4. Physical/Geographical location

>>
The main works of the Project as dam and powerhouse are situated in Tam Quang commune, Tuong Duong district, Nghe An Province, Viet Nam. It is approximately 150 km Northwest of Vinh city. Figure below shows the detailed geographical location of the Project site. The project's geographic coordinates are[3]:

- Dam: 104°39'46.74"E or 104.6630 East longitude and 19°10'52.66"N or 19.1813 North latitude
- Power house: 104°39'51"E or 104.6642 East longitude and 19°10'35"N or 19.1764 North latitude.

.

[3] Sighted during verification site visit and also confirmed by PP. Evidence has been provided to DOE for verification.



Legend:

Project Site

Figure 1: Project location in Nghe An province, Viet Nam

A.3. Technologies and/or measures

>>

Prior to the implementation of the project activity, electricity delivered to the Grid would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations desrcibed in the "Tool to calculate the emission factor for an electricity system". The electricity in Viet Nam is generated mainly by firing coal, oil or gas and is solely distributed via the unique national electricity grid that is managed by Electricity of Viet Nam. All fossil-fuel fired power plants connected to the

national grid use oil or coal firing boilers and steam turbines as well gas turbines to generate electricity. During that technology cycle, GHGs are generated. Since hydro power generation technology is a renewable electricity generation technology, which displaces fossil fuel fired power generation technology to supply electricity to the grid, the implementation of this project activity will generate emission reductions.

The baseline scenario is the same as the scenario existing prior to the implementation of the proposed project activity.

The Project is a newly-built accumulation reservoir hydropower plant that involves the construction of a dam, intake, penstock, power house, and tailwater. The total installed capacity of the Project is 100 MW (2 x 50 MW) and the reservoir surface area at full level of the project is 9.6 km^2, therefore the power density can be calculated to be 10.4 W/m^2. Annual expected gross electricity generation of the Project is 442,800 MWh for a net annual supply to the Grid of 436,158MWh. The power generation will be exported to the local grid through the 220 kV transmission line.

The Plant Load Factor was defined as 50.54% by the contracted third party [4] (i.e. Power Engineering Construction Consultant 1 - PECC1) by considering the annual electricity production of the plant are expected to be 442,800 MWh which was indicated in the FSR and also approved by the local authority. Hence, the PLF has been determined in line with the "Guidelines for the reporting and validation of Plant Load Factor", version 01, EB48.

The Project will use state-of-the-art recognised technology in electricity generation and transmission, which is environmentally safe and sound. The essential equipment used in the Project is imported from China and the Project Developer is experienced in handling and operating this kind of equipment.

Table A.4.1: Key technical parameters of the hydro turbine and the generator[5]

Hydro Turbine		Generator	
Turbine Type	Kaplan, vertical axis.	Generator Type	Three phases – synchronous-vertical axis
Max water head	25.90 m		
Rated water head	23.00 m	Rated power	58.82 MVA
Rated output	51.282 MW	Rated speed	125 rpm
Rated speed	125 rpm	Rated power factor cos φ	0.85
Rated flow	243.9 m^3/s	Rated voltage	13.8 kV
Efficiency	93.06 %	Rated frequency	50 Hz
Manufacturer	Zhejiang Fuchunjiang Hydropower Equipment Co., Ltd	Manufacturer	Zhejiang Fuchunjiang Hydro Power Equipment Co., Ltd
Expected lifetime	40 years[6]	Expected lifetime	40 years[7]

The generators are connected to an onsite transformer, which is connected to the Viet Nam National Electricity Grid via a 220kV local transmission line. It is expected that the electricity

[4] The evidence of PLF calculation has been provided to DOE as the supporting document.

[5] Turbine/generator contract signed 18/04/2009 and the nameplate of turbine/generator.

[6] Decision 709/QD-NLDK dated 13th April 2004

[7] Decision 709/QD-NLDK dated 13th April 2004

generated by the Project will be measured at two agreed connection points for two generator units separately[8] with identical power meters. Locations of the first meter (main meter) and the second meter (back up meter) are at the connection point, where the electricity generated by the Project will be connected to the Viet Nam National Electricity Grid.

A.4. 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)
Viet Nam (host)	Viet Nam Power Development Joint Stock Company	No

A.5. Public funding of project activity

>>

No public funds from Annex I countries is involved in this project.

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

B.1. Reference of methodology and standardized baseline

>>

Applied methodology:

- Version 13.0.0 of ACM0002: "Consolidated baseline methodology for grid-connected electricity generation from renewable sources"

Related tools:

- Version 2.2.1 of the "Tool to calculate the emission factor for an electricity system"
- Version 07.0.0 of the "Tool for the demonstration and assessment of additionality"

The methodology and the related tools are available on the UNFCCC website:

http://cdm.unfccc.int/methodologies/DB/UB3431UT9I5KN2MUL2FGZXZ6CV71LT

B.2. Applicability of methodology and standardized baseline

>>

The proposed project activity meets the applicability conditions of the methodology ACM0002 version 13.0.0 as follows:

Table B.2.1: Comparison of project's characteristics and eligibility criteria of Version 13.0.0 of ACM0002

Applicability conditions in Version 13.0.0 of ACM0002	Characteristics of the project activity	Applicability criterion met?
This methodology is applicable to grid-connected renewable power generation project activities that: (a) install a new power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (green field plant); (b) involve a capacity addition; (c) involve a retrofit of (an) existing plant(s); or (d) involve a	The project activity consists in the installation of a new grid connected renewable power plants at a site where no renewable power plant was operated prior to the implementation of the project activity (green field plant)	Yes

[8] Following Power Purchase Agreement signed on 20/06/2013 between PP and EVN.

replacement of (an) existing plant(s).		
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 the installation of new hydropower plant.	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 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.;	The project activity is the installation of new hydropower plant.	Not applicable
In case of hydro power plants, one of the following conditions must apply: • The project activity is implemented in an existing single or multiple reservoir, with no change in the volume of any of reservoirs; or • The project activity is implemented in an existing single or multiple reservoirs, where the volume of any of reservoirs is increased and the power density of each reservoir, as per the definitions given in the project emissions section, is greater than 4 W/m^2; or • The project activity results in new single or multiple reservoirs and the power density of each reservoir, as per the definitions given in the project emissions section, is greater than 4 W/m^2.	• The project activity constructs a new single reservoir. • The project activity constructs a new single reservoir. • The power density of the single reservoir is 10.4W/m^2.	Not applicable Not applicable 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; • Multiple reservoirs and hydro power plants located at the same river and where are designed together to function as an integrated project that collectively constitute the generation capacity of the combined power plant; • Water flow between multiple reservoirs is not used by any other hydropower unit	The project activity uses a single reservoir	Not applicable

which is not a part of the project activity; • 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 15 MW; • Total installed capacity of the power units, which are driven using water from reservoirs with power density lower than 4 W/m^2, is less than 10% of the total installed capacity of the project activity from multiple reservoirs.		
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.	Yes
This methodology is not applicable to the biomass fired power plants;	The project activity is a hydropower plant.	Yes
This methodology is not applicable to hydro power plant that results 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 Khe Bo Hydropower Project is 10.4W/m^2; it is above 4 W/m^2.	Yes
In the case of retrofits, replacements, or capacity additions, this methodology is only applicable if the most plausible baseline scenario, as a result of the identification of baseline scenario, is "the continuation of the current situation, i.e. to use the power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance".	The project activity is the installation of new hydropower plant.	Not applicable
In addition, the applicability conditions included in the tools referred to above apply:	**Related tools:** • The applicability conditions of the "Tool to calculate the emission factor for an electricity system" are further discussed in section B.6. • The applicability conditions of the "Tool for the demonstration and assessment of additionality" are further discussed in section B.5.	Yes

B.3. Project boundary

As per methodology ACM0002 (Version 13.0.0), the spatial extent of the project boundary includes the project power plant (including the 220kV substation the Project is connected to) and all power plants physically connected to the electricity system, i.e. the Vietnamese National Electricity Grid.

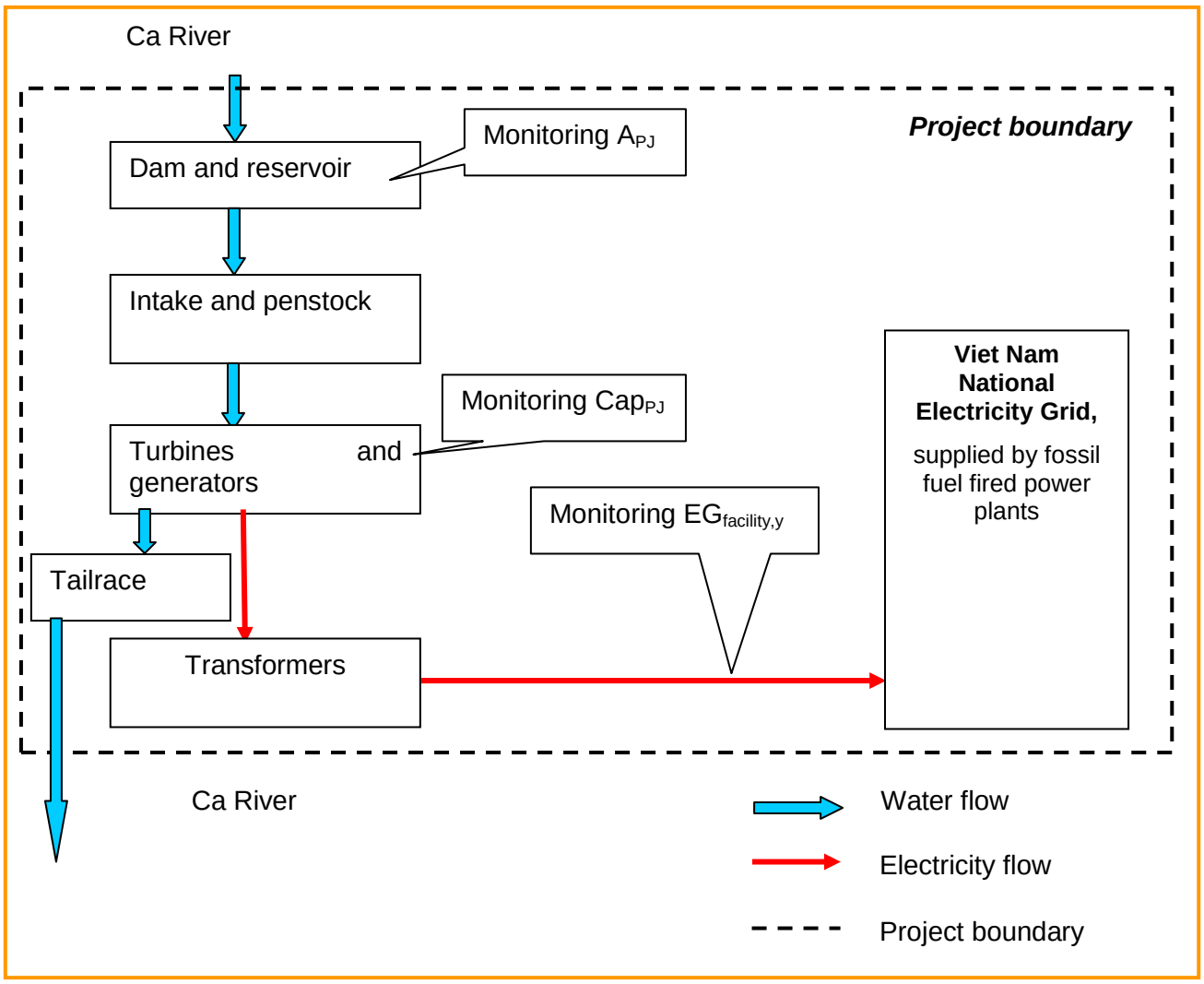


Figure B.3.1: Project Boundary

The emission sources and GHGs in the project boundary are as follows:

Table B.3.1: Emission resources and gases

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 resource
		CH_4	No	Minor emission resource
		N_2O	No	Minor emission resource
Project scenario	Emissions of CH_4 from the reservoir	CO_2	No	As per ACM0002 CO_2 project emissions are not to be considered
		CH_4	No	As the power density[9] of the Project is 10.4W/m^2 which is greater than 10W/m^2, thus, as per ACM002 Version 13.0.0, emissions of CH_4 from the reservoir are considered as zero.
		N_2O	No	As per ACM0002, N_2O project emissions are not to be considered

B.4. Establishment and description of baseline scenario

>>

According to ACM0002 Version 13.0.0 for a new grid-connected hydropower project, in the baseline scenario, the electricity delivered to the national grid by the project would have otherwise been generated by the operation of grid connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the "*Tool to calculate the emission factor for an electricity system*" in B.6.1.

The Viet Nam national electricity grid, which is operated and monopolized by the Vietnam Electricity (EVN) and is the unique transmission and distribution line, to which all power plants in Viet Nam are physically connected is the project electricity system.

Thus the baseline scenario of the proposed project is the delivery of equivalent amount of annual power output from the Viet Nam national grid to which the proposed project is also connected. The database for calculating the baseline is provided by the DNA of Viet Nam.

The analysis and description in B5 and B.6 will support the baseline scenario shown above.

B.5. Demonstration of additionality

>>

Prior Consideration of CDM

The major milestones in developing the investment project and CDM application are summarized in the below table.

Table B.1.1: The timeline of the milestone of the proposed project

Date	Event	Remark
20/10/2005	Completion of First Feasibility Study Report	

[9] The power density of the project activity is calculated as indicated the methodology ACM0002 version 13.0.0

	(FSR)	
30/07/2006	Completion of Environment Impacts Assessment Report (EIA)	
13/09/2006	EIA approval	
18/01/2007	Minutes of Meeting on CDM with CERtech Environment Inc	CDM early consideration
22/02/2007	Revised FSR updating Financial Analysis values and including CDM revenues	CDM awareness and early consideration
02/04/2007	Acquisition of Project Approval	Issuance by Ministry of Industry (MoI) based on both the first FSR in 2005 and the revised FSR in 2007 submissions as indicated in Appendix of Approval
12/04/2007	Board meeting on CDM consideration	CDM awareness and early consideration
18/04/2007	**Board decision on the CDM development**	**Date of making investment decision**
03/07/2007	CDM stakeholder consultation meeting	CDM early consideration
08/08/2007	Investment License Issuance	
12/09/2007	Consultancy Agreement between the PO and Certech Environment Inc. for finding a CER Buyer and ERPA negotiation	CDM early consideration
05/10/2007	**Project construction start up**	**Starting date of Project activity**
08/11/2007	ERPA signed with Certech Environment Inc.	Continuing and real actions were taken to secure CDM status
08/03/2008	Bank loan agreement	
31/07/2008	Nghe An Province People Committee sent a CDM development supporting letter to the DNA Viet Nam	Continuing and real actions were taken to secure CDM status
17/03/2009	DNA Viet Nam issued PIN Approval letter	Continuing and real actions were taken to secure CDM status
18/04/2009	Equipment contract was signed	
22/01/2010	CDM development agreement for Khe Bo project was signed	Continuing and real actions were taken to secure CDM status
25/02/2010	ERPA signed with another CER Buyer.	Continuing and real actions were taken to secure CDM status
17/02/2011	GSC PDD was uploaded	Continuing and real actions were taken to secure CDM status
31/01/2012	The LoA from host country was issued	Continuing and real actions were taken to secure CDM status

The Project starting date is 5 October 2007, which is defined as the date of signing the first construction contract. According to the table above, the Board investment decision has been made based on the approval FSR which seriously considered the CDM revenues as decisive investment values. It could be demonstrated that the CDM benefit was a decisive factor in the decision to proceed with Project implementation, and the awareness of CDM prior to the Project start date..

Besides, the gap between actions was less than 2 years so it could be proved that the continuing and real actions were taken to secure CDM status for the project in parallel with its implementation.

In conclusion, the prior consideration of the CDM was seriously taken into account when developing of this proposed project according to the "Guidelines on the demonstration and assessment of prior consideration of the CDM" Version 04, EB 62, Annex 13.

Additionality

According to the Approved methodology ACM0002, the additionality of the Project is demonstrated by using the latest version of the *Tool for the Demonstration and Assessment of Additionality*- version 07.0.0 approved by the CDM EB. This tool provides a step-wise approach to demonstrate and assess additionality. These steps include:

Step 0: Demonstration whether the proposed project activity is the first-of-its-kind

This step is not applied to the project activity since it is not first-of-its-kind, hence the additionality of the project will be demonstrated in next steps below.

Step 1. Identification of alternatives to the project activity consistent with current laws and regulations Define realistic and credible alternatives to the project activity(s) through the following sub-steps:

Sub-Step 1a: Define alternatives to the project activity

According to the Validation and Verification Manual (version 01.2): "Para.105: The PDD shall identify credible alternatives to the project activity in order to determine the most realistic baseline scenario, unless the approved methodology that is selected by the proposed CDM project activity prescribes the baseline scenario and no further analysis is required.", there is no need to further analyze alternatives to the project activity to assess and demonstrate the additionality, since the methodology ACM0002 prescribes the baseline scenario for the proposed project as below:

- In case the project activity involves the installation of a new grid-connected renewable power plant/unit, the baseline scenario is the following:

  Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system".

For this reason, two following alternatives are listed for consideration.
Alternative 1: the project activity undertaken without being registered as a CDM project activity, and

Alternative 2: the continuation of the current situation, in this case the project activity will not be constructed and the equivalent annual power output will be supplied by the Viet Nam National Electricity Grid.

Sub-step 1b: Consistency with mandatory laws and regulations*:*

The alternative 1 is consistent with mandatory laws and regulations in Viet Nam. This is evidenced by issuance of investment license for this project on 08 August 2007 by Provincial People' Committee which grants the project owner to invest the project activity.

The alternative 2 "continuation of the current situation" does not face any impediment from the current laws and regulations since it is the "do-nothing" alternative: the electricity delivered to the Grid by the Project would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources. The project owner of this project is under no obligation to invest or build a power plant to supply the electricity for local area. This alternative, therefore, is consistent with mandatory laws and regulations.

Step 2. Investment analysis

The purpose of this step is to determine whether the proposed project activity is economically or financially less attractive than other alternatives without additional CDM funding. The investment analysis was conducted in the following steps:

Sub-step 2a. Determine appropriate analysis method

The proposed project activity generates financial and economic benefits other than CER revenues, so the simple cost analysis (Option I) is not applicable. Because the alternative for the project activity identified above is supplying electricity from the grid, according to the paragraph 19 of Guidelines on the Assessment of Investment Analysis - Version 05, Annex 5, EB 62 "If the alternative to the project activity is the supply of electricity from a grid this is not to be considered an investment and a benchmark approach is considered appropriate" thus, the benchmark analysis (Option III) is chosen to prove additionality.

Sub-step 2b Option III. Apply benchmark analysis

As per the "Tool for the demonstration and assessment of additionality" and its annex "Guidance on the Assessment of Investment Analysis", "*local commercial lending rates are appropriate benchmarks for a project IRR*". Thus the project developer selected the Local Commercial Lending Rate in Viet Nam at the time the decision was made to proceed with the project implementation (in 2007) as the benchmark. This lending rate is from local commercial banks and applicable for all sectors.

At the time of decision making on 18/04/2007, the State Bank of Viet Nam's prime interest rate was 8.25% (decision No. 632/QĐ-NHNN dated 29th March, 2007[10]). According to the country's civil code (Civil law no. 33/2005/QH11, dated 14/06/2005) commercial banks may charge up to 150% of the prime lending rate, which equal 12.375%. Moreover, at the time of decision making, the lending rate as published by the IMF was 13.7%[11] - higher than 12.375%. For these reasons, the selected benchmark of 12.375% can be considered applicable and conservative.
According to the guidelines on the Assessment of Investment Analysis (version 05), EB 62 Report Annex 5, "Taxation should only be included as an expense in the IRR calculation in cases where the benchmark or other comparator is intended for post-tax comparisons". Hence the project participants calculated the project IRR (before tax) for comparison with the selected benchmark and assessment of the additionality.

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

Based on the above-mentioned benchmark and calculation, a financial indicator has been computed and compared with the chosen benchmark.

All input parameters have been sourced from the Financial Analysis chapter (the revised FSR was prepared in February, 2007 and the investment decision project as CDM project was made on 18 April, 2007, based on this Analysis). Since the time elapsed between the updated FSR preparation date and the Board Meeting date (in which serious consideration of CDM benefits was made), is only two months, the input parameters used in the FSR were valid and applicable at the time of investment decision.

The investment estimation is based on the feasibility study report, which was carried out by an independent organisation; national regulations and other data sources are listed below.

Table B.5.2: Key parameters to calculate the financial indicators of the Project

Items	Unit	Value	Data sources

[10] http://www.sbv.gov.vn/

[11] http://www.imf.org/external/pubs/ft/scr/2007/cr07386.pdf

Installed capacity	MW	100	Revised FSR in Feb 2007
Net electricity generation	MWh	436,158	Net annual supply is estimated after deducting 1.5% for transmission losses and self-consumption from the annual total electricity generation of 442,800 MWh (which was taken from FSR and also consistent with the number given in the Investment license for the proposed project)
Total investment cost	10^9 VND	2,146.928	Revised FSR in Feb 2007 (not included VAT and the interest cost during construction period)
Project lifetime	Year	40	Decision No.709/QD-NLDK
Electricity tariff	VND/kWh	677	Revised FSR in Feb 2007. The average tariff assumed in the FSR investment analysis is 677 VND/kWh or 4.21 US cents/kWh, which is consistent with the tariff range set by the Decision 709/QD-NLDK Ministry of Industry for similar projects (i.e. 2.5 - 4.5 US cent/kWh for dry season and 2.0 - 4.3 US cent/kWh for rainy season)
Natural resources royalties rate	%	2	Circular No.05/2006/TT-BTC
Natural resources royalties fee	VND/kWh	700	Circular No.05/2006/TT-BTC
Annual O&M cost rate	%	0.5	Decision No 709/QD-NLDK
Exchange rate	VND/USD	16,120	Published by State bank of Vietnam on 18 April 2007
Exchange rate	VND/EUR	21,619.08	Published by State bank of Vietnam on 18 April 2007 (downloaded)[12]
Annual estimated CERs	tCO_2e/year	242,416	Project Emission Reduction Spread sheet
Pre-tax Project IRR without CDM	**%**	**11.12**	**Calculated**

Based on the above assumptions, the pre-tax projects IRR is 11.12% without CER sales revenues and lower than the benchmark of 12.375%. Therefore, the Project is not financially attractive without considering CDM revenues.

Sub-step 2d. Sensitivity analysis

In order to test the robustness of the conclusion from the investment analysis, a sensitivity analysis has been conducted by subjecting critical parameters to a reasonable variation as required by the "Tool for demonstrating and assessing the additionality" (Version 07.0.0,). The following parameters are considered in the sensitivity analysis of the project activity:

- Total investment cost
- Annual O&M cost
- Electricity tariff
- Net electricity generation

Table below shows the impact of variations in key factors on the Project IRR considering a ±10% variation in the parameters.

[12] http://www.sbv.gov.vn/wps/portal/vn

Table B.5.3: Sensitivity analysis

No	Parameter	Variation	Project IRR	Likelihoods to happen
1	Net electricity generation	11.91%	12.375%	According to the FSR, the variation of electricity generation is mainly subject to the water resources of the project site. It is very unlikely for the electricity generation of the project to increase more than 11.91% because electricity generation was estimated according to the historical hydrology data[13] for 44 years (1960~2003). It is concluded that, according to the hydrological condition, it is not possible to reach an 11.91% annual increase compared with the current estimation for the entire crediting period.
		10.00%	12.18%	Lower than the benchmark.
		-10.00%	10.03%	Lower than the benchmark
2	Total investment cost	10.00%	10.17%	Lower than the benchmark
		-10.00%	12.25%	Lower than the benchmark
		-19.10%	12.375%	The total investment cost of the project activity was estimated by the third party and then approved by the local government so it was reflected the real material cost, equipment cost, labour cost, etc. at time of preparing the FSR. The probability of a 19.10% decrease in the total investment cost is not likely to happen because the inflation, average consumer prices[14] in 2008, 2009, 2010, 2011 and 2012 show an annual increase of 24%, 15%, 9%, 6.5% and 6% respectively. Besides, the actual contracted cost for construction and equipment (till to 2010 year) is 29.9% higher than estimation in FSR. And actually the project activity is still under construction, so the actual investment cost is likely going up. Hence a reduction in the investment cost is very unlikely occurred.
3	Annual O&M cost	10.00%	11.08%	Lower than the benchmark
		-10.00%	11.16%	Lower than the benchmark
		-100.00%	11.519%	Even when the annual O&M cost is zero (or reducing by 100%), the IRR still lower than the benchmark, therefore this option shall be discarded as unrealistic.
4	Electricity tariff	11.67%	12.375%	The probability of an 11.67% increase in feed in tariff annually is very unlikely because following the In principle power purchase agreement (Pre-PPA) dated 12/10/2007, the tariff of Khe Bo has been assumed as in the range of 3.7 to 4.5 US cent/kWh following Decision 2014/QD-BCN dated 13/06/2007. Moreover, even the tariff applying for the project is maximum value as of 4.5 US cent/kWh (or 725.4 VND/kWh, equivalent to 7.15% increased),

[13] The historical hydrology data has been provided to the validation team during desk review

[14] http://www.imf.org/external/pubs/ft/weo/2008/02/weodata/weoreptc.aspx?sy=1980&ey=2013&scsm=1&ssd=1&sort=country&ds=.&br=1&c=582&s=PCPIPCH&grp=0&a=&pr1.x=77&pr1.y=10

				the IRR of the project would still be lower than benchmark. Hence, it is highly unlikely that power tariff would increase of approximate 11.67%.
		10.00%	12.20%	Lower than the benchmark
		-10.00%	10.01%	Lower than the benchmark

Outcome of Sub-step 2: the sensitivity analysis shows that the project is not economically and financially attractive, without the revenues from the sale of CERs. The project thus faces significant economic and financial barriers without CDM support.

Step 3. Barrier analysis
This step is not applied.

Step 4 Common practice analysis
According to point 4.5.1 of the "Tool for the demonstration and assessment of additionality", version 07.0.0, since the project activity applies the measure that is listed in the paragraph 13.b.ii, then the latest version of the "Guidelines on common practice" available on the UNFCCC website shall be applied. Hence, following the "Guideline on Common practice", version 02.0, EB 69, the project activity falls in the type of "Switch of technology with or without change of energy source including energy efficiency improvement as well as use of renewable energies" which listed in the para 2 of the Guideline. The following step- wise approach shall be applied to the common practice analysis for the proposed project.

Step 1: Calculate applicable output range as+/-50% of the design output or capacity of the proposed project activity.

The proposed project activity has the installed capacity of 100 MW.

Hence the applicable output range of +/-50% of the capacity of the proposed project activity is defined from 50 MW to 150 MW.

Step 2: Identify similar projects (both CDM and non-CDM) which fulfill all of the following conditions:

(a) The projects are located in the applicable geographical area;

The applicable geographical area for the proposed project is the whole host country (Viet Nam).

(b) The projects apply the same measure as the proposed project activity;

The proposed project activity is a power generation based on renewable hydrological energy. As per the definition of "Measure" prescribed in the "Guidelines on common practice" (version 02.0), all projects of power generation based on renewable energy are considered.

(c) The projects use the same energy source/fuel and feedstock as the proposed project activity, if a technology switch measure is implemented by the proposed project activity;

The proposed project activity uses hydropower resource and hence only hydropower generation projects indicated in step (b) above are considered.

(d) The plant in which the project are implemented produce goods or services with comparable quality, properties and application areas (e.g. clinker) as the proposed project plant;

The proposed project activity only generates electricity. All hydropower projects indicated in step (c) with electricity generation are considered.

(e) *The capacity or output if the project is within the applicable capacity or output range calculated in Step 1;*

Installed capacity from 50 MW to 150 MW as assessed in step 1 are considered.

(f) *The project started commercial operation before the project design document (CDM-PDD) is published for global stakeholder consultation or before the start date of proposed project activity, whichever is earlier for the proposed project activity.*

Since the PDD of the proposed project published for global stakeholder consultation was 17/02/2011 which was later than the start date of the project on 05/10/2007. Hence the common practice analysis will include all hydro power projects (CDM and non CDM) as the same measure, same energy source as the proposed project activity within the applicable output range determined in Step 1 and that have started commercial operation before the start date of the project activity on 05/10/2007. The list of projects included in the analysis can be found in table B.5.4.

Table B.5.4: List of relevant plants for common practice analysis[15]

No	***Name***	***Capacity MW***	***CDM applied (Yes/No)***	***Commissioning year***	***Investor during the investment and construction period***
0	The proposed project	100	Yes	2013	Viet Nam Power Development Joint Stock Company (private entity)
1	*Thac Ba*	*120*	*No*	*1972*	*EVN[16]*
2	*Vinh Son*	*66.0*	*No*	*1994*	*EVN[17]*
3	*Thac Mo*	*150.0*	*No*	*1995*	*EVN[18]*
4	*Song Hinh*	*70.0*	*No*	*2000*	*EVN[19]*
5	*Can Don*	*77.6*	*No*	*January 2004*	*Song Da Corporation[20]*
6	*Se San 3A*	*108.0*	*No*	*May 2007*	*Song Da Corporation[21]*

[15] Information on Power Plants connected to the national electricity grid issued by the Institute of Energy in Aug 2008.

[16] http://www.thacba.evn.com.vn/CategoryPages/2/121/Lich-su-phat-trien.aspx

[17] http://www.vinacorp.vn/stock/hose-vsh/thuy-dien-vinh-son-sh

[18] http://www.tmhpp.com.vn/Home/Detail/tabid/84/ItemId/781/View/2/CateId/40/language/vi-VN/Default.aspx

[19] http://www.vinacorp.vn/stock/hose-vsh/thuy-dien-vinh-son-sh

[20] http://www.sudicosd.com.vn/news.aspx?cate0=478&cate1=495&id=338

[21] http://thuvienphapluat.vn/arc hive/Quyet-dinh/Quyet-dinh-898-QD-TTg-dau-tu-Du-an-thuy-dien-Se-San-3A-vb17481t17.aspx

7	*Srokphu Mieng*	*51.0*	*No*	*December 2006*	*Vietnam Urban and Industrial Zone Development Investment Corporation*[22]

Step 3: Within plants identified in Step 2, identify those that are neither registered CDM project activities, project activities submitted for registration, nor project activities undergoing validation. Note their number N_{all}

Out of 07 hydropower projects in the list above, there is no CDM project in the list identified in Step 2, hence $N_{all} = 7$.

Step 4: within similar project identified in Step 3, identify those that apply technologies that are different to the technology applied in the proposed project activity. Note their number N_{diff}

According to the Guideline EB69, Annex 8, different technologies are technologies that deliver the same output and differ by at least one of the following: (i) energy source/fuel; (ii) feed stock; (iii) size of installation (power capacity); (iv) investment climate in the date of the investment decision; (v) other features (unit cost of output).

As per investment climate, the guidance further distinguishes between the following (inter alia):

- Access to technology;
- Subsidies or other financial flows;
- Promotional policies;
- Legal regulations;

The following differences are identified between the proposed project and the projects listed in table 10:

- *Projects number 1, 2, 3 and 4* were constructed before the issuance of the Government Decree No 45/2001/ND-CP on power generation and consumption on 2 August 2001 that created a legal basis to allow private entities to invest in and generate electricity rather than only state-owned entities. Before that time, all power plants have been invested from the state budget sources and operated by state owned companies. Hence, these hydropower projects having started the construction activities before August 2001 enjoyed different investment climate from the proposed project.

  Moreover, above hydropower plants were invested and operated by EVN subsidiaries where EVN Corporation was kept as majority shareholder enable to control over with more than 60% of shares[23] at each company. Meanwhile, the proposed project is initially invested by Viet Nam Power Development Joint Stock Company which is a private company with only 20% of shares from EVN[24]. In other words, the investments made by state-owned enterprises under EVN like the project No. 1, 2, 3 and 4 have the objective to benefit the state and are often not primarily based on the direct financial merits of the company. This is inherently different from the objectives of private entities that primarily pursue profits over the benefits to the nation as a whole.

Therefore, the projects number 1, 2, 3, 4 are applied different technologies from the proposed project according to the paragraph 4 (d) of the "*Guidelines on common practice*" Version 02, EB 69, Annex 08.

[22] http://www.idico-udico.com.vn/partners/en/detail/Vietnam-Urban-and-Industrial-Zone-Development-Investment-Corporation--IDICO-/20090929/2.html

[23] The shareholder information of Thac Ba hydropower Joint stock company; Thac Mo hydropower Joint stock Company; Vinh Son & Song Hinh hydropower Joint stock Company.

[24] Viet Nam Power Development Joint Stock Company 's Business License

- *Project number 5:* The Can Don hydropower is invested by Song Da Corporation within Build Operate and Transfer mechanism, the first BOT[25] to be implemented so project received certain support mechanism from the government such as EPC contractor, taxes exemption... And beyond the production and supplying to the grid purpose, project will help to assure water supply for 4.800 ha agricultural land of the district at the downstream and regulatory on domestic and industrial water for Binh Phuoc, Binh Duong and Ho Chi Minh[26].
- *Project number 6:* The project Se San 3A is invested by the state budget under a preferable condition to access the loan (loan source is assigned by the government). In particular, the Se San 3A project can take a loan up to 82.3% of the total investment cost[27] so it is less risky than the proposed project which loan amount can only be 70% as maximum. Moreover, the project owner is Song Da Corporation, belonging to the Ministry of Construction has been constructing many large scale hydropower plants since 1990s like Hoa Binh (1,920 MW), Yaly (720 MW), Tri An (400 MW), Thac Ba (108 MW). Therefore, they have substantial experiences compared to the project owner of proposed project in designing, investing, constructing and operating hydropower plants, which has invested only 2 small scale projects (Nam Ma 3.2MW, Bac Binh 3.2MW) and one large scale project of Khe Bo 100MW[28]. It can be concluded that the projects No.5 & 6 applied different technology from the proposed project according to the paragraph 4 (d) of the "*Guidelines on Common Practice*" Version 02, EB 69, Annex 08.
- *Project number 7* was invested by Vietnam Urban and Industrial Zone Development Investment Corporation, state-owned company belongs to Ministry of Construction receiving preferential interest [29] from state owned budget for the investment and government guarantee[30] as well for a foreign loan from China Export-Import Bank that is a serious facilitation for securing the investment. In term of construction, they have substantial experiences in designing, investing, constructing and operating hydropower plants and this project that is different from the project owner of the proposed project is a private entity that does not have such important role and rich experience. In conclusion, the projects No. 7 applies different technology from the proposed project according to the paragraph 4 (d) of the "*Guidelines on Common Practice*" Version 02, EB 69, Annex 08.

Hence N_{diff} = 7.

Step 5: Calculate factor $F=1-N_{diff}/N_{all}$ representing the share of similar projects (penetration rate of the measure/technology) using a measure/technology similar to the measure/technology used in the proposed project activity that deliver the same output or capacity as the proposed project activity.

As shown in the previous steps:

F = $1-N_{diff}/N_{all}$ =1-7/7= 0;
$N_{all}-N_{diff}$ = 7 – 7 = 0.
Because F < 0.2 and $N_{all}-N_{diff}$ < 3 the proposed project is not common practice within a sector in the applicable geographical area, and the proposed project shall be deemed additional according the tool for the demonstration and assessment of additionality.

[25] http://vietbao.vn/Kinh-te/Du-an-BOT-dau-tien-cua-nganh-thuy-dien/10741209/87/

[26] http://www.vncold.vn/Web/Content.aspx?distid=124

[27] Section III.1 of http://www.kiemtoannn.gov.vn/website/db_images/documents/20.%20Du%20an%20thuy%20dien%20Se%20san%203A.doc

[28] http://vnpd.com.vn/index.php/dau-tu-phat-trien

[29] http://www.sggp.org.vn/thongtincanuoc/nam2005/thang12/82144/

[30] http://www.vanbanphapluat.com/danh-muc-van-ban-phap-luat.html?view=doc&id=50989

B.6. Emission reductions

B.6.1. Explanation of methodological choices

>>

In accordance with ACM0002 (Version 13.0.0), the emission reductions attributable to the proposed project activity during any given year (y) are calculated as the difference between the Baseline Emissions (BE_y), Project Emissions (PE_y) and emission due to leakage (L_y)in that year.

Project Emissions

As per methodology ACM0002 (Version 13.0.0) the project emissions are calculated using the following formula:

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

Where:

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

$PE_{FF,y}$ = Project emissions from fossil fuel consumption in year y (tCO_2/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 hydro power plants in year y (tCO_2e/yr)

Project emissions from fossil fuel consumption

The proposed project activity does not use fossil fuel, even in case of startup, maintenance or emergency, electricity is imported from the grid, Therefore $PE_{FC,j,y} = 0$.

Project emissions from the operation of geothermal power plants

The proposed project activity is not a geothermal power plant, $PE_{GP,y} = 0$.

Project emissions from water reservoirs of hydro power plants

For hydropower project activity that results in new single or multiple reservoirs and/or the increase of single or multiple existing reservoirs, the power density (*PD*) of the project activity shall be calculated as follows:

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

Where:

PD = Power density of the project activity, in 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 hydro power plants, this value is zero.

A_{PL} = Area of the single or multiple reservoirs measured in the surface of the water, after the implementation of the project activity, when reservoir is full(m^2)

A_{BL} = Area of the single or multiple reservoirs 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.

(a) If the *PD* is greater than 4 W/m^2 and less than or equal to 10 W/m^2:

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

Where:

$PE_{HP,y}$ Emission from reservoir expressed as tCO_2e/year (tCO_2/year)

EF_{Res} is the default emission factor for emissions from reservoirs, and the default value as per EB23 is 90 Kg CO_2e /MWh.

TEG_y Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year *y* (MWh).

(b) If *PD* is greater than 10 W/m^2, then:

$PE_{HP,y} = 0$

Because the proposed project is the hydropower project activity that results in new single reservoir, therefore the project emission for the Hydropower project is:

$PE_y = PE_{HP,y}$

Where:

$PE_{HP,y}$: Emission from reservoir (tCO_2/year) = *0 (tCO_2e/yr)*

The project has an installed capacity of 100 MW, and a single reservoir water surface area of 9.6 km^2.

The power density of the single reservoir of the proposed project is:

$$PD = \frac{100{,}000{,}000W - 0W}{9{,}600{,}000m^2 - 0m^2} = 10.4W / m^2$$

The power density is greater than 10 W/m^2, according to Version 13.0.0 of ACM0002, the project emission from reservoir is zero:

$PE_{HP,y} = 0$;
or
$PE_y = 0$

Baseline Emissions

As per methodology ACM0002, the baseline emissions are calculated using the following formula:

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

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 $EG_{PJ,y}$

As the project activity is the installation of a new grid-connected renewable power plant/unit at a site where no renewable power plant was operated prior to the implementation of the project activity then

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

Where:

$EG_{PJ,y}$ The 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)

$EG_{facility,y}$ The quantity of net electricity generation supplied by the Project activity to the grid in year *y* (MWh/yr).

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

The combined margin CO_2 emission factor for grid connected power generation ($EF_{grid,CM,y}$) is calculated in accordance with the latest version of "Tool to calculate the emission factor for an electricity system" (Version 2.2.1), hereinafter referred to as the "Tool", as follows:

Step 1: Calculation of the emission factor for the electricity of Viet Nam electricity Grid
The baseline emission factor ($EF_{grid,CM,y}$) is calculated as the combined margin, consisting of the combination of Operating margin ($EF_{grid,OM,y}$) and Build margin ($EF_{grid,BM,y}$) factors calculated using version 2.2.1 of the "*Tool to calculate the emission factor for an electricity system*" as follows.

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

STEP 1. Identify the relevant electricity systems

Determination of project electricity system
Because the Viet Nam DNA has not published a delineation of the project electricity system and connected electricity, the national grid can be applied by default as per Tool.

Determination of electricity imports

The Viet Nam national grid imports electricity from China's power grid. The emission factor for imported electricity[31] is considered as 0 tons CO_2 per MWh.

STEP 2. Choose whether to include off-grid power plants in the project electricity system (optional)
This step offers two options to calculate the operating margin and build margin emisison factors and project participants may choose between the following two options:

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

Option I is selected for calculation of the emission factor: Only grid power plants are included in the calculation.

STEP 3. Select a method to determine the operating margin (OM).
The "Tool to calculate the emission factor for an electricity system" offers four methods to calculate the OM emission factor (EFgrid,OM,y):

1 Simple OM, or
2 Simple adjusted OM, or
3 Dispatch Data Analysis OM, or
4 Average OM.

Of these procedures, Option (a) (Simple OM) is applied. This is because low-cost/must-run resources constitute less than 50% of total grid generation in average of the five most recent years. The hydropower plants are low cost operation power plants and the Grid Emission Factor Study Report issued by Viet Nam DNA on 26/03/2010 shows that all hydropower plants are excluded in calculation of simple OM. Accordingly, the rate of low cost/must run resources from 2004 to 2008 is determined as follows:

Table B.6.1: Rate of low cost/must-run sources based on electricity generation[32]

[31] "*Tool to calculate the emission factor for an electricity system*". Version 02.2.1, EB 63 Annex 19

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

The "Tool" offers the choice between two data vintages to calculate the Simple OM emission factor ($EF_{grid,OMsimple,y}$):

- *Ex-ante* option: A 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation, without requirement to monitor and recalculate the emissions factor during the crediting period; or
- *Ex-post* option: The year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring.

The simple OM emission factor is calculated *ex-ante* using the data from 2006, 2007 and 2008 available in the Grid Emission Factor Study Report issued by Viet Nam DNA in March 2010. This data vintage remains unchanged during the crediting periods.
As power plants registered as CDM project activities are only hydropower projects[33], they are excluded from calculating simple OM.

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

The simple OM emission factor is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all generating power plants serving the system, not including low-cost/must-run power plants units. It may be calculated:

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

Option A has been selected as the required data is available for Viet Nam. Under this option, the simple OM emission factor is calculated based on the net electricity generation of each power unit and an emission factor for each power unit, as follows:

$$\mathrm{EF}_{\mathrm{grid,OMsimple,y}} = \frac{\sum_{m} EG_{m,y} . EF_{\mathrm{EL,m,y}}}{\sum_{\mathrm{m}} \mathrm{EG}_{\mathrm{m,y}}}$$

Where:

$EF_{grid,OMsimple,y}$	Simple operating margin CO_2 emission factor in year y (tCO_2/MWh)
$EG_{m,y}$	Net electricity generated and delivered to the grid by power plant/unit *m* in year *y (*MWh)
$EF_{EL,m,y}$	CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)

[32] Grid Emisison Factor Study Report issued by Viet Nam DNA in March 2010 http://www.noccop.org.vn/Data/vbpq/Airvariable_ldoc_vnHe%20so%20phat%20thai%202008.pdf)

[33] UNFCCC website

m	All power plants/units serving the grid in year *y* except low-cost/must-run power plants/units
y	The relevant year as per the data vintage chosen in Step 3

Under Option A, $EF_{EL, m,y}$ is determined using one of the following 3 sub-options:

- Option A1: if data on fuel consumption and electricity generation is available for relevant power units.
- Option A2: if only data on electricity generation and the fuel types is available.
- Option A3: to be used if only data on electricity generation is available.

Option A1 is the most appropriate one because data on fuel consumption and electricity generation is available in the data source provided by Viet Nam DNA.

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

Under Option A1, the emission factor for each power unit ($EF_{EL,m,y}$) is determined as follows:

$$\mathrm{EF}_{\mathrm{EL,m,y}} = \frac{\sum_i FC_{i,m,y} \times NCV_{i,y} \times EF_{\mathrm{CO2,i,y}}}{EGm,y}$$

Where:

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

Based on data vintage for 2006-2008 with net electricity output, amount of fossil fuel consumption and NCV value of fossil fuel used by each power plant and based on the IPCC CO_2 emission factor for fossil fuels at lower limit of the uncertaintyat the 95% confidence interval, the $EF_{grid,OM,y}$ has been calculated as below:

Table B.6.2: Total emissions and power output of the most recent available 3 years

Year	2006	2007	2008	Total
Total output (MWh)	37,618,119	43,921,501	48,719,874	**130,259,494**
Total Emission (tCO2e)	24,806,935	27,558,493	28,924,142	**81,289,570**

So $EF_{grid,OMsimple,y}$ is derived as follows:

$$EF_{grid,OM,y} = \frac{(24{,}806{,}935 + 27{,}558{,}493 + 28{,}924{,}142)}{(37{,}618{,}119 + 43{,}921{,}501 + 48{,}719{,}874)} = 0.6241$$

$EF_{grid,OM,,y}$ = 0.6241 tCO_2**/MWh**

For details to refer to Annex 3

STEP 5. Calculate the Build margin (BM) emission factor .

The Emission Factor Tool allows project participants to choose between two options to calculate the build margin emission factors. **Option 1 is selected**: "*For the first crediting period, calculate the build margin emission factor ex ante based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period*".

According to the Emission Factor Tool, the sample group of power units m used to calculate the build margin should be determined as per the following procedure, consistent with the data vintage selected above:

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

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

(c) From $SET_{5\text{-units}}$ and $SET_{\geq 20\%}$ select the set of power units that comprises the larger annual electricity generation (SET_{sample});

Identify the date when the power units in SET_{sample} started to supply electricity to the grid. If none of the power units in SET_{sample} started to supply electricity to the grid more than 10 years ago, then use SET_{sample} to calculate the build margin.

Table below shows recently built power plants of the National Power Grid.

Table B.6.3: Overview of most recently-built power units

Plant	**Commissio n-ing year**	**Fuel consumption (Coal diesel: k tons Gas: mm^3)(*)**		**Power supply to grid (MWh)(**)**	**CO_2 emission (tCO_2)**
A Vuong	2008	HPP		168,103.50	
Tuyen Quang	2008	HPP		1,136,112.18	
Dai Ninh	2008	HPP		1,145,108.50	
Nhon Trach	2008	Gas	166.38	544,808.60	365,894
Ca Mau 1&2	2007	Gas	647.24	2,106,807.24	1,385,309
		WHR		2,728,872.00	
Sub-total of generation by 5 most recently built power units				**7,829,812.02**	
A Vuong	2008	HPP		168,103.50	
SROC Phu Mieng IDICO	2006	HPP		241,556.00	
SE SAN 3A	2006	HPP		394,895.70	
Tuyen Quang	2008	HPP		1,136,112.18	
Dai Ninh	2008	HPP		1,145,108.50	
SE SAN 3	2006	HPP		1,131,614.00	
Quang Tri	2007	HPP		250,804.40	

Uong Bi 2	2007	Coal	281,759	532,000.00	559,172
Na Duong	2005	Coal	532	627,930.00	850,615
Cao Ngan	2007	Coal	526	708,693.00	1,040,511
Formosa	2004	Coal	495	560,295.00	1,221,712
Nhon Trach	2008	Gas	166,38	544,808.60	365,894
Ca Mau 1&2	2007	Gas	647,24	2,106,807.24	1,385,309
		WHR		2,728,872.00	
Phu My 2,2	2004	Gas	1,159,75	4,141,980.00	2,430,192
Dam Phu My	2006	Gas	56,15	4,716.00	129,573
CAI LAN - VINASHIN	2007	FO	22,48	90,465.01	69,633
Total of generation of the most recently built power units that comprise at least 20% of the system generation				**16,514,761.12**	**8,052,610**

(*) and (**) Data source: grid emission factor issued by DNA 26-Mar-2010

So the sample group of power units used to calculate the build margin is $SET_{\geq 20\%}$ and none of the power units in $SET_{\geq 20\%}$ started to supply electricity to the grid more than 10 years ago.

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

Where:

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

The CO_2 emission of most recent built Power plants is calculated based on the available data of net output electricity, fuel consumption, NCV of fuel used to generate electricity and based on IPCC data of CO_2 emission factor for fossil fuels at lower limit of the uncertainty at the 95% confidence interval.

Calculation of the BM emission factor is presented in Table below:

Table B.6.4: Build Margin emission factor 2008

Year	Unit	2008
Total electricity delivered to the grid by group of power units	MWh	16,514,761.12
Total emission of group of power units	tCO_2e	8,052,610

The BM emission factor is calculated as follows:

$$EF_{grid,BM,y} = \frac{8,052,610}{16,514,761.12}$$

$EF_{grid,BM,y}$= 0.4876 tCO_2e/MWh.

For details to refer to Annex 3.

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 baseline (CM) emission factor

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

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

The weighted average CM method (option A) should be used as the preferred option.

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

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

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

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

Where:

$EF_{grid,BM,y}$	=	Build margin CO_2 emission factor in year y (tCO_2/MWh)
$EF_{grid,OM,y}$	=	Operating margin CO_2 emission factor in year y (tCO_2/MWh)
W_{BM}	=	Weighting of operating margin emissions factor (%)
W_{BM}	=	Weighting of build margin emissions factor (%)

According to the latest version of "*Tool to calculate the emission factor for an electricity system*", W_{OM} = 0.5 and W_{BM} = 0.5 in the crediting period.
The baseline emission factor of Viet Nam National Grid ($EF_{grid,CM,y}$) is fixed ex-ante as follow:

$EF_{grid,CM,y}$ = 0.5×0.6241 + 0.5×0.4876 = 0.5558 tCO_2/MWh

Leakage (L_y)
According to ACM0002, Version 13.0.0 leakage do not need to be considered, therefore ***Ly = 0***.

Emission reductions (ER_y)
The emission reductions (ER_y) by the Project activity during a given year *y* is the difference between baseline emissions (BE_y) and project activity emissions (PE_y):

$$ER_y = BE_y - PE_y \quad \text{(Equation 11 of the methodology ACM0002 Version 13.0.0)}$$

Where

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

B.6.2. Data and parameters fixed ex ante

Data / Parameter	**Cap_{BL}**
Unit	W
Description	Installed capacity of the hydro power plant before the implementation of the project activity. For new hydro power plants, this value is zero.
Source of data	-

Value(s) applied	0
Choice of data or Measurement methods and procedures	The Project activity involves the construction of a new hydropower plant, therefore, according to Version 13.0.0 of ACM0002, the value of Cap_{BL} is zero.
Purpose of data	
Additional comment	-

Data / Parameter	**A_{BL}**
Unit	m^2
Description	Area of the single or multiple reservoirs measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m^2). For new reservoirs, this value is zero
Source of data	-
Value(s) applied	0
Choice of data or Measurement methods and procedures	The Project activity involves the construction of a new reservoir, therefore, according to Version 13.0.0 of ACM0002, the value of A_{BL} is zero.
Purpose of data	
Additional comment	-

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	Data is provided by DNA Viet Nam.
Value(s) applied	The value of fossil fuel consumed to generate electricity by power plants supplied to national grid in year of 2006, 2007 and 2008 used in the project calculation is referred to Annex 3
Choice of data or Measurement methods and procedures	As per the "Tool to calculate the emission factor for an electricity system": The amount of fossil fuel type j consumed by power plant/unit m has been adopted from official publication No 151/KTTVBDKH on Grid Emission Factor Study Report issued by Viet Nam DNA dated 26th March 2010.
Purpose of data	
Additional comment	For calculation of EF_{OM} or EF_{BM}

Data / Parameter	**$NCV_{i,y}$**
Unit	GJ / mass or volume unit
Description	Net calorific value (energy content) of fossil fuel type *i* in year *y*
Source of data	Data is provided by DNA Viet Nam.
Value(s) applied	The NCV value of specific fossil fuel used to generate electricity at power plants supplied to national grid in year of 2006, 2007 and 2008 is referred to the official document No 151/KTTVBDKH on Grid Emission Factor Study Report issued by Viet Nam DNA dated 26th March 2010.(Annex 3)

Choice of data or Measurement methods and procedures	As per the "Tool to calculate the emission factor for an electricity system": NCV of specific fossil fuel used has been adopted from official publication No 151/KTTVBDKH on Grid Emission Factor Study Report issued by Viet Nam DNA dated 26th March 2010, which has been analyzed and provided by each power plant.
Purpose of data	
Additional comment	For calculation of EF_{OM} or EF_{BM}

Data / Parameter	$\mathbf{EF_{CO2,i,y}}$
Unit	tCO_2/GJ
Description	CO_2 emission factor of fossil fuel type *i* in year *y*
Source of data	IPCC default values at the lower 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	Value applied in Annex 3
Choice of data or Measurement methods and procedures	This data is the best data available as no reliable regional or national emission factor data or values provided by the fuel supplier could be obtained.
Purpose of data	
Additional comment	For calculation of EF_{OM} or EF_{BM}

Data / Parameter	$\mathbf{EG_{m,y}}$
Unit	MWh
Description	Net electricity generated and delivered to the grid by power plant *m* in year *y*
Source of data	Data is provided DNA Viet Nam.
Value(s) applied	The value of net electricity generated by power plants supplied to national grid in year of 2006, 2007 and 2008 used in the project calculation is referred to Annex 3
Choice of data or Measurement methods and procedures	As per the "Tool to calculate the emission factor for an electricity system": The electricity generation has been adopted from official publication No 151/KTTVBDKH on Grid Emission Factor Study Report issued by Viet Nam DNA dated 26th March 2010.
Purpose of data	
Additional comment	For calculation of EF_{OM} or EF_{BM}

Data / Parameter	$\mathbf{EF_{grid,BM,y}}$
Unit	tCO_2/MWh
Description	Build Margin Emission Factor for the Viet Nam electricity grid
Source of data	Ex-ante calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (see Annex 3)
Value(s) applied	0.4876

Choice of data or Measurement methods and procedures	Build Margin emission factor was calculated from data source provided by Viet Nam DNA in accordance with the latest version of Tool to calculate emission factor for an electricity system. This data is the best data available and has been provided by the national utility EVN.
Purpose of data	
Additional comment	

Data / Parameter	**$EF_{grid,OM,y}$**
Unit	tCO_2/MWh
Description	Operating Margin Emission Factor for the Viet Nam electricity grid
Source of data	Ex-ante calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (see Annex 3)
Value(s) applied	0.6241
Choice of data or Measurement methods and procedures	Operating Margin emission factor was calculated from data source provided by Viet Nam DNA in accordance with the latest version of Tool to calculate emission factor for an electricity system. This data is the best data available and has been provided by the national utility EVN.
Purpose of data	
Additional comment	

Data / Parameter	**$EF_{grid,CM,y}$**
Unit	tCO_2/MWh
Description	Combined Margin Emission Factor for the Viet Nam electricity grid connected power generation in year *y* calculated using the latest version of the "Tool to calculate the emission factor for an electricity system"
Source of data	Calculated ex-ante based on the available data from Grid Emission Factor Study Report issued by Viet Nam DNA dated 26th March 2010 as per "Tool to calculate the emission factor for an electricity system"
Value(s) applied	0.5558
Choice of data or Measurement methods and procedures	Combined Margin emission factor was calculated from data source provided by Viet Nam DNA in accordance with the latest version of Tool to calculate emission factor for an electricity system.
Purpose of data	
Additional comment	

B.6.3. Ex ante calculation of emission reductions

>>

1. Project emissions

As described in part B.6.1, the project emissions PE_y= 0 tCO_2e/yr

According to the ACM0002 Version 13.0.0, the TEG_y parameters only applicable to hydro power project activities with a power density of the project activity (PD) greater than 4 W/m^2 and less than or equal to 10 W/m^2. Since the Project's power density is greater than 10 W/m^2 TEGy is not monitored.

2. Baseline emissions

The baseline emissions (BEy) are the product of the baseline emissions factor ($EF_{grid,CM,y}$) calculated above, times the net electricity supplied by the project activity to the national grid ($EG_{facility,y}$, as per the formulae given below:

$$BEy = EG_{facility,y} \times EF_{grid,CM,y}$$

Where:

$EG_{facility,y}$:	=	Electricity supplied by the Project to the grid	= 436,158 (MWh)
$EF_{grid,CM,y}$	=	Combined margin CO_2 emission factor for grid connected power generation in year *y*	= 0.5558 (tCO_2/MWh**)**

Therefore:

BE_y = 242,416 (tCO_2/yr)

3. Leakage

As described in part B.6.1, the leakage of the Project (L_y) is 0 tCO_2e.

4. Emission reductions

Emission reductions of the Project activity is calculated by using the formula 11 of the ACM0002 Version 13.0.0, as follows:

$ER_y = BE_y - PE_y$ = 242,416 tCO_2e/yr

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

>>

The estimated emission reduction of the project activity is provided in Table below.

Table B.6.5: Emission reduction of the project activity

Year	Baseline emissions (t CO_2e)	Project emissions (t CO_2e)	Leakage (t CO_2e)	Emission reductions (t CO_2e)
2013 (from Apr to Dec)	181,812	0	0	181,812
2014	242,416	0	0	242,416
2015	242,416	0	0	242,416
2016	242,416	0	0	242,416
2017	242,416	0	0	242,416
2018	242,416	0	0	242,416
2019	242,416	0	0	242,416
2020	242,416	0	0	242,416
2021	242,416	0	0	242,416
2022	242,416	0	0	242,416
2023 (from Jan to Mar)	60,604	0	0	60,604
Total	**2,424,160**	**0**	**0**	**2,424,160**
Total number of crediting years	**10**			
Annual average over the	**242,416**	**0**	**0**	**242,416**

crediting period				

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

Data / Parameter	**$EG_{facility, y}$**
Unit	MWh/yr
Description	Net electricity supplied by the proposed hydropower plant to the national grid
Source of data	Electricity meter(s)
Value(s) applied	436,158
Measurement methods and procedures	The following parameters shall be measured: (i) The quantity of electricity supplied by the project plant/unit to the grid ($EG_{ex,y}$); (ii) The quantity of electricity delivered to the project plant/unit from the grid ($EG_{im,y}$) $EG_{facility, y}$ will be calculated by subtracting $EG_{im,y}$ from $EG_{ex,y}$. The net amount of power supplied to the grid by the project will be continuously measured by power meters and monthly recorded and double checked by EVN and Project owner to ensure the consistency. Data will be archived within the crediting period and 2 years after the end of the crediting period.
Monitoring frequency	Continuously measured and at least monthly recording
QA/QC procedures	Cross check measurement results with records for sold electricity The net supply of power to the grid by the proposed project activity is measured through national standard electricity metering instruments. The measurement of electricity will be in accordance with the following standard *"Decision 02/2007/ QD-BCN (Ministry of Industry) standard IEC 62053-22"*[34].
Purpose of data	Calculation of baseline emissions
Additional comment	For CERs calculation The calibration and accuracy of the power meters has been indicated in Section B.7.2 below.

Data / Parameter	**Cap_{PJ}**
Unit	W
Description	Installed capacity of the hydro power plant after the implementation of the project activity.
Source of data	Project site
Value(s) applied	100,000,000
Measurement methods and procedures	Determine the installed capacity based on the recognized standards yearly.
Monitoring frequency	Yearly
QA/QC procedures	The capacity of the turbines is to be checked with reference to the specification from the equipment supplier
Purpose of data	
Additional comment	Refer to B.7.2. Description of the monitoring plan

[34] Decision No. 02/2007/QD-BCN dated 9th Jan. 2007 issued by Ministry of Industry

Data / Parameter	A_{PJ}
Unit	m^2
Description	Area of the single or multiple reservoirs measured in the surface of the water, after the implementation of the project activity, when the reservoir is full
Source of data	Project site
Value(s) applied	9,600,000
Measurement methods and procedures	Measured from topographical surveys, maps, satellite pictures, etc
Monitoring frequency	Yearly
QA/QC procedures	-
Purpose of data	
Additional comment	Refer to B.7.2. Description of the monitoring plan

B.7.2. Sampling plan

>>

Not applicable.

B.7.3. Other elements of monitoring plan

>>

The monitoring plan will be made in accordance with the methodology; the Project Owner will be responsible for the implementation of the monitoring plan. The data that is required to be monitored is described in section B.7.1.

This section details the steps taken to monitor on a regular basis the GHG emission reductions from the Khe Bo Hydropower Project. The Monitoring Plan for this project has been developed to ensure that from the start, the project is well organized in terms of the collection and archiving of complete and reliable data.

1. Monitoring organization

1.1. Operational and Management Structure

The project owner has a dedicated Technical Department, which is responsible for the installation, maintenance and calibration of all meters. In addition, the project owner will allocate specific responsibilities as described below.

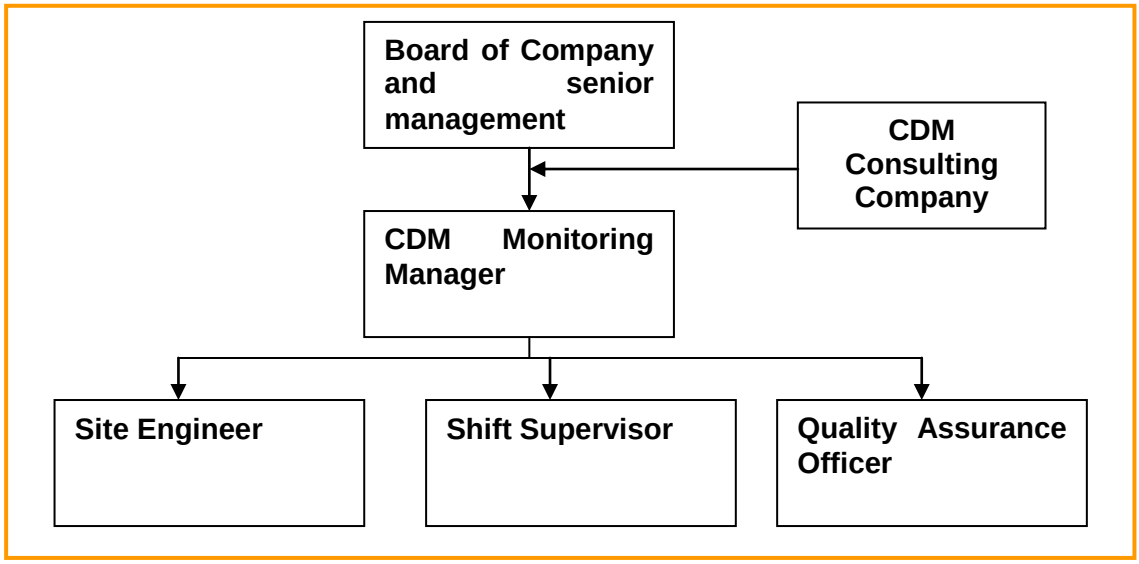


Figure 3: Operational and Management Structure

Table 2: Monitoring responsibility

Position	Outline of Responsibilities	Reporting
CDM Monitoring Manager	• Ensures ongoing compliance with the CDM monitoring plan; • Supervises meter calibration requirements and preparation of the meter calibration report; • Reviews and approves quarterly metered net electricity generation reports; • Oversees the collection, recording and storage of data; • Calculates Emission Reductions; • Prepares the CDM Monitoring Report; • Prepares Baseline Emission Factor report at the end of each crediting period.	Reports to senior management and the Board of the Company
Site Engineer	• Responsible for the completeness and reliability of the data; • Responsible for carrying out meter calibration; • Generates quarterly metered net electricity generation reports.	Reports to the CDM Monitoring Manager (for CDM purposes only)
Shift Supervisor (Shift Based)	• The person appointed for each shift must be an experienced officer involved in the operation and maintenance of the hydro power plant; • Responsible for monitoring hourly measurements, generating daily reports, and ensuring that meters are functioning correctly.	Reports to the Site Engineer
Quality Assurance Officer	• Undertakes regular internal audits of the project; • Ensures compliance with Company Quality Assurance Procedures.	Reports to senior management

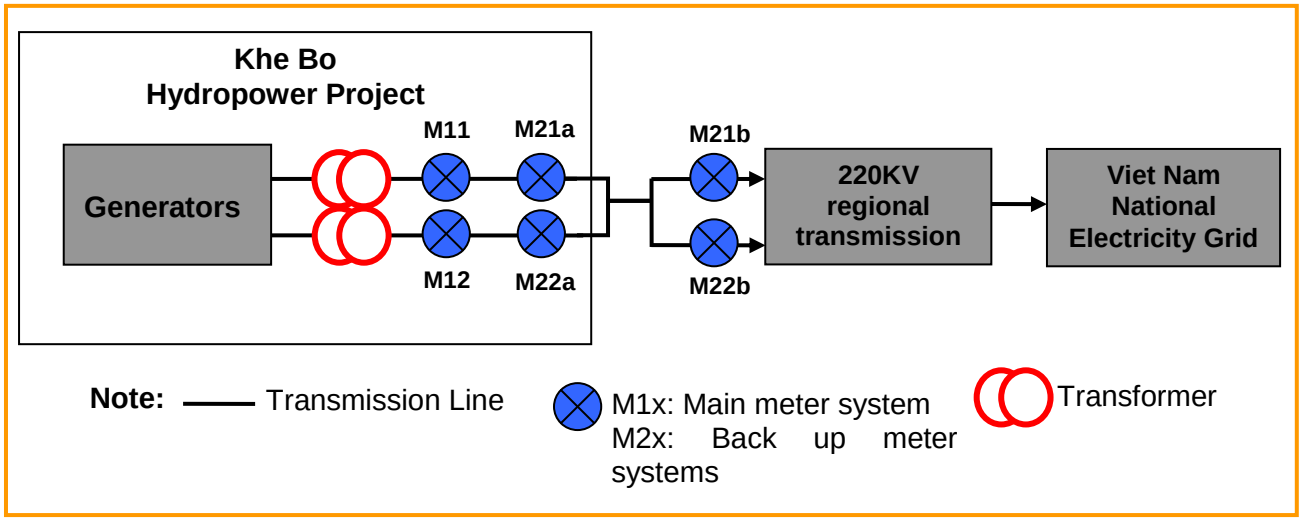
1.2 Training

All persons that are involved in the CDM monitoring will receive appropriate training to be conducted by the project owner in association with a CDM consulting company. The training will provide an overview of the CDM and will cover all elements of the monitoring plan in detail. A copy of the project monitoring manual will be distributed to all training participants, and an additional copy will be easily accessible at appropriate locations on site.
The electromechanical equipment supplier will provide technical training with respect to assembly, start-up, operation, maintenance and/or repair of the electrical and mechanical equipment. This forms part of the contract terms for equipment supply.

2. Monitoring data

2.1. Installation of monitoring equipment

The specification of energy meters installed in the project shall comply with Technical Specification of Energy Metering (Decision No. 02/2007/QD-BCN dated 9th Jan. 2007 issued by Ministry of Industry) with accuracy class of 0.2s for main meters complied with international standard IEC 62053-22 and accuracy class 0.5s for the backup meters complied with international standard IEC 62053-22. The energy metering will be properly configured, and the metering equipment shall be checked by both the project owner and the grid company before operation.
Below is the layout of the monitoring systems in the project:



Where:
M1x: including M11 and M12 such main meters for Unit 1 and Unit 2 respectively and separately.
M2x: including M21a and M22a such backup meters No.1 for Unit 1 and unit 2 respectively and separately; and M21b and M22b such backup meters No.2 for both Unit 1 and unit 2.

Figure 4: Monitoring layout[35]

2.2. Net electricity supplied to the Grid by the Project

The net electricity, which is the difference between the measured quantities of the grid electricity export ($EG_{ex,y}$) and import ($EG_{im,y}$), delivered to the grid by the project activity will be monitored by main meters (M1x) installed at the booster station. The main meters are bidirectional meters, and the accuracy will be no less than 0.2s [36]. These meters reading records will be the basis of CER estimation. The monthly electricity sale receipt mentioning the export and the import will be provided by the grid company to the project owner to cross-check the CER calculation.

[35] The monitoring system has been changed in number of meters according to EVN's requirement, as indicated in Power Purchase Agreement signed between PP and EVN on 20/06/2013.

[36] Decision No 02/2007/QD-BCN

Additionally, the backup meters (M2x) with the accuracy class of no less than 0.5s [37] will also be installed by the PP at the substation alongside the main meters. Both the main meters and the backup meters will be capable of measuring the exported electricity from the project activity to the grid and the imported electricity to the project activity from the grid. The data recording for both the main and backup meters will be recorded simultaneously. The detailed monitoring procedures of measuring electricity supplied to the grid by the project will be established later between the project owner and the grid company in line with the Power Purchase Agreement.

2.3. Monitoring of CAP_{PJ} and A_{PJ}

Installed capacity of the hydro power plant after the implementation of the project activity will be monitored by checking the rated capacity on the nameplate of the generator.

Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full, is monitored by calculations based on relevant maps supplied by qualified parties.

2.4. Quality Assurance and Quality Control

QA & QC procedures for recording, maintaining and archiving data shall be improved as part of this CDM project activity. This is an on-going process which will be ensured through the CDM mechanism in terms of the need for verification of the emission on an annual basis according to the PDD.
Frequently the monitoring plan including all defined procedures, reports, data, and personnel will be inspected internally to ensure the monitoring activities. Especially in the beginning of the crediting period, these internal inspections should take place, to guarantee the implementation of monitoring procedures.
Corrective actions will be taken promptly by the project owner when the erroneous measurements and deviations occur:
Actions to correct deviations from the monitoring plan and the guidelines for the project operation and monitoring will be implemented as these deviations are observed either by the operator or during internal audits.
Except periodic meeting, additional technical meetings among the operator, the management board of the project owner will be held, if necessary, in order to define the corrective actions to be carried out.
Corrective actions are also set down in case of equipment or systems malfunction or breakdown.

2.5. Calibration of Meters and Metering

The meters will be calibrated and verified pursuant to national standard according to Decision 25/2007/QD-BKHCN on application of process and period for inspection of measurement devices. The calibration and verification for the power meters need to be conducted at least every two years by the third party once during project operation. However, following the Power Purchase Agreement (PPA) signed between Vietnam Power Development JSC (as the Seller) and EVN (as the Buyer) on 20/06/2013, the EVN required the power meters to be calibrated every year[38]. After every calibration, the meters will be seal so that no illegal interference is possible.

2.6. Data Management System

Data will be archived time to time in an electronic spreadsheet printed out monthly. The electronic files will be stored on a hard disk or/and other media; a data backup system shall be established. The project owner will also collect and keep electricity sales receipts from the grid company for the purpose of double checking. At the end of each vintage year, a monitoring report will be compiled detailing the metering results and evidence.

[37] Decision No 02/2007/QD-BCN

[38] The PPA signed on 20/06/2013.

All data records will be kept for 2 years after the end of the crediting period.

2.7. Damages to metering equipment:

In case the main meter(s) (M1x) fails, the data from the backup meter(s) (M2x) will be considered for calculation of net electricity exported to the grid. In details, following the PPA signed on 20/06/2013 with EVN:

- In case the main meters (M1x) fails, the metering data logged by backup meter No.1 and evidence of sales records will be used to determine net power supplied to the grid for the days for which no record could be kept. The project entity will furthermore document all efforts taken to restore normal monitoring procedures.
- In case of both metering equipment (main and backup No.1) operated by the project entity are damaged: The metering data measured by backup No.2 will be used to release the billing invoices in the period of both main and backup No1 broken.

In case both meters fail (main meter(s) and backup meters), then the Project Owner and the grid company will jointly calculate a conservative estimate of the amount of power supplied to the grid. A statement will be prepared indicating:

- The background of 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;
- The estimation of power supplied to the grid;
- The statement will be signed by both a representative of the Project Owner as well as a representative of the grid company.

The Project Owner will furthermore document all efforts taken to restore normal monitoring procedures. Based on that number, the project participant can calculate the ER and cross check with electricity invoices. *However, the case is hardly to happen since Khe Bo Hydropower Plant has two backup metering systems.*

The main meter(s) will be immediately repaired / replaced and calibrated for its accuracy before re-installing. In case the backup meter(s) (M2x) fails, then the backup meter will be immediately repaired / replaced and calibrated for its accuracy before re-installing.

2.8. Emergencies:

In case of emergencies, the Project Owner will follow the following procedure for declaring the emergency period to be over:

- The Project Owner will ensure that all requirements for monitoring of emission reductions have been re-established.

- The monitoring manager 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.

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 and standardized baseline:
17/12/2012
Contact information of responsible persons/ entities:
Joost Willem van Acht
Joost.van.acht@blueworldcarbon.com

SECTION C. Duration and crediting period

C.1. Duration of project activity

C.1.1. Start date of project activity

>>

05/10/2007

This is the date of signing the construction contract which is the earliest contract that the project owner to commit for the project's expenditures of the Khe Bo Hydropower Project. This is in accordance with the "CDM Glossary of Terms" version 07, which define the starting date of project as "the earliest date at which either the implementation or construction or real action of a project activity begins".

C.1.2. Expected operational lifetime of project activity

>>

40 years 0 months [39]

C.2. Crediting period of project activity

C.2.1. Type of crediting period

>>

Fixed crediting period has been selected.

C.2.2. Start date of crediting period

>>

01/04/2013 or the date of registration, whichever is later.

C.2.3. Length of crediting period

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

>>

In accordance with Decree No.80/2006/ND-CP dated on 09 August 2006[40] which states that for all hydropower projects with reservoir volume of more than 1 million m^3, an Environment Impact Assessment (EIA) report is required to be implemented and approved by the designated local authority. This EIA shall be complied with Circular No.08/2006/TT-BTNMT [41] "on guiding assessment of strategic environment, environmental impact and environment protection commitment".

The EIA of the Project has been approved by the Nghe An Province People's Committee by Document No. 3315/QD-UBND.DT on 13 September 2006 and environmental impacts resulting from the Project are considered insignificant.

[39] This figure is consistent with the Annex 1 of the Decision 709/QD-NLDK dated 13 April 2004 which states that the operational lifetime of hydropower projects with a total installed capacity greater than 30MW will be 40 years.

[40] http://www.nea.gov.vn/luat/luat_eng/toanvan/80_2006_ND-CP.pdf

[41] http://www.moitruongdulich.vn/en/index.php?itemid=45

The Project entity shall be responsible for carrying out correctly all the following contents and requirements stated in the EIA report. The content of EIA will be the basis for State environmental protection agencies to check and supervise the performance of environmental protection.

D.2. Environmental impact assessment

>>

According to the Vietnamese Law on Environment Protection issued in November 2005, the EIA report of the Project was completed by an independent third party, and approved by the Nghe An People's Committee. (Approval Document No. 3315 is issued on 13 September 2006).

The project is expected to have long-term environmental and social benefits. Measures will be taken to mitigate any negative impacts on the environment as a result of the project construction and operation and the project will meet all Viet Nam national requirements for environmental safety. Concretely the potential environmental impacts of the Khe Bo Hydropower Project are analyzed as below:

Impact on soil quality

The construction of the dam may trigger soil erosion, especially in the areas that will be covered by the project reservoir. This may lead to a reduction in the effective volume of the reservoir and decreased project efficiency. Therefore, in accordance with the current regulation for prevention of soil erosion and improvement of soil protection, trees will be planted in the weak reservoir zone and along the reservoir sides.

Impact on water quality

All necessary measures will be taken to prevent water pollution during the construction works. This includes collection and disposal of generated waste, collection and disposal of lubricants and control on waste disposal at soil and rock excavation sites.

Impact on the atmosphere, noise

Major impacts may result from the use of heavy machinery during dam and plant construction. State of the art equipment will be utilized to reduce the adverse impact of construction works. And this is impact during construction period only.

Impact on the ecosystem

The dam construction and reservoir formation will result in flooding of the area. The reservoir area consists of wasteland, agricultural land and living households will be also partially affected. The effects on the flora and fauna are expected to be minimal and within the standards set by the government of Viet Nam. In order to prevent deforestation and soil erosion, trees will be planted in the areas adjacent to the project site after the end of construction works.

Socio-economic impact on local communities

The land area occupied by the proposed project implementation is about 956.6ha of which 119.6ha of agricultural land, 10.3 ha of real estate, 89.5 ha of indicated land, 318.8 ha of stream and 418.3ha of unused land. The submerged flora is mainly the poor forest and brushwood, thus its impacts were considered insignificant. The project activity also made about 3.2km of road No.7 inundated, however the project owner had plan to construct pass ways and new two bridges to ensure the continuous transportation between districts and communes in region.

The proposed project is expected to result in the resettlement of the local communities of 585 households. These farmers will lose their agricultural lands due to the reservoir, but they will be appropriately compensated through a specially designed compensation package according to legislated and local regulations. (Decree No. 197/2004/ND-CP dated on 13 December 2004 and temporarily regulations No. 1174/CV-NLDK dated 12 May 2004 on Compensation and Resettlement for Ban Ve Hydropower Project). Before the project was started, the project owner

hired an independent organization is NIAPP[42] which is specialized in research on compensation and resettlement issues of irrigation and hydropower projects to investigate the existing livelihood of local residents and then design appropriate compensation and resettlement options to the local residents to optimize and reduce the damages caused by the project implementation and help the local people adapt to the new relocations. To ensure the transparence the first local stakeholder consultations were held in 2005 in combination between the project owner and PECC1 electricity consulting company which was employed to prepare the project feasible study report and the second one was held in 2008 in coordination between the project owner and NIAPP to collect all opinions and comments raised by the local residents regarding the compensation and resettlement issues. All comments raised by the local residents were considered and addressed seriously by the project owner and accredited consulting companies in their compensation and resettlement planning reports submitted to the local government for approval. The comprehensive compensation and resettlement plan prepared by the NIAPP then was approved by the local government in Document No. 4026/QD/UBND.CNXD dated on 18th Aug.2009. The compensation and resettlement implementation was complied with the government and local regulations.

SECTION E. Local stakeholder consultation

E.1. Solicitation of comments from local stakeholders

>>

As a part of relevant stakeholder's consultation process the relevant stakeholders were identified as Commune People Committee and Fatherland Front of impacted communes comprising Tam Quang, Yen Thang, Tam Dinh, Tam Thai, Thach Giam, Xa Luong and Hoa Binh town and local people under those. During the 2005 initial stage of project preparation the project owner in combination with electricity consulting company (PECC1) hired for developing feasibility study report of the project organised the meetings with local authorities and local people in each impacted commune to inform them on the project implementation plan and the impacts of the project construction on local communities, in especially the impacts from occupation of the cultivated land and issues regarding compensation and relocation for local people when implementing the project in region. The identified relevant stakeholders were invited to give their comments/opinions on the deployment of the project in region. All comments raised by the relevant stakeholders were collected in writing and considered carefully by the project owner during preparation of compensation and resettlement plan in order to satisfy the expectations of local people impacted by the project construction.

In addition to those, as of 03/07/2007 a stakeholder consultation for the CDM project activity was also held at Tam Quang Commune where main works of the project activity as dam, reservoir and powerhouse to be built. The local authorities had received an official invitation letters; the local radio broadcast was used to provide information on the project; local residents, local villages had been invited; and suggestions regarding the Project were received. The local stakeholders identified for the proposed project are as follows:

- Representatives of Tam Quang Commune People's Committee
- Representative of Tam Quang Commune Farmer's Union
- Representative of Tam Quang Commune Women's Union
- Representative of local villages

The project owner invited the participants to a meeting room to express their comments and concerns about the project and CDM introduction. All questions related to the Project were addressed and seriously considered.

To ensure the continuous involvement of local people in the process of implementing the project in 2008 the project owner in co-ordination with the National Institute for Agricultural Planning and Protection (NIAPP) employed for preparation of compensation plan continued conducting the meetings with local people to consult their expectations about carrying out the compensation

[42] http://www.niapp.org.vn/

solutions. All opinions raised by the local people were recorded in Minutes of Meeting and were gone through by the project owner in development of compensation and relocation plan.

Below section summarized the comments/concerns raised by the relevant stakeholders during meetings. All Minutes of Meeting have been provided to the validation team for their assessment.

E.2. Summary of comments received

>>

Comments raised by the relevant local stakeholders during the Meetings in 2005 were summarised as flows:

1. **Comments raised by representatives from Hoa Binh town**
   - Having agreed with the Government policy in implementing the Khe Bo hydropower project in region.
   - Having supported and created favourable conditions and merged closely with the project owner in order to obtain the best results.
   - Having proposed the project owner timely informs the time point of starting construction so that the local people have planned to adapt the production.
   - Having proposed the project owner and the Government takes appropriate actions and supportive policies for the local people when the construction of the project.
   - Having proposed the project owner has to build and ensure the quality of infrastructures for relocation areas.

2. **Comments raised by representatives from Thach Giam commune**
   - Having agreed with the Government policy in implementing the Khe Bo hydropower project in region.
   - Having suggested the project owner to implement the appropriate compensation policy which did not make the removed households disadvantaged.

3. **Comments raised by representatives from Tam Quang commune**
   - Having agreed with the Government policy in implementing the Khe Bo hydropower project in region.
   - Having proposed that the compensation and resettlement plan has to make the local people life more improved and that the impacted households were expected to relocated within the same commune.

4. **Comments raised by representatives from Xa Luong commune**
   - Having agreed with the Government policy in implementing the Khe Bo hydropower project in region.
   - Having supported and created favourable conditions and merged closely with the project owner in order to obtain the best results.
   - Having suggested that the new relocation areas have to be built with improved and better infrastructures than where they were living.

5. **Comments raised by representatives from Yen Thang commune**
   - Having agreed with the Government policy in implementing the Khe Bo hydropower project in region.
   - Having supported and created favourable conditions and merged closely with the project owner in order to obtain the best results.
   - Having proposed the project owner timely informs the time point of starting construction so that the local people have planned to adapt the production.

6. **Comments raised by representatives from Tam Dinh commune**
   - Having agreed with the Government policy in implementing the Khe Bo hydropower project in region.

- Having supported and created favourable conditions and merged closely with the project owner in order to obtain the best results.
- Having proposed the project owner timely informs the time point of starting construction so that the local people have planned to adapt the production.
- Having suggested that the new relocation areas have to be built with more improved and better infrastructures than where they were living.

7. Comments raised by representatives from Tam Thai commune

- Having agreed with the Government policy in implementing the Khe Bo hydropower project in region.
- Having supported and created favourable conditions and merged closely with the project owner in order to obtain the best results.
- Having proposed the project owner timely informs the time point of starting construction so that the local people have planned to adapt the production.
- Having suggested that the new relocation areas have to be built with more improved and better infrastructures than where they were living.

Comments received during the CDM stakeholder consultation meeting in 2007 were described below:

All organizations acknowledged that the project contributes to sustainable development and environment protection of Viet Nam, especially increase in local budget and reduction of poverty; hence they fully supported the project.

The results of stakeholder consultation are shown as follow:

✓ The Project generates clean energy source in this mountainous and remote area and will contribute to socio-economic development in the area.

✓ *The good impacts are expected from infrastructure improvement such as road, electricity access, irrigation and better trading possibilities.*

✓ *Increase income for local authority.*

✓ *Creating jobs for local people, reduces unemployment rate*

✓ *Compensation and levelling has been implemented well as per government and local regulations.*

Besides positive comments, some negative comments by stakeholders were also found and the Project Owner's clarifications on the concerns were made as follows:

Table E.2.1. Comments by local stakeholders

Queries raised by stakeholders	Clarifications by the project owner
The project partially affects agricultural land as well as the livelihood of local people. How does the project owner overcome this issue?	All compensations and levelling have been implemented according to national and local regulations.
Will the installation of machines create noise and disturb the surroundings?	The project owner personnel clarified that the Environmental Impact Assessment of the project has been approved and all the solutions for the noise reduction during construction and operation are listed in this document and the PO will seriously adopt the agreed countermeasures.

The stakeholders present were satisfied with these responses and were appreciative of the efforts by the project proponent in undertaking the said project.

E.3. Report on consideration of comments received

>>

The organization's comments are carefully reviewed. Almost all of them are positive comments. However, the project activity still received negative comments, which have been addressed in table E.2.1 above:

SECTION F. Approval and authorization

>>

The Letter of Approval has been issued by the host country of Viet Nam on 31/01/2012.

- - - - -

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	Viet Nam Power Development Joint Stock Company
Street/P.O. Box	3rd Floor-CT1-Nang Huong Housing and Commercial Service Area, 583 Km9 Nguyen Trai Road, Van Quan Award, Ha Dong District, Hanoi Capital, Viet Nam.
Building	-
City	Hanoi
State/Region	North of Viet Nam
Postcode	
Country	Viet Nam
Telephone	+84 4 2131580
Fax	+84 4 7724355
E-mail	vnpd@evn.com.vn
Website	
Contact person	Nguyen Thanh Tung
Title	Director
Salutation	Mr.
Last name	Nguyen
Middle name	
First name	Thanh Tung
Department	-
Mobile	-
Direct fax	+84 4 7724355
Direct tel.	+84 4 2131580
Personal e-mail	-

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	Blue World Carbon SEA Pte Ltd
Street/P.O. Box	15A Temple Street #02-01
Building	
City	Singapore
State/Region	
Postcode	058562
Country	Singapore
Telephone	+65 6338 9411
Fax	+65 6338 9411
E-mail	
Website	www.blueworldcarbon.com
Contact person	Joost Willem van Acht

Title	Managing Director
Salutation	Mr.
Last name	van Acht
Middle name	
First name	Joost Willem
Department	
Mobile	
Direct fax	+65 6338 9411
Direct tel.	+65 6338 9411
Personal e-mail	joost.van.acht@blueworldcarbon.com

Appendix 2. Affirmation regarding public funding

No public funding from Parties included in Annex I of UNFCCC is involved in the Project activity.

Appendix 3. Applicability of methodology and standardized baseline

The applicability of the Methodology has been demonstrated in section B.2

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

The data used to calculate the emission factor for the Viet Nam National Electricity Grid is taken from Vietnamese DNA published Grid Emission Factors Report on 26/03/2010, which is made publicly on Vietnamese DNA website. The emission factor is based on combined margin approach and the value will be used as the *ex-ante* grid emission factor for the first crediting period of the project activity.

Table 1. Total emissions and power output for the years 2006-2008[43];

Plant group	Fuel consumption Coal, oil: kton Gas: mm^3	Electricity to the grid (MWh)	Emission (tCO_2)
2006			
Coal-based thermal plant	5,645.86	8,989,230	11,359,495

[43] Source: Document 151 KTTVBDKH regarding the National Power Grid Emission Factor, published by the Viet Nam DNA on March 26, 2010.

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

Gas turbine	5,743,305.42	26,542,978.34	12,081,952.73
Gas turbine using gas	*5,743,235.28*	*18,838,764.20*	*11,851,782*
Gas turbine using oil	*70.14*	*233,582*	*230,171*
Steam tail	*0*	*7,470,632*	*0*
Oil-based thermal plant	397.65	1,043,991	1,295,034
Diesel firing FO	16.60	80,000	50,374
Diesel firing DO	6.39	25,000	20,080
Import		937,000	0
Total		37,618,199	24,806,935
2007			
Coal-based thermal plant	6,386.09	9,836,406	12,753,379
Gas turbine	5,911,105	29,474,918	12,702,524
Gas turbine using gas	*5,910,941.84*	*20,023,590*	*12,168,170*
Gas turbine using oil	*163.27*	*557,880*	*534,353*
Steam tail	*0*	*8,893,447*	*0*
Oil-based thermal plant	614.06	1,834,408	1,996,185
Diesel firing FO	25.15	104,626	77,907
Diesel firing DO	9.16	42,000.000	28,499
Import		2,629,000	
Total	5,918,140	43,921,358	27,558,493
2008			
Coal-based thermal plant	6,483.99	10,055,394	12,854,854
Gas turbine	6,839,169	33,857,135	14,246,948
Gas turbine using gas	*6,839,114.84*	*22,396,231*	*14,069,090*
Gas turbine using oil	*54.35*	*183,088*	*177,858*
Steam tail		*11,277,816*	
Oil-based thermal plant	534.592	1,481,880	1,741,069
Diesel firing FO	22.48	90,465	69,633
Diesel firing DO	3.73	15,000	11,638
Import		3,220,000	
Total	**6,846,214**	**48,719,874**	**28,924,142**

Table 2: Accumulative emissions and power output 2006-2008;

	2006	**2007**	**2008**	**total**
Total electricity (MWh)	37,618,199	43,921,358	48,719,874	130,259,431
Total emission (tCO_2)	24,806,935	27,558,493	28,924,142	81,289,571

Source: Document 151 KTTVBDKH regarding the National Power Grid Emission Factor, published by the Viet Nam DNA on March 26, 2010

Table 3: The calculation of Simple Operation Margin (OM) emission factor;

Year	Total electricity (MWh)	Total CO_2 emission tCO_2	OM_{2008} (tCO_2/MWh)
	A	B	∑B/∑A
2006	37,618,199	24,806,935	
2007	43,921,358	27,558,493	
2008	48,719,874	28,924,142	
Total	130,259,431	81,289,571	**0.6241**

Source: Document 151 KTTVBDKH regarding the National Power Grid Emission Factor, published by the Viet Nam DNA on March 26, 2010

Table 4: The calculation of Build Margin (BM) emission factor 2008

Plant	Commissio n-ing year	Fuel consumption (Coal diesel: k tons Gas: mm^3)		Power supply to grid (MWh)	CO_2 emission (tCO_2)
A Vuong	2008	HPP		168,103.50	
TuyenQuang	2008	HPP		1,136,112.18	
DaiNinh	2008	HPP		1,145,108.50	
NhonTrach	2008	Gas	166.38	544,808.60	365,894
Ca Mau 1&2	2007	Gas	647.24	2,106,807.24	1,385,309
		WHR		2,728,872.00	
Sub-total of generation by 5 most recently built power units				**7,829,812.02**	
A Vuong	2008	HPP		168,103.50	
SROC Phu Mieng IDICO	2006	HPP		241,556.00	
SE SAN 3A	2006	HPP		394,895.70	
TuyenQuang	2008	HPP		1,136,112.18	
DaiNinh	2008	HPP		1,145,108.50	
SE SAN 3	2006	HPP		1,131,614.00	
Quang Tri	2007	HPP		250,804.40	
Uong Bi 2	2007	Coal	281,759	532,000.00	559,172
Na Duong	2005	Coal	532	627,930.00	850,615
Cao Ngan	2007	Coal	526	708,693.00	1,040,511
Formosa	2004	Coal	495	560,295.00	1,221,712
NhonTrach	2008	Gas	166,38	544,808.60	365,894
Ca Mau 1&2	2007	Gas	647,24	2,106,807.24	1,385,309
		WHR		2,728,872.00	
Phu My 2,2	2004	Gas	1,159,75	4,141,980.00	2,430,192
Dam Phu My	2006	Gas	56,15	4,716.00	129,573
CAI LAN - VINASHIN	2007	FO	22,48	90,465.01	69,633

Total of generation of the most recently built power units that comprise at least 20% of the system generation	**16,514,761.12**	**8,052,610**

Source: Document 151 KTTVBDKH regarding the National Power Grid Emission Factor, published by the Viet Nam DNA on March 26, 2010

Table 5: Build Margin emission factor 2008

Year	Unit	2008
Total electricity delivered to the grid by group of power units	MWh	16,514,761.12
Total emission of group of power units	tCO_2e	8,052,610
The BM emission factor	tCO_2/MWh	0.4876

Based on the BM and OM weight factors of both 50%, the Combined Margin (CM) emission factor for 2008 is 0.5558[44] tCO_2e/MWh.

Appendix 5. Further background information on monitoring plan

Please refer to Section B.7.2

Appendix 6. Summary of post registration changes

There are some post registration changes as follows:

1. Updated the PDD Template form to version 05.0.
2. Correction in GPS coordinates of Dam and Power house of the project since the GPS coordinates in registered PDD was typo mistake hence they were incorrect.
3. The corrections in technical parameters in section A.3 of registered PDD since there are some inconsistencies between registered PDD and revised registered PDD. The values indicated in the registered PDD were taken from the bidding document dated 03/2008 which was not the final numbers agreed by two parties. And the actual parameters have been taken from the signed contract dated 18/04/2009 and also from the nameplates of turbines/generators installed at the plant. Hence, there are some differences between the technical parameters in registered PDD and in actual situation. However, the differences do not cause to any changes of turbine capacity as well as the total installed capacity of the project. Hence, following the Appendix 1 of Project Standard, the correction does not need the prior approval by EB.
4. There is different number of power meters in the actual monitoring system of Khe Bo Hydropower plant compared to the registered PDD.
   The registered PDD has described the metering system installed in the plant including a main meter system (M1) and a backup meter system (M2). However, due to requirements from EVN, who is buying the power generated from Khe Bo Hydropower Plant, following the Power Purchase Agreement (PPA) signed on 20/06/2013, the plant shall install a main meter system and two backup meter systems. Since the additional meters are the backup

[44] The Grid EF calculation spread sheet for Khe Bo hydropower project.

meters with the accuracy class of 0.5s that are meet the national standard electricity metering instruments as well as the EVN's requirement, hence the monitoring measurements of the project have not been adversely impacted by this change. Therefore, this is not in the control of Project Participants. Hence, following Appendix 1 of Project Standard, the change does not require the prior approval by EB.

5. Changes to start date of crediting period
   The project has been registered as CDM project on 28/12/2012 with UNFCCC registration reference number 9036. The start date of crediting period stated in the PDD section C.2.1.1 was 01/04/2013; however the actual commercial operation date of the project was 12/05/2013 (unit 1). Thus, according to paragraphs 263-266 in PS version 07.0.0, a notification letter for requesting change of crediting period start date to 12/05/2013 was submitted to EB and got approval on 17/09/2014. So the fixed crediting period is from 12/05/2013 to 11/05/2023.

6. Changes in calibration frequency
   Following the section B.7.2 of registered PDD, the meters need to be calibrated every 02 years in line with national standard according to Decision 25/2007/QD-BKHCN issued by Ministry of Technology and Science on application of process and period for inspection of measurement devices. However, as per the Power Purchase Agreement (PPA) signed between Vietnam Power Development JSC Company (Project Owner or the seller) and EVN (the Buyer) dated 20/06/2013, the EVN required that all power meters which are using for billing purpose have to be calibrated every year by a qualified calibration party during the project operation. Then the calibration frequency of the meters has been changed to once per year. Since this change is required by EVN in PPA dated 20/06/2013 which is out of the control of Project Participants. Hence, following the Appendix of Project Standard, the change does not require the prior approval by EB.
7. Some editorial corrections have been addressed in section B.7.3. subsequent to such changes above.

- - - - -