Component project activity design document form

(Version 09.0)

Complete this form in accordance with the instructions attached at the end of this form.

BASIC INFORMATION	
Title of the CPA	CPA3_Pa Chien Hydropower Project
Scale of the CPA	☒ Large-scale ☐ Small-scale
Version number of the CPA-DD	07
Completion date of the CPA-DD	14/12/2020
Title and UNFCCC reference number of the registered CDM PoA	Vietnam Renewable Energy Development Program (REDP) 6810
Title and reference number of the corresponding generic CPA	Title: CPAXX: [Name of the Hydro Project] Hydropower Project Reference Number: 6810-[XX]
Coordinating/managing entity	Ministry of Industry and Trade of Vietnam (MOIT)
Host Party	Viet Nam
Applied methodologies and standardized baselines	**Applied methodology:** ACM0002 Version 13.0.0 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources", EB 67 **Standardized baseline:** N/A
Sectoral scopes	1: Energy industries (renewable - / non-renewable sources)
Estimated amount of annual average GHG emission reductions	48,120 tCO_2e

SECTION A. Description of component project activity (CPA)

A.1. Purpose and general description of CPA

>>

The present CPA is to be implemented as part of the CDM PoA: *Vietnam Renewable Energy Development Program (REDP)*. It aims at avoiding CO_2 emissions from Pa Chien Hydropower Project in Vietnam.

Pa Chien Hydropower is a run-off-river hydropower plant with an install capacity of 22MW connecting to Vietnam national electricity grid.

Description and purpose of the CDM programme activity

The CDM programme activity of Pa Chien hydropower project is part of the Program of Activities (PoA) supporting the Renewable Energy Development Program (REDP) in Vietnam. The PoA will be coordinated and managed by the Project Management Board for Rural Energy and Renewable Energy (PMB-RERE) under the Energy Department of the Ministry of Industry and Trade (MOIT). The CPA implemented as part of the PoA, proposes to reduce the GHG emissions from fossil fuels used for power generation.

The CDM programme activity, Pa Chien Hydropower Project (the "project" or the "proposed CPA"), involves the construction and operation of a new run-of-river hydroelectric power project on the Chien stream, Chieng San commune, Muong La district, Son La province, Vietnam. The developer of the project is Pa Chien Hydropower JS Company (the "project owner").

The main objective of the project is to generate power from clean renewable hydropower in Vietnam and to contribute to the sustainability of power generation of the National Power Grid of Vietnam (the "National Power Grid"). The project will install two turbine / generator units, with an installed capacity of 11 MW for each unit for a total installed capacity of 22MW.

- **Scenario existing prior to the start of the implementation project:**
  The scenario prior to the start of the implementation of the project consists of the non-utilization of the Chien stream at the given site, and the continued expansion of the National Power Grid with a combination of fossil-fuel fired and renewable energy resources.

- **Baseline scenario:**
  According to the approved CDM methodology ACM0002, the baseline scenario for the CPA is the electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system".

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

Implementation schedule

A summary of implementation milestones of the project activity is given in the below table:[1]

[1] The above milestones are derived directly from the actual implementation schedule. The actual implementation schedule was prepared by the project owner based on the signing of respective contracts.

No	Description	Start	Completion
1	Construction of free spillway dam and related items	December 2010	April 2012
2	Construction of office building	December 2010	March 2011
3	Supply and installation of mechanical hydraulics equipment	February 2012	April 2013
4	Installation and testing of equipment	March 2012	June 2012
5	Concrete work and completion of diversion canal	May 2012	April 2013
6	Supply of mechanical hydraulics, electro-mechanical equipment and technical services	May 2012	March 2013
7	Supply and installation of pressure pipe	May 2012	April 2013
8	Concrete work and completion of pressure tank and pressure pipe	June 2012	January 2013
9	Concrete work and completion of powerhouse	June 2012	December 2012
10	Construction of tailrace	September 2012	November 2012
11	Construction of transmission line and substation	March 2013	June 2013
12	Commissioning	-	23 June 2013
13	Commercial generation	-	26 June 2013

Contribution to sustainable development

The project activity contributes to sustainable development in the following ways:

- Reduction of the dependence on exhaustible fossil fuels for power generation;
- Reduction of air pollution by displacing coal-fired power plants with clean, renewable power;
- Reduction of the adverse health impacts from air pollution;
- Reduction of the emissions of greenhouse gases to combat global climate change;
- Promotion of local economic development through employment creation during construction and operation; and
- Improvement of water regulation and maintenance of local area's biodiversity.

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

A.2. Location of CPA

>>

Pa Chien Hydropower Project is located Chien stream, Chieng San commune, Muong La district, Son La province.

The geographical references of Pa Chien Hydropower Project's main construction works are within the following geographical coordinate range:[2]

[2] The geographical coordinates were taken from the approval for inclusion of Pa Chien into province hydropower plan, dated 01 August 2007.

- Dam location: Longitude: 104.080; Latitude: 21.475
- Powerhouse location: Longitude: 104.072; Latitude: 21.476

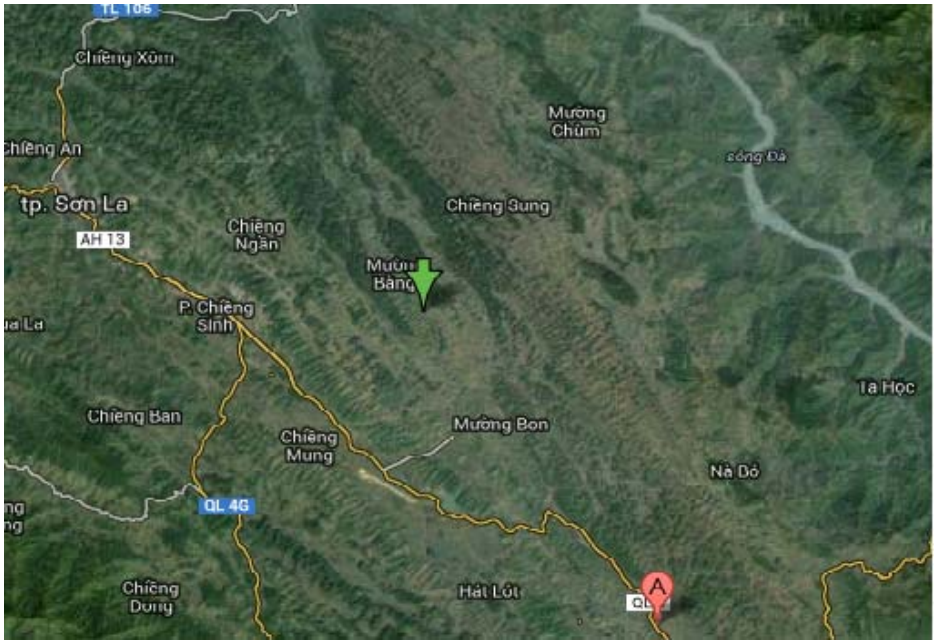

Figure 1. Location (arrow) of the main construction works of the project activity by GPS

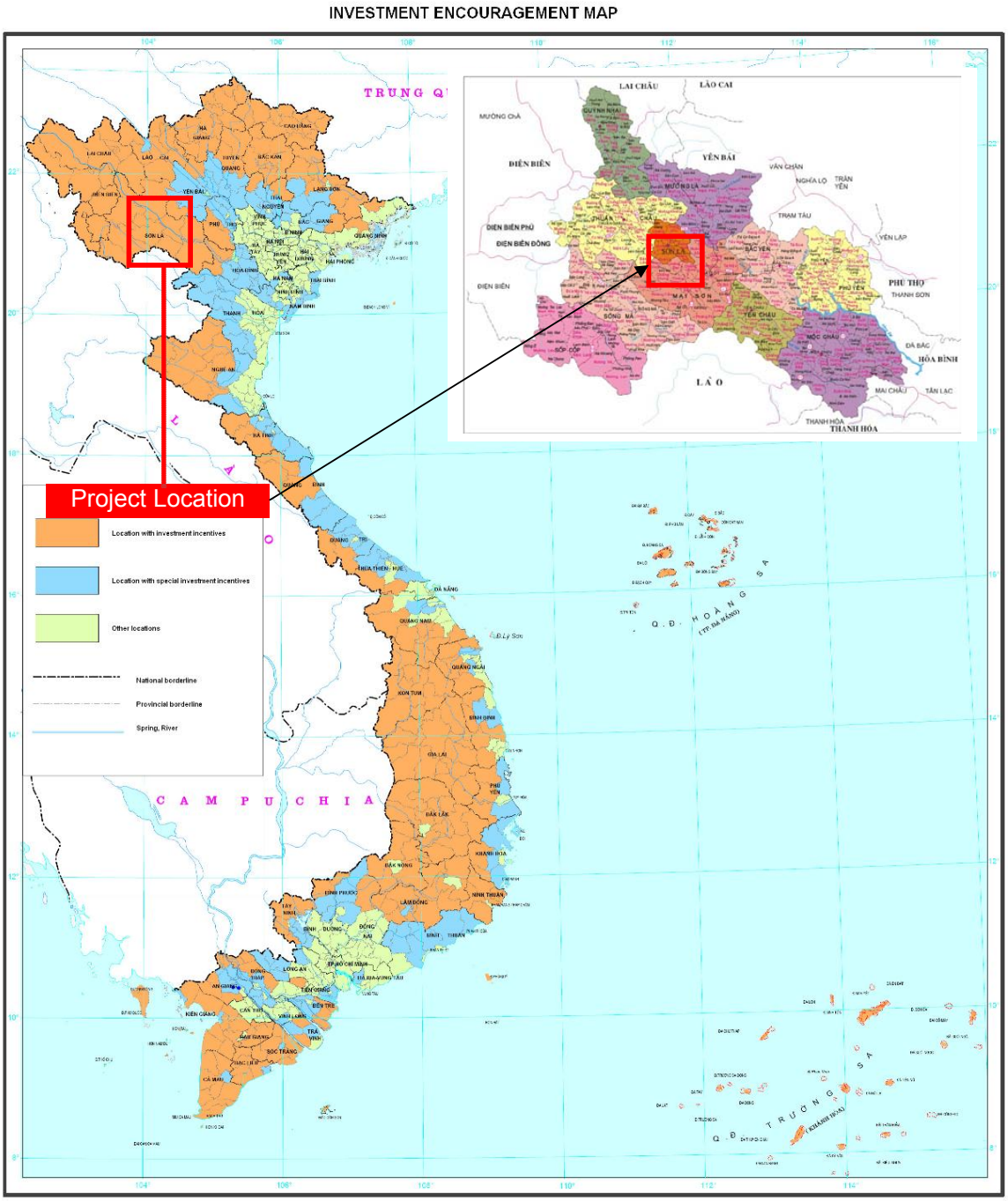

Figure 2. Location of the project in Vietnam

A.3. Technologies/measures

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The CPA involves the construction and operation of a new hydropower plant facility with a maximum water head of 50.02 meters. The project design consists of a gravity dam, water intake, water diversion canal, pressure tank, pressure pipe, a powerhouse, and a switching station. The dam will consist of a gravity dam, with dam top elevation of 175.20 m. The water intake will lead part of the available water flow through a 3,806.44m long concrete canal, through the pressure

tank and 02 pressure pipes, each of which is 170 m long, prior to going into the powerhouse. The newly created reservoir shall have a surface area of 16,000m^2[3] at full capacity and a gross capacity of 88,030m^3[4] and active capacity of 19,200m^3 for daily regulation. The project will have a total installed capacity of 22 MW from 2 Francis, vertical axis turbine/generator units with a capacity of 11 MW per unit. The technical data of the turbine/generator units are listed in Table 1 below.

Table 1: Technical data of turbines and generators[5]

Main Technical Data		Value (per unit)
Turbines	Units	02
	Runner diameter	1,850mm
	Type	Francis, vertical axis turbine
	Rated speed	300 rpm
	Rated efficiency	92.5 %
Generators	Units	02
	Rated speed	300 rpm
	Efficiency	95.3 %
	Capacity per unit	11 MW
	Rated voltage	6.3 kV
	Power factor (cosφ)	0.8
	Plant load factor	42.94%

Total annual power generation is considered at 82,750MWh, and approximately 81,923MWh[6] of that will be supplied to the grid. Power generated by the project will be transmitted to the National Power Grid through the step-up 6.3kV to 110kV substation via the double-circuit overhead lines.

A.4. Coordinating/managing entity

>>

Ms. Pham Huong Giang (who is also a project participant)
General Directorate of Energy, Ministry of Industry and Trade (MOIT)
Tel: 844- 22202431; Email: giangph@moit.gov.vn

[3] The reservoir surface area was derived from the Environmental Management Plan, page 21, dated 2010

[4] See Engineering Design, General Description, page 10

[5] Engineering Design, Volume 4 – Equipment and Technology, page 6 & 14

[6] The annual gross generation was derived from the Engineering Design, Volume 1, General Description, page 178. The annual net electricity generation was calculated by subtracting to 1% of own use and transmission loss according to the Engineering Design, Volume 2, Hydrology and Economics Analysis, page 10

A.5. Parties and CPA implementers

Parties involved	CPA implementers	Indicate if the Party involved wishes to be considered as CPA implementer (Yes/No)
Socialist Republic of Viet Nam (Host Country)	Ministry of Industry and Trade of Vietnam (MOIT).	No
Socialist Republic of Viet Nam (Host Country)	Pa Chien Hydropower JS Company (CPA implementer)	Yes
Sweden (Annex 1 Country)	International Bank for Reconstruction and Development (IBRD) as trustee of the Carbon Partnership facility (CPF)	No
Sweden (Annex 1 Country)[7]	Government of Sweden - Swedish Energy Agency	No
Spain (Annex 1 Country)[8]	Kingdom of Spain - Ministry of the Agriculture, Food and Environment & Ministry of Economy and Competitiveness	No
Norway (Annex 1 Country)[9]	Norwegian Ministry of Climate and Environment	No

A.6. Public funding of CPA

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

A.7. History of CPA

>>
Pa Chien Hydropower Project is not among CDM hydropower project activities of Vietnam which has been submitted for validation and global consultation, thus this CPA is neither registered as an individual CDM project activity nor is part of any other registered PoA in Vietnam. It is also not a de-registered project activity.

This CPA is not a CPA that has been excluded from a registered CDM PoA as a result of erroneous inclusion of CPAs. There is no other hydropower plant that is a registered CDM project activity or a CPA under a registered CDM PoA whose crediting period has or has not expired exists in the same geographical location as this CPA. This is evidenced by the coordinates of Pa Chien CPA in Section A.2.

A.8. Debundling

>>
Not applicable

[7] Though this project participant was there during PoA registration, it was not mentioned in CPA DD before

[8] Project participant detail updated in UNFCCC project page only on 19/03/2015

[9] Project participant detail updated in UNFCCC project page only on 19/03/2015

SECTION B. Application of methodologies and standardized baselines

B.1. References to methodologies and standardized baselines

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Name of approved baseline and monitoring methodology:
ACM0002, Version 13.0.0 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources", EB 67.
http://cdm.unfccc.int/UserManagement/FileStorage/DYPFI935XBG274NWH6O8CM1KEZR0VU

The following related tools are applied for this CPA:
Version 2.2.1 of the "Tool to calculate the emission factor for an electricity system", which was approved by the Executive Board in its 63rd meeting.
http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v2.2.1.pdf
Version 06.1.0 of the "Tool for the demonstration and assessment of additionality", which was approved by the Executive Board in its 69th meeting.
http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v6.1.0.pdf
Version 03.0.1 of the "Combined tool to identify the baseline scenario and demonstrate additionality."
http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-02-v3.0.1.pdf

This proposed project is a grid-connected renewable power generation that is eligible to apply Version 13.0.0 of ACM0002. The fulfilment of relevant applicability conditions of ACM0002, version 13.0.0 are demonstrated in below table.

Table 2: Comparison of project characteristics and eligibility criteria of ACM0002 methodology

Applicability conditions of ACM0002	Characteristics of the project activity	Applicability criteria met?
The project activity is the installation, *capacity addition, retrofit or replacement* of a power plant/unit of *one of the following types:* hydro power plant/unit (either with a run-of-river reservoir or an accumulation reservoir), *wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit;*	The project activity is to install a new run-of-river hydropower plant. This is evidenced by the feasibility study and related construction contracts.	Yes
In case of hydro power plants, one of the following conditions must apply: • *The project activity is implemented in an existing single or multiple reservoirs, with no change in the volume of any 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 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 definitions given in the Project Emissions section, is greater than 4 W/m^2.*	If the project involves construction of a new reservoir, the power density will be greater than 4 W/m^2. The power density of the project activity is 1,375 W/m^2 which is much larger than 4 W/m^2. Installed capacity is provided in the feasibility study. Reservoir	Yes

	surface area from the EMP, page 21.[10] The project activity does not involve retrofit, replacement or capacity additions of any power plant/unit as evidenced by the feasibility study and construction contract.	
The methodology is not applicable to the following: • 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; • Biomass fired power plants; • Hydro power plants that result in new reservoirs or in the increase in existing reservoirs where the power density of the power plant is less than 4 W/m^2	It is a renewable energy project with no fuel-switch nor biomass involved.[11] The power density of the new reservoirs is larger than 4 W/m^2	Yes

B.2. Project boundary, sources and greenhouse gases (GHGs)

>>

The spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system that the CDM project power plant is connected.

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

Source		GHG	Included?	Justification/Explanation
Baseline scenario	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity.	CO_2	Yes	Main emission source.
		CH_4	No	Minor emission source.
		N_2O	No	Minor emission source.
Project scenario	For hydro power plants, emissions of CH_4 from the reservoir.	CO_2	No	Minor emission source.
		CH_4	No	Main emission source. Negligible as power density is > 10 W/m^2.
		N_2O	No	Minor emission source

[10] The power density is calculated based on the reservoir surface area taken from the Environmental Management Plan, page 21, dated 2010 and the installed capacity from the Engineering Design, Volume 1, General Description, page 6.

[11] As evidenced in Engineering Design, Volume 1, General Description, page 6.

Figure 3 below provides a flow diagram of the CPA and related emissions that potentially need to be taken into account. Leakage associated with the project does not have to be taken into account as the project employs new turbines / generators and does not involve the transfer of equipment from another activity. The ACM0002 methodology also does not require the consideration of technology.

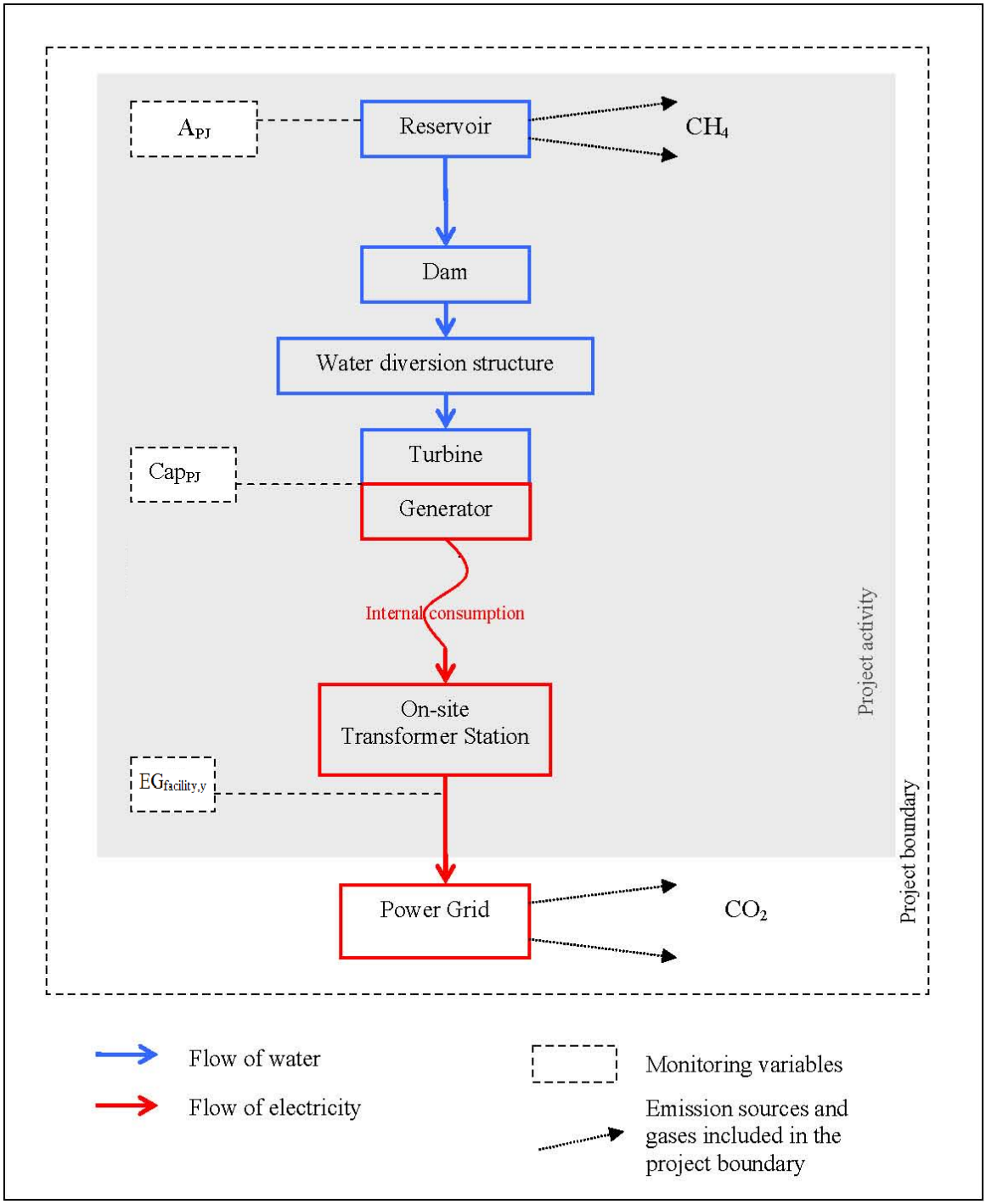


Figure 3: Project boundary

B.3. Establishment and description of baseline scenario

>>

According to the approved CDM methodology ACM0002, the baseline scenario for the CPA is the electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system".

B.4. Estimation of emission reductions

B.4.1. Explanation of methodological choices

>>

The ex-ante calculation of the emission reductions follows methodology ACM0002 (version 13.0.0)

Baseline emissions

The baseline emissions (BE_y) are the product of the baseline emissions factor (EF_y) calculated below, times the electricity supplied by the project activity to the national grid (EG_y), as per the formulae given below:

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

Where:

BE_y	tCO_2/yr	Baseline emissions in year *y*
$EG_{PJ,y}$	MWh	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)
$EF_{Grid,CM,y}$	tCO_2/MWh	Combined margin CO_2 emission factor for grid connected power generation in year *y* calculated using the "*Tool to calculate the emission factor for an electricity system*", version 2.2.1.

The quantity of net electricity generation by CPA in year y is determined as

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

where:

$EG_{PJ,y}$	=	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year *y* (MWh/yr)
$EG_{facility,y}$	=	Quantity of electricity generation supplied by the project plant/unit to the grid in year *y* (MWh/yr). It shall be determined as a difference between (i) quantity of electricity supplied by the project plant/unit to the grid and (ii) quantity of electricity delivered to the project plant/unit from the grid.

Based on the ex-ante baseline emission factor set out in the PoA-DD, the baseline emissions of the CPA are calculated as shown below:

$$BE_y = EG_{facility,y} \times EF_{grid,CM,y} = 81{,}923 \times 0.5874 = 48{,}120 tCO_2$$

The baseline emission factor is ($EF_{grid,CM,y}$) is calculated ex-ante 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.

BASELINE METHODOLOGY PROCEDURE

Project participants shall apply the following six steps:

STEP 1. Identify the relevant electricity systems.

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 electric power system

The electricity generated by the project activity will be delivered to the Vietnamese national grid, the only grid existing in the country.

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

Off-grid power plants are not included in the project electricity system, thus ***Option I: Only grid power plants*** are included in the calculation.

STEP 3. Select a method to determine the operating margin (OM).

The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is based on one of the following methods:
(a) Simple OM, or
(b) Simple adjusted OM, or
(c) Dispatch data analysis OM, or
(d) Average OM.

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

The Simple OM is applicable to this project activity since it involves hydropower which has low marginal generation costs. And as Table 3 shows below, Low-Cost/Must-run power resources constitute less than 50% of the total grid generation on average over five recent years. Therefore, as per the tool, simple OM can be used in the calculation of the OM emission factor.

Table 3: Electricity generation of the National Power Grid of Viet Nam, period 2007-2011[12]

Year	2007	2008	2009	2010	2011	Period 2007-2011
Hydropower (MWh)	22,385,232	25,933,762	29,033,871	24,241,216	35,185,329	136,779,410
Total power (MWh)	66,348,589	74,689,636	81,369,303	91,224,603	100,851,857	414,483,988
Low-	33.74%	34.72%	35.68%	26.57%	34.89%	33.00%

[12] Data is extracted from the annex 1 of 2011 EF calculation report for the national electricity grid system published by Vietnam DNA

cost/Must-run Ratio						

In accordance with the "Tool to calculate the emission factor for an electricity system", the OM is calculated according to the "*ex-ante* option": a three-year generation-weighted average, based on the most recent data available at the time of submission of the CPA-DD to the DOE for validation, without the requirement to monitor and recalculate the emissions factor during the crediting period.

STEP 4. Calculate the operating margin emission factor according to the selected method ($EF_{grid,OM,y}$)

According to the simple OM method, the OM emission factor is calculated as the generation-weighted average tCO_2 emissions per unit of net electricity generation (tCO_2/MWh) of all generating power plants serving the system, excluding the low-cost/must-run power plants/units.

We calculate the OM emission factor according to option B of the simple OM method because: (i) The data required for option A (net quantity electricity ($EG_{m,y}$) and a CO_2 emission factor of each power unit ($EF_{EL,m,y}$)) is not available. The 2011 EF report by Vietnam DNA only published 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; (ii) Only renewable power generation is considered as low-cost/must-run in Viet Nam and its quantity is known and included in the 2011 EF report; and (iii) The off-grid power plants are not included in the calculation (As per choice of step 2).

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

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

$$EF_{grid,OMsimple,y} = \frac{\sum_i (FC_{i,y} \times NCV_{i,y} \times EF_{CO_2,i,y})}{EG_y}$$

Where:

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

The carbon emission factors ($EF_{CO_2,i,y}$) and net calorific value ($NCV_{i,y}$) are default values at the lower limit of the uncertainty at 95% confidence interval as provided in Table 1.4, page 1.23 and 1.24, Chapter 1 of Volume 2 (Energy) of the *2006 IPCC Guidelines for National Greenhouse Gas Inventories.*

The net electricity generated and supplied to the national power grid (EG_y) and amount of fuel consumption of each fuel type ($FC_{i,y}$) in the project electricity system were obtained from the 2011 EF report published by Vietnam DNA on 28/05/2013.

The simple OM is derived as in the below table.

Year	Total Emissions (tCO2)	Total Generation (MWh)	Simple OM value (tCO2 / MWh)
2009	28,382,922	52,303,503	**0.5598**
2010	36,057,342	66,933,115	
2011	39,038,319	65,620,049	

STEP 5. Calculate the Build Margin emission factor *($EF_{grid,BM,y}$)*

Vintage of Data:
In accordance with the "Tool to calculate the emission factor for an electricity system", the BM emission factor is calculated according to option 1: For the first crediting period, the BM emission factor is calculated *ex-ante* based on the most recent information available. For the second crediting period, the BM emission factor will be updated based on most recent data available at the time of submission of the request for registration. For the third crediting period, the BM emission factor calculated for the second crediting period will be used.

The sample group of power units *m* used to calculate the build margin consists of either:

(a) The set of five power units that have been built most recently, or
(b) The set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently

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 (2011):

(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≥20%) and determine their annual electricity generation (AEG_{SET}-≥20%, in MWh);
(c) From $SET_{5\text{-units}}$ and SET≥20% select the set of power units that comprises the larger annual electricity generation (SETsample); Identify the date when the power units in SETsample started to supply electricity to the grid. If none of the power units in SETsample started to supply electricity to the grid more than 10 years ago, then use SETsample to calculate the build margin. Ignore steps (d), (e) and (f).

In accordance with the 2011 EF report published by Vietnam DNA, the total domestic electricity generation of Vietnam National Power Grid in 2011 was 100,851,857.00 MWh, the 20% of domestic electricity generation of Vietnam National Power Grid in 2011 is 20,170,371.40 MWh. The most recently commissioned 17 power plants (20,929,236.83MWh) in the grid contributed 20.75% of the total electricity generation.

The build margin is calculated as the generation–weighted average emission factor (tCO_2/MWh) of a sample of power plants as follows:

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

Where:

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

$EF_{grid,BM,y}$ is calculated ***ex–ante*** as described in Option 1 of the "Tool to calculate the emission factor for an electricity system" version 2.2.1.

The CO_2 emission factor of each power unit *m* ($EF_{EL,m,y}$) is determined as per the guidance in Step 4 (a) for the simple OM, option A1, using electricity generation data for 2011 which is the most recent historical year for which is available at the time of the CPA inclusion.

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

Where:

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

Using the data from the 2011 EF report published by the Vietnam DNA, the build margin emission factor is derived as follows:

Total Generation	20,929,236.83	MWh
Total Emissions	12,871,467	tCO2
$EF_{grid,BM,y}$	0.6150	tCO2/MWh

STEP 6. Calculate the combined margin baseline emission factor $EF_{grid,CM,y}$

The baseline emission factor $EF_{grid,CM,y}$ is calculated ex-ante as the weighted average of the operating margin and the build margin. Default weights of 50% for the first crediting period are used.

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

Where:

$EF_{grid,BM,y}$	tCO_2/MWh	Emission factor of the build margin.
$EF_{grid,OM,y}$	tCO_2/MWh	Emission factor of the operating margin.
w_{OM}	%	Weighting of the operating margin emission factor. (Default of

		50%)
w_{BM}	%	Weighting of the build margin emission factor. (Default of 50%)

$$EF_{grid,CM,y} = 0.5 \times 0.5598 + 0.5 \times 0.6150$$

$EF_{grid,CM,y}$ =	**0.5874**	**tCO_2/MWh**

Details of the generation data and power units used in the calculation of the grid emission factor for the first crediting period are listed in Appendix 3.

B.4.2. Data and parameters fixed ex ante

(Copy this table for each piece of data or parameter.)

Data/Parameter	**EF_{Res}**
Data unit	$kgCO_2e/MWh$
Description	Default emission factor for emissions from reservoirs
Source of data	Decision by EB23
Value(s) applied	0 $kgCO_2e/MWh$
Choice of data or measurement methods and procedures	The CPA consists of a new hydropower project (greenfield) with no reservoirs existing.
Purpose of data	For calculating project emission from the reservoir
Additional comment	

Data/Parameter	**Cap_{BL}**
Data unit	W
Description	Installed capacity of the hydro power plant before the implementation of the project activity. For new hydro power plants, this value is zero
Source of data	Operations Manual of REDP
Value(s) applied	0
Choice of data or measurement methods and procedures	The PoA consists of new hydropower projects (greenfield projects) only.
Purpose of data	For calculating the power density
Additional comment	-

Data/Parameter	**A_{BL}**
Data unit	m^2
Description	Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m^2). For new reservoirs, this value is zero
Source of data	Operations Manual of REDP
Value(s) applied	0
Choice of data or measurement methods and procedures	The PoA consists of new hydropower projects (greenfield) with no reservoirs existing before the CPAs.
Purpose of data	For calculating the power density

Additional comment	-

Data/Parameter	**$EF_{grid,CM,y}$**
Data unit	tCO_2/MWh
Description	Combined margin CO_2 emission factor of grid connected power generation in year y calculated using the version 2.2.1 of the "Tool to calculate the emission factor for an electricity system"
Source of data	Department of Meteorology, Hydrology and Climate Change (DNA of Vietnam).
Value(s) applied	0.5874
Choice of data or measurement methods and procedures	The CM emission factor is recalculated using the data extracted from the 2011 grid EF report published by Vietnam DNA. The calculation was made in accordance with version 2.2.1 of the "Tool to calculate the emission factor for an electricity system". Link to the 2011 EF report published by Vietnam DNA: http://www.noccop.org.vn/Data/vbpq/Airvariable_ldoc_61vnBC%20cuoi%20cung%202011.pdf
Purpose of data	For calculating the baseline emission
Additional comment	As per the "Tool to calculate the emission factor for an electricity system" Calculated as a weighted sum of the operating margin and the build margin. Given that both the $\boldsymbol{EF_{grid,OM,y}}$ and the $\boldsymbol{EF_{grid,BM,y}}$ are calculated *ex-ante*, the $\boldsymbol{EF_{grid,CM,y}}$ will be fixed during the first crediting period.

Data/Parameter	**EG_y**
Data unit	MWh
Description	Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost/must-run power plants/units, in year *y* (MWh)
Source of data	Department of Meteorology, Hydrology and Climate Change (DNA Vietnam)
Value(s) applied	See Appendix 3 for 2009, 2010 and 2011 data
Choice of data or measurement methods and procedures	Electricity generation data are used for OM and BM calculations
Purpose of data	For calculating the baseline emission
Additional comment	-

Data/Parameter	**$NCV_{i,y}$ -**
Data unit	$TJ/10^3$ tonnes or TJ/Gg
Description	Net calorific value (energy content) 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 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value(s) applied	See Appendix 3
Choice of data or measurement methods and procedures	No data for the fuels used in Vietnam is available hence IPCC defaults are used.

Purpose of data	For calculating the emission factor
Additional comment	-

Data/Parameter	**$FC_{i,m,y}$**
Data unit	mass (tones) or volume unit (m^3)
Description	Amount of fossil fuel type i consumed by power plant / unit m in year y
Source of data	Department of Meteorology, Hydrology and Climate Change (DNA Vietnam)
Value(s) applied	See Appendix 3 for 2009, 2010 and 2011 data
Choice of data or measurement methods and procedures	Fuel consumption data are used for OM and BM calculations
Purpose of data	For calculating the emission factor
Additional comment	-

Data/Parameter	**$EF_{CO2,i,y}$**
Data unit	tCO_2/TJ
Description	CO_2 emission factor of fossil fuel type i in year y
Source of data	2006 IPCC Guidelines on National GHG Inventories
Value(s) applied	See Appendix 3
Choice of data or measurement methods and procedures	IPCC default values at the lower limit of the uncertainty at 95% confidence interval as provided in table 1.4 of Chapter1 of Vol.2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Purpose of data	For calculating the emission factor
Additional comment	-

B.4.3. Ex ante calculation of emission reductions

>>

Project emissions

For the project activity, which involves construction of a new hydropower project with a new accumulated reservoir, project emissions associated with reservoir must be accounted if the power density of the project activity is less than 10 W/m^2.

Power density is calculated as follows.

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

Where:

Parameter	Unit	Description
PD	W/m^2	Power density of the project activity
Cap_{PJ}	W	Installed capacity of the hydro power plant after the implementation of the project activity
Cap_{BL}	W	Installed capacity of the hydro power plant before the implementation of the project activity. For new hydro power plants, this value is zero.

A_{PJ}	m^2	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.
A_{BL}	m^2	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. For new hydro power plants, this value is zero.

Installed capacity is 22MW or 22,000,000W. The power density is calculated as follows.

$PD = (Cap_{PJ} – Cap_{BL}) / (A_{PJ} – A_{BL})$ = (22,000,000 – 0) / (16,000 – 0) = 1,375 W/m^2

The power density of the project is 1,375 W/m^2, which is much greater than 10W/m^2. Therefore, the project will result in no emissions.

$PE_y = 0.$

Also, as per the methodology, the use of fossil fuels for the back up or emergency purposes (e.g. diesel generators) can be neglected and hence not included.

Leakage

The project will result into no leakage.

$LE_y = 0$

Emission reductions

Emission reductions are calculated with the following formula:

$ER_y = BE_y – PE_y – LE_y$

Where:

ER_y	tCO_2e/yr	Emission reductions in year *y*
BE_y	tCO_2e/yr	Baseline emissions in year *y*
PE_y	tCO_2e/yr	Project emissions in year *y*
LE_y	tCO_2e/yr	Leakage emissions in year *y*

The annual emission reductions are calculated with the following formula:

$ER_y = BE_y – PE_y – LE_y$ = 48,120 – 0 – 0 = 48,120 tCO_2

B.4.4. Summary of ex ante estimates of emission reductions

Year	Baseline emissions (t CO_2e)	Project emissions (t CO_2e)	Leakage (t CO_2e)	Emission reductions (t CO_2e)
2014 (7 months)	28,070	0	0	28,070
2015	48,120	0	0	48,120
2016	48,120	0	0	48,120
2017	48,120	0	0	48,120
2018	48,120	0	0	48,120
2019	48,120	0	0	48,120
2020	48,120	0	0	48,120
2021 (5 months)	20,050	0	0	20,050
Total	**336,840**	0	0	**336,840**
Total number of crediting years	7			
Annual average over the crediting period	48,120	0	0	48,120

B.5. Monitoring plan

B.5.1. Data and parameters to be monitored

(Copy this table for each piece of data or parameter.)

Data/Parameter	**$EG_{facility,y}$**
Data unit	**MWh**
Description	Quantity of net electricity generation supplied by the CPA to the grid in year *y.*
Source of data	Measured from applicable meter(s) and calculated from export and import power
Value(s) applied	81,923[13]

[13] Ex-ante net electricity supplied to the grid by the CPA. In ex-ante estimation, there is no power import.

Measurement methods and procedures	The data are directly measured by bidirectional electronic power meters installed at the project activity substation as described in the signed Agreement (PPA) with EVN. There will be 03 sets of meters, including two main, and four back-up bidirectional meters. These meters will measure both the electricity supplied by the power plant to the grid (positive value) and the electricity supplied by the grid to the power plant (negative value) through the main cycle. The electricity will be continuously measured by the power meters and hourly recorded. Double checking by the invoice issued by project owner to ensure the consistency. Proportion of data to be monitored: 100% Data will be recorded electronically and kept during the crediting period and two years after. Accuracy level: according to the signed power purchase agreement and/or latest legal requirements.
Monitoring frequency	Continuous measurement and monthly recording.
QA/QC procedures	The measurement/ monitoring equipment should adopt the colligated automation system complying with national standard and technology. These equipment and systems should be calibrated and checked in accordance with the signed power purchase agreement and/or latest requirements. If the main meter is failed, the value recorded by the backup power meter will be used generation calculation. If both main and backup power meters are also error, the data used for generation calculation will be conducted according to the details agreed in the Power Purchase Agreement.
Purpose of data	For calculating baseline emission of the CPA.
Additional comment	The monitored value of this parameter will be calculated from the power export and import. The power export and import will be based on the data from the applicable meter(s).

Data/Parameter	**Cap_{PJ}**
Data unit	W
Description	Installed capacity of the hydropower plant after the implementation of the project activity.
Source of data	Nameplate of the generating equipment.
Value(s) applied	22,000,000
Measurement methods and procedures	Verified at the project site.
Monitoring frequency	Monitored yearly.
QA/QC procedures	Photos to be taken showing the status of generators and the nameplates with specifications of generators. Cross check with the Maintenance Logbook for any modification or replacement.
Purpose of data	For calculating PD, from which determine EF_{Res} and PE_y
Additional comment	-

Data/Parameter	**A_{PJ}**
Data unit	m^2

Description	Area of reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full.
Source of data	Measurement report by a third-party entity.
Value(s) applied	16,000
Measurement methods and procedures	The measurement method will be applied by the third-party consultant in accordance with the local industry practices.
Monitoring frequency	Monitored yearly.
QA/QC procedures	The third-party entity will have sufficient qualification and licensing to conduct the measurement. The actual water level will also be measured on-site for the operational purpose and records. The uncertainty level of the data is low.
Purpose of data	For calculating PD, from which determine EF_{Res} and PE_y
Additional comment	-

B.5.2. Sampling plan

>>
Not applicable

B.5.3. Other elements of monitoring plan

>>
The monitoring plan of the CPA is consistent with methodology ACM0002 (version 13.0.0). Description of the monitoring plan is presented below.

MONITORING OF NET ELECTRICITY SUPPLIED BY THE PROJECT TO THE GRID AND RELATED PARAMETERS

Pa Chien Hydropower Project is connected to the national power grid through one transformer substation with two busbars hooking up to the national power grid. An indicative grid connection diagram is provided in Figure 4 as below. The grid connection diagram indicates the principles for positioning of metering instruments that will be used in the monitoring of emission reductions.

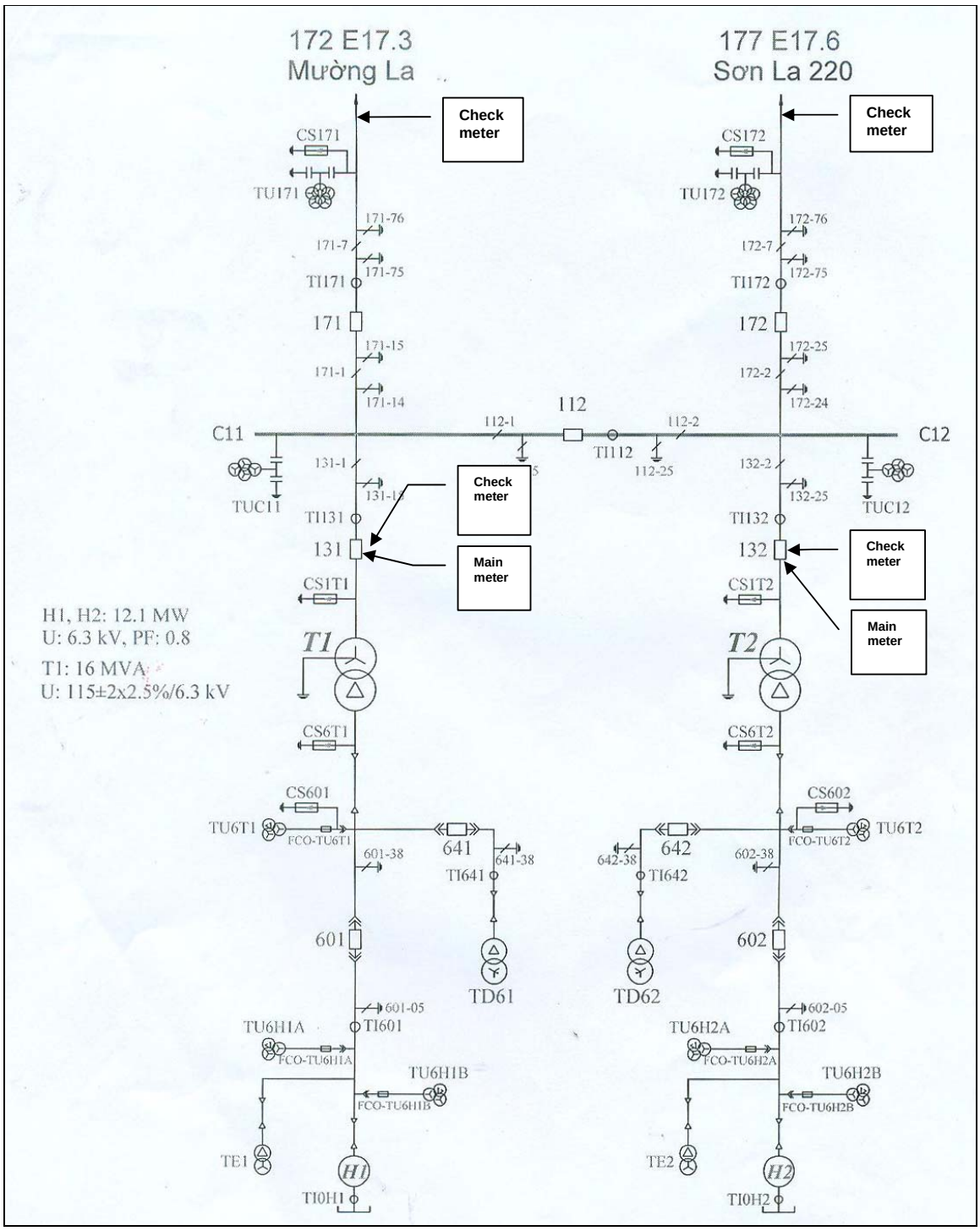


Figure 4. Metering and grid connection diagram

The Project Entity will monitor the parameters in accordance to the following principles:

- **Power supplied to the grid by the component project activity:**
  As indicated in Figure 4, the project is connected by two busbars, which will deliver power generated by the project to the grid. The power supplied to the grid is metered by means of 03 sets of bidirectional meters (totally 06 meters, of which 02 are main and 04 are check meters) as below:
  - Project entity: The power supplied to the grid is metered by the project entity at the substation after power is stepped up to high voltage. Therefore, no further

transformer losses will occur before the project is connected to the grid. The power supply of the project to the grid will be metered with standard electricity meters in accordance with national regulations (that meet the accuracy level of 0.2s for main meters and 0.5s for back-up meters; in compliance with IEC 62053-22)[14]. The metering instruments may record either a net figure of power delivered to the grid or two readings, i.e. power delivered to the grid and power received from the grid.

- Grid company: The grid company, EVN, will meter the power supply also at the high voltage side of the on-site transformer station with its own metering equipment. The calibration will be carried out according to the internal calibration requirements of the grid company itself.
- Calibration: Calibrations are carried out by the grid company or by a certified company appointed by the grid company following the procedures and cycles as stipulated in the Decision No. 25/2007/QD-BKHCN dated 05 October 2007 by the Ministry of Science and Technology or any specific regulations applicable, i.e. DLVN 39 : 2012 and DLVN 39 : 2019, which is the latest now. If there are any substantial discrepancies between the readings of the metering instruments throughout the year, both instruments will be recalibrated. The frequency of calibration for the meters will be every two (02) years up to 31/12/2019 in accordance with Circular No. 23/2013/TT-BKHCN dated 26/09/2013, which takes effect as of 15/01/2013 (Article 30), by the Vietnamese Ministry of Science and Technology.[15]
  From 01/01/2020 onwards, the meters will be calibrated every 3 years in line with the Circular No. 07/2019/TT-BKHCN dated 26/07/2019 by the Vietnamese Ministry of Science and Technology.[16]

- **Power imported from the grid to the component project activity:**
  As indicated in Figure 4, the project is connected by means of 03 sets of bidirectional meters (totally 06 meters, of which 02 are main and 04 are check meters), which will deliver power from the grid to the project in case of emergencies or when the turbines of the proposed component project activity are not in operation. The power received from the grid is metered as below:
  - Grid company: The grid company will meter the power supplied to the project through the same 03 sets of bidirectional meters in line with standard metering instruments in accordance with national regulations.
  - Calibration: Calibrations are carried out by the grid company or by a certified company appointed by the grid company following the procedures and cycles as stipulated in the Decision 25/2007/QD-BKHCN dated 05 October 2007 by the Ministry of Science and Technology or any specific regulations applicable, i.e. DLVN 39 : 2012 and DLVN 39 : 2019, which is the latest now. If there are any substantial discrepancies between the readings of the metering instruments throughout the year, both instruments will be recalibrated. The frequency of calibration for the meters will be every two (02) years up to 31/12/2019 in accordance with Circular No. 23/2013/TT-BKHCN dated 26/09/2013, which takes effect as of 15/01/2013 (Article 30), by the Vietnamese Ministry of Science and Technology.
    From 01/01/2020 onwards, the meters will be calibrated every 3 years in line with the Circular No. 07/2019/TT-BKHCN dated 26/07/2019 by the Vietnamese Ministry of Science and Technology.[17]

[14] Circular 27/2009/TT-BCT dated 25 September 2009 by the Ministry of Industry and Trade

[15] This Circular took effect as of 15/01/2013. The grid company may request specific power plants to calibrate meters more often than legal requirements. They only allowed Pa Chien to calibrate meters every 2 years in 2018

[16] Due to Circular No. 07/2019/TT-BKHCN dated 26/07/2019 by the Ministry of Science and Technology, Electricity of Vietnam – Northern Power Corporation issued Letter No. 2791/EVNNPC-KD dated 05/06/2020 requesting all IPPs having signed PPAs with Northern Power Corporation to sign additional appendix to PPAs on change in frequency of meter calibration; Pa Chien CPA implementer has signed additional appendix to the PPA with the grid company.

- **Installed capacity of the hydropower plant (Cap_{pj}):**
  In addition to the above, the installed capacity of the hydropower plant will be monitored annually. Photos showing the date of checking, the status of generators and the nameplates with specifications of generators shall be taken and along with information from supplier should be enclosed with the Annual Monitoring Report for submission to the PoA coordinating entity.

- **Surface area of the reservoir (A_{PJ}):**
  The level of the water reservoir will be measured and the surface area of the reservoir is calculated annually by a third-party measurement consultant, to check whether the actual reservoir does not deviate substantially for the design.

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

Determination of net power supply

The net electricity supplied by the project through the two busbars (in MWh) is continuously metered by the grid company (evidenced by monthly sales receipts), monthly recorded and cross-checked against the readings of metering instruments of the project entity.

Archiving, reporting, and preparation for periodic verification

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

Procedures in case of damaged metering equipment / Emergencies

The data recorded from the back-up system will be used in case of the failure of the main system:

- The main metering system is to measure the total electricity export and import.
- The backup systems are also installed and operated for measuring the total electricity export and import in redundancy with the main system. Its recorded data will be served in case of any failure of the main system.

Furthermore, the project entity will document all efforts made to restore normal monitoring procedures.

Emergencies

[17] Due to Circular No. 07/2019/TT-BKHCN dated 26/07/2019 by the Ministry of Science and Technology, Electricity of Vietnam – Northern Power Corporation issued Letter No. 2791/EVNNPC-KD dated 05/06/2020 requesting all IPPs having signed PPAs with Northern Power Corporation to sign additional appendix to PPAs on change in frequency of meter calibration; Pa Chien CPA implementer has signed additional appendix to the PPA with the grid company.

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

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

OPERATIONAL AND MANAGEMENT STRUCTURE FOR MONITORING

The monitoring of the emission reductions will be carried out according to the scheme shown in Figure 5. Within the project entity, a monitoring officer is appointed to undertake the day-to-day supervision responsibility. The measurement of the electrical energy supplied to the grid and reporting of daily operations will be carried out by the plant operation staff.

The monitoring officer will be responsible for checking the measurements, collection of sales receipts, collection of billing receipts of the power supplied by the grid to the hydropower plant and the calculation of the emissions reductions. The monitoring officer will prepare operational reports of the component project activity, recording the daily operation of the hydropower station, including operating periods, power delivered to the grid, equipment defects, etc. The selection procedure, tasks and responsibilities of the monitoring officer are described in detail in Appendix 4. Finally, the monitoring reports will be reviewed by a CDM Advisor, who will be engaged by the coordinating entity to assure that all monitoring requirements are met.

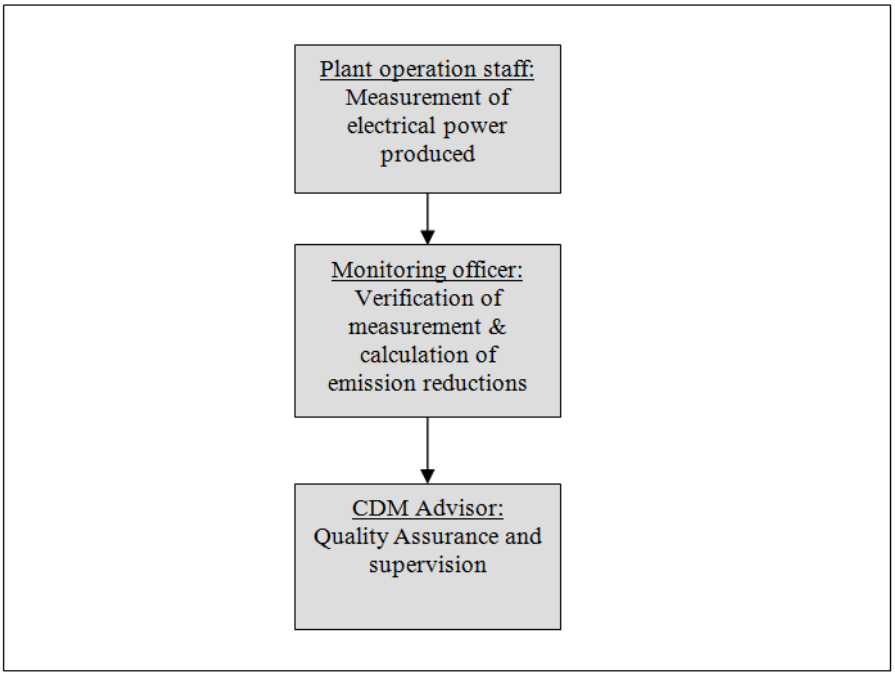


Figure 5. Management structure for monitoring emission reductions

Training

A detailed Monitoring Manual for CDM will be prepared by the CDM Advisor and delivered to the coordinating entity and the CPA implementing entity before the start of the crediting period. A training course will be designed and conducted so that the monitoring officer and the technical staff are fully familiar with the procedures set out in the Manual and the latest EB guidelines on monitoring for preparation of the monitoring report (CDM-MR).

SECTION C. Start date, crediting period type and duration

C.1. Start date of CPA

>>
08/12/2010, which was the date that the civil construction contract for the spillway dam and related items was signed between the project owner and third-party contractor.

C.2. Expected operational lifetime of CPA

>>
30 years

C.3. Crediting period of CPA

C.3.1. Type of crediting period

>>
Renewable crediting period.

C.3.2. Start date of crediting period

>>
01/06/2014 or the date of inclusion of this CPA in the registered POA, whichever is later.

C.3.3. Duration of crediting period

>>
7 years and 00 months

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

>>
An Environmental Protection Commitment (EPC) report was carried out by the project entity. A summary of the main findings of the EPC is provided below.

Summary of main environmental impacts:

1. Land acquisition.

Permanent land acquisition area shall be 13.5 ha for the reservoir and 14 ha for water canal and pressure basin, 1.25 ha for penstock, 4.5 ha for powerhouse and other project construction items. Temporarily occupied land area shall be 7.6 ha for the disposals and temporary material handling processes.

2. Landslide, erosion and sedimentation.

This will cause sedimentation on different parts of the project site, including the main gravity dam, water canal, and powerhouse, thereby affecting the quality of surface water and aquatic life.

3. Impacts on quality of surface water.

This shall be mainly resulted from the rainwater run-offs that sweep away constructional material waste and domestic waste from the workers working at the site. The polluted rainwater shall increase the water turbidity in nearby water bodies and hence affecting the marine life.

4. Impacts on air quality.

During the project's construction, some air pollution will occur due to dust resulting from construction and skimming tools. There will also be exhaust gases from transport vehicles and machines during construction and exhaust gases from transportation activities during operation, which have insignificant an impact on the air quality.

The other impact on the air quality will come from the storage of water in the reservoir. The changes in buffering surface type will cause the humidity pattern of the lake area and surroundings to change. The increased humidity reserves can create favourable conditions for cloud and frost forming in the area.

5. Noise impacts.

This may be resulted from the operation of constructional machinery and equipment during construction phase of the hydropower plant. In addition, transport vehicles and mine explosions may also be a significant source of noise impacts which directly influence workers' health at the site.

6. Impacts on soil.

Water from the turbines containing little suspended sediment may cause sand erosion through abnormal changes. Large erosion may affect the reservoir's capacity.

7. Impacts on the river flow in the downstream region, marine life and reservoir side subsidence and/or landslide during operation phase.

Summary of mitigation measures:

Environment and Compensation working group shall be formed by Pa Chien Hydropower JSC. This working group shall manage the environmental protection and compensation issues. The group shall have at least 05 persons.

Main responsibilities of the working group on Environmental issues shall include the followings: (i) supervise contractors in the application of mitigation measures; (ii) monitoring and propose additional mitigation measures as necessary; (iii) report on environmental monitoring and submit report to relevant parties (Environmental Management Division of Chieng San district people's committee; leaders of Pa Chien Hydropower JSC , BIDV branch in Son La, World Bank and Project Management Board of the MOIT.)

The EPC report did not report any trans-boundary impacts since the project is completely located within Vietnam land territory.

D.2. Environmental impact assessment

>>

For Pa Chien Hydropower Project, in accordance with the local Decree 21/2008/ND-CP, the project activity is required to conduct an environmental protection commitment (EPC) report.

The project activity had already obtained the approval for the EPC from Muong La District Peoples' Committee on 19 November 2008 via the letter No. 1275/UBND. The approval letter mandated that the project participant shall ensure full compliance with the contents of its environmental protection commitments. In addition, the project has also complied with the Environment Safeguards Framework, which was approved for REDP. In accordance with the ESF, an Environment Management Plan for the project was prepared so as to meet the requirements of

Vietnam's regulation on environment issues, which was given no objection by the WB and endorsed by MOIT.

Below is the list of environment regulations that the project complied with:

Related Law and Regulations of Vietnam:

- Environment protection Law of the Socialist Republic of Vietnam No. 52/2005/QH11 dated 29/11/2005, which come into effect since 01/07/2006
- Decree No. 80/2006/ND-CP dated 09/09/2006 by the Government on detail regulations and guidelines for the implementation of the Environment protection Law
- Decree No. 117/2009/ND-CP dated December 31, 2009 of the Government on the handling of law violations in the domain of environmental protection
- Circular No. 05/2008/TT-BTNMT dated 08/12/2008 by the Ministry of Natural Resources and Environment on guidelines for strategic environment assessment, environmental impact assessment and environment protection commitment.
- Decree No. 21/2008/ND-CP dated 28/02/2008 by the Government on amendment to Decree No. 80/2006/ND-CP dated 09/09/2006 by the Government which provides detail regulations and guidelines for the implementation of the Environment protection Law.
- Vietnam's current standards related to environment issues.

World Bank safeguards policies:

Safeguard
OP/BP 4.01 Environmental Assessment (January 1999)
OP/BP 4.04 Natural Habitats (June 2001)
OP/BP 4.10 Indigenous Peoples (July 2005)
OP/BP 4.11 Physical Cultural Resources (July 2006)
OP/BP 4.12 Involuntary Resettlement (December 2001)
OP/BP 4.37 Safety of Dams (October 2001)
OP/BP 7.50 International Waterways (June 2001)
World Bank Policy on Disclosure of Information (January 2002)

SECTION E. Local stakeholder consultation

E.1. Modalities for local stakeholder consultation

>>

The following the procedures on stakeholder consultations required by the local regulation (Circular No. 05/2008/TT-BTNMT, dated 08/12/008 by the Ministry of Natural Resources and Environment), the comments of the commune's stakeholders were collected. These comments were received by the project entity during a meeting with the commune's officials and local residents, which occurred on 11 September 2010 in Chieng San commune, Muong La district, Son La province. The proposed project is solely located in Chieng San commune, Muong La district, Son La province. The officials of the People's Committee of Chieng San commune and all households affected by the construction of the project were invited to the stakeholder consultation meeting. The following commune officials and local representatives participated in such stakeholder consultation meeting:

Commune officials:

1. Mr. Cam Van Luan, Chairman of Chieng San Commune People's Committee.
2. Mr. Leo Van Suong, Deputy Standing Secretary of Chieng San Commune Party Committee.
3. Mr. Buong Van Panh, Chief of Commune Police Affairs
4. Ms. Luong Thi Pang, Director of the Commune Women's Union
5. Mr. Leo Van Luoi, Pa Lang village fatherland front committee
6. Mr. Cam Van Luan, Leader of Chien village

7. Mr. Vi Van Yen, Leader of Pa Chien village
8. Mr. Lo Van Lai, Leader of Pa Lang village

Representatives of Pa Chien Hydropower JSC:

1. Mr. Tong Duc Diep, Director of Pa Chien Hydropower Project Management Unit
2. Mr. Nguyen Xuan Kiem, Technician of Pa Chien Hydropower Project Management Unit

Environment consultant;

1. Ms. Le Thi Ngoc Quynh, Environmental Consultant

Local residents:[18]

1. Mr. Lo Van Loi, Lam village
2. Mr. Quang Van Dan, Pa Chien village
3. Mr. Cam Van Luan, Pa Chien village
4. Mr. Quang Van Cuong, Pa Lang village
5. Mr. Lo Van Trien, Chien village
6. Mr. Lo Van Cham, Pa Lang village
7. Mr. Quang Van Doam, Pa Chien village

E.2. Summary of comments received

>>

All the comments received have been taken into consideration by the project owner and documented in the minute of stakeholder consultation meeting. A summary of the comments received are as follows:

- President of Chieng San commune: the project owner has frequent communications and exchange with the commune authorities during the preparation of construction for the project activity. The project owner also helped to prepare the site for the commune to build a new school. It also has good relation with the local residents.
- Pa Chien villager: the construction of the project activity may result in dust pollution because the site is quite near the residents area. The project owner therefore will need to take appropriate measures to reduce the dust concentration during the excavation and transport processes. The project owner will need to pay special attention to conduct the compensation properly. There is no valuable animal in the region, except for some rats and monkey which are destructive to the local residents' corn field.
- The project owner will also need to pay attention in order to avoid scattering rock and soil into the river, which may cause sedimentation in the river bed.
- The project owner is kindly advised to support the local residents by dumping the refilling soil into some unused areas so that the local residents can have more farming land.
- The project owner will need to ensure sufficient water for local resident rice field during construction phase.
- The project owner is suggested to widen the access road to the project site so that the local residents can benefit from that.
- Impacts during construction are short term and will be over when the project activity is put into operation. However, the project owner is requested to clean up the site properly when the construction is completed to provide clean environment for the local residents.

In general, all of the participating stakeholders are very supportive of the construction of the project activity.

[18] Just to name a few, the full list of attendance was included in the stakeholder consultation meeting records and attached attendance list conducted on 11 September 2010

E.3. Consideration of comments received

>>

The organization's comments are carefully reviewed. All of them are positive comments. The representative of the project owner, Mr. Diep, committed that the company will undertake the followings:

- Concretization of the roads in Ban Chien, Pa Chien, and upgradation of the road in Pa Lang village.
- Construction of a bridge crossing over Chien river in Pa Chien village.
- The widening of these roads shall be discussed with the commune authorities so that proper steps can be proceeded.

SECTION F. Eligibility for inclusion

A CPA under the PoA is required to fulfill the eligibility criteria outlined in the below table for inclusion in the PoA. The developed eligibility criteria are consistent with the "Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programme of activities", Version 02.1, EB 70.

Pa Chien Hydropower Project is eligible to be included to the Renewable Energy Development Program PoA because it meets all established eligibility criteria as demonstrated in the below table.

Table 4: Conformity of the CPA with the eligibility criteria for inclusion in the PoA

No.	Eligibility criterion - Category	Eligibility criterion - Required condition	Supporting evidence for inclusion	Description of this CPA in relation to the criterion and supporting evidence
a	**Geographical boundary of the CPA**	Each Project should be located within the geographical boundary of the PoA, i.e. in Vietnam.	Map of CPA and/or description of location indicating project within Vietnam boundary.	The CPA is located in Son La province, Vietnam see Section A.2
b	**Avoidance of double counting of emission reductions**	Each CPA-DD shall be uniquely identified and defined in an unambiguous manner.	Geographic information (GPS coordinates).	The geographical reference of Pa Chien Hydropower Project: Dam location: Longitude: 104.080; Latitude: 21.475 Powerhouse location: Longitude: 104.072; Latitude: 21.476[19]
		The coordinating entity will ensure that all CPAs under its PoA are neither registered as an individual CDM project activity nor included in another registered PoA, and	Demonstration should be provided in the CPA-DD.	The CPA has never been registered or submitted for registration under the CDM. See Section A.7

[19] The geographical coordinates were taken from the approval for inclusion of Pa Chien into province hydropower plan, dated 01 August 2007.

No.	Eligibility criterion - Category	Eligibility criterion - Required condition	Supporting evidence for inclusion	Description of this CPA in relation to the criterion and supporting evidence
		that the CPA is subscribed to the PoA.		
		Each CPA must be approved by the coordinating entity.	Evidences could include agreement, letters, communications between CME and CPA implementer with statement of approval for participation in the programme.	The project was approved by the MOIT which is the coordinating entity. This is evidenced by the internal MOIT letter approving the refinancing for this CPA in the PoA on 09/04/2011.
c	**Specifications of technology/measure implemented by the CPA**	The project activity shall involve the construction and operation of a new hydropower project. No capacity addition or retrofit will be accepted.	Evidences should include any of the following: Technical specification/Manufacturer data/nameplate data/procurement contract/feasibility study, etc.	The project activity involves the construction of a new hydropower plant. This is evidenced by the feasibility study[20] and related construction contract.[21]
		The maximum capacity of the project or the renewable energy component (in cases where it is a combination of renewable and non-renewable) is 30 MW.	Evidences should include any of the following: Technical specification/Manufacturer data/nameplate data/procurement contract/feasibility study, etc.	The capacity of the project is 22MW. This is evidenced by the feasibility study.[22]
		In the case that the project activity involves the construction of a new reservoir, the power density shall be larger than 4 W/m^2.	Reservoir surface and installed capacity or power density shall be documented from topological study or feasibility study, etc.	The power density of the project activity is 1,375 W/m^2 which is much larger than 4 W/m^2.[23] Installed capacity is provided in the feasibility study. Reservoir surface area from the EMP, page 21.
d	**Check the start date of the CPA through documentary evidence**	The start date of the CPA is in line with CDM glossary.	Evidences should include date of real actions such as loan contract, contract for construction,	Construction contract for the spillway dam and related items was signed between the project owner and third

[20] Engineering Design, Volume 1, General Description, page 6 indicates Pa Chien is a greenfield project.

[21] The civil construction contract for the spillway dam was signed on 08 December 2010.

[22] As evidenced in Engineering Design, Volume 1, General Description, page 6.

[23] The power density is calculated based on the reservoir surface area taken from the Environmental Management Plan, page 21, dated 2010 and the installed capacity from the Engineering Design, Volume 1, General Description, page 6.

No.	Eligibility criterion - Category	Eligibility criterion - Required condition	Supporting evidence for inclusion	Description of this CPA in relation to the criterion and supporting evidence
			equipment procurement, equipment supply, etc.	party company on 08/12/2010[24] whilst the date of publication of the PoA for global public consultation is 30/12/2009.
e	**Compliance with applicability and other requirements of the methodology applied by CPAs**	Each CPA is in compliance with applicability and other requirements of the ACM0002 baseline and monitoring methodology. "*Consolidated baseline methodology for grid-connected electricity generation from renewable sources", Version 13.0.0*.	The compliance should be demonstrated against the applicability conditions of the methodology as outlined in Section B.2. of the PoA-DD.	The CPA meets all applicability conditions of ACM0002 baseline and monitoring methodology (version 13.0.0) as demonstrated in the below table.
f	**CPAs meet the requirements pertaining to the demonstration of additionality**	FIRR of the CPA is below the benchmark rate applicable to the CPA as per the Guidelines on the Assessment of Investment Analysis. The financial analysis should be provided and all assumptions are justified through relevant evidences by the CPA implementer. The analysis will be done following the "Tool for the demonstration and assessment of additionality"	The financial analysis sheet and all assumptions justified through relevant evidences by the CPA implementer. The values for key parameters used in the calculation of the FIRR can be sourced from documents such as feasibility studies, detailed project reports, bank appraisal documents, loan sanction documents, etc. The Equity rate and the debt interest rate, involved in the calculation of the benchmark rate, can be sourced from documents such as Annex I of the Guidelines on the Assessment of Investment Analysis,	Additionality is demonstrated through benchmark analysis. The equity IRR (7.59%) is far below the standard benchmark for Vietnam for this type of projects (12.75%). The project is not a common practice. The financial analysis sheet is available and all assumptions are justified. Details in section F.

[24] Civil construction contract for the spillway dam.

No.	Eligibility criterion - Category	Eligibility criterion - Required condition	Supporting evidence for inclusion	Description of this CPA in relation to the criterion and supporting evidence
			relevant documents of the financial sector, loan sanction documents, etc.	
		CPA has access to loan from participating banks under REDP, and participating banks have a refinance agreement with WB-REDP/MOF.	Loan agreement between the CPA and local banks and list of participating banks in WB-REDP/MOF refinancing scheme.	The CPA accessed loan from the BIDV, Son La branch, a participant bank, dated 18/05/2011 and BIDV has a refinance agreement with WB-REDP/MOF (refinancing application approved by MOIT on 09/02/2010).
g	**Local stakeholder consultations and environmental impact analysis**	The CPA must have secured all required environmental clearances as outlined in Section E.	The relevant documents should include inter alia Initial Environmental Evaluation, water rights, land right, power purchase agreement, etc.	Secured relevant environmental clearances outlined in section E of this CPA-DD. Muong La district people's committee approved the EPC prepared by the Project Owner on 19/11/2008. All other permits are available.[25]
		The CPA must comply with Dam Safety Framework, Resettlement Policy Framework and Ethnic Minority Planning Framework or similar instruments.	The project safeguard documents must be publicly disclosed.	Complies with the requirements. The Resettlement Plan (RP) and Ethnic Plan (EP) of Pa Chien Hydropower Project were disclosed to stakeholders on 25/02/2011 by the Project Owner.[26] The project has an environmental management plan which has granted no objection by the WB and endorsed by MOIT on 31/03/2011.[27]
		The project must have undertaken a stakeholder	Evidences could include the following : meetings minutes,	Stakeholder consultations have been undertaken by the

[25] Muong La district approval for the EPC report on 19/11/2008.

[26] Based on the letter by the project owner to MOIT, dated 25/02/2011.

[27] Based on the letter by the World Bank sent to MOIT giving no objection to the environmental management plan.

No.	Eligibility criterion - Category	Eligibility criterion - Required condition	Supporting evidence for inclusion	Description of this CPA in relation to the criterion and supporting evidence
		consultation as outlined in Section F.	press release, list of participants and records of participants comments and project developers responses, pictures, etc.	CPA. This is evidenced by the stakeholder meeting minutes.[28]
		Participating developers and bank attended the training and capacity building programs conducted by MOIT.	Participants list or confirmation by MOIT.	The developer and the bank attended the training and capacity building programs conducted by MOIT. This has been evidenced by providing the attendance log sheet of the training sessions.
h	**Affirmation of non-diversion of official development assistance (ODA)**	A letter from Annex I parties should affirm that funding, if any, does not result in a diversion of ODA.	Participant from Annex I country LoA could be used. This evidence could be used for the inclusion of further CPAs	LoA for Sweden clearly states that non ODA is involved in the project.
i	**Target group**	The project must be connected to the national distribution grid of Vietnam, which predominantly supplied by both fossil fuel based and non-fossil fuel based generating units.	Agreement/letter of intent between the project developer and the national utility or transmission and/or distribution entity.	The project will be connected to the national grid. The Project Owner had obtained the acceptance for power purchase on 21/05/2008[29] and approval for grid connection on 09/06/2008 with the grid company[30]

Criteria j, k and l of the "Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programme of activities" are not applicable as sampling is not applied and the project is not a small-scale project activity neither a micro-scale project.

Demonstration of project additionality:

[28] Based on the minute of stakeholder meeting organized on 11/09/2010 at Chieng San commune.

[29] Based on the acceptance letter by Power Company No. 1 for purchasing the electricity from Pa Chien HPP, dated 21/05/2008.

[30] Based on the grid connection arrangement issued by Power Company No.1 for Pa Chien HPP, dated 09/06/2008.

The additionality of the project activity is demonstrated using the key criteria defined in Section B.2 of the PoA-DD, version 09, dated 02/07/2015, following the applicable tools:

- Version 05.0 of the "Combined tool to identify the baseline scenario and demonstrate additionality."
http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-02-v5.0.0.pdf
- Version 07 of the "Tool for the demonstration and assessment of additionality", which was approved by the Executive Board in its 70th meeting.
http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v7.0.0.pdf

Accordingly, investment analysis and checklist for additionality will be carried out at CPA level for assessment and demonstration of additionality. The analysis aims at demonstration of the FIRR of the CPA below the benchmark established in the PoA-DD and the participation of CPA in to the program has addressed some of the barriers faced by these kinds of projects in Vietnam.

The steps for demonstration of additionality are as per the description in the PoA-DD and "Tool for the demonstration and assessment of additionality", version 06.1.0. The benchmark analysis is performed using Step 2 of the "Tool for the demonstration and assessment of additionality". This includes applying benchmark analysis (sub step 2b), calculation and comparison of financial indicators (sub step 2c) and sensitivity analysis (sub step 2d).

STEP 1 – Identification of alternatives to the project activity consistent with current laws and regulations

Sub–step 1a. Define alternatives to the project activity:

The following alternatives to the project activity will be considered:

Alternative 1: The proposed project activity undertaken without being registered as a CDM project activity

The construction and operation of a hydropower project with the total installed capacity below or equal to 30 MW, without being registered as a CDM project activity.

Alternative 2: Adding a new fossil fuel-fired power plant with equivalent power output

The construction and operation of a new fossil fuel power plant with equivalent power output means that the installed capacity of the fossil fuel plant shall be smaller than the proposed capacity of the hydropower project since any fossil power plant has a longer operational hour than those of a hydropower plant.

Alternative 3: Adding a new renewable energy power plant other than hydropower plant

The construction and operation of another renewable power plant (e.g. solar, wind, biomass).

Alternative 4: Continuation of the current situation

In this case, the project activity will not be constructed and the power will be solely supplied from the Vietnam national grid.

Alternative 2 cannot be the baseline scenario because there is not any fossil fired power plant with the equivalent power output is constructed/under construction and or planned in Vietnam.[31]

[31] See Chapter VII of the Master Plan on Power Development for period of 2006-2015 with perspective to 2025 (the Sixth Master Plan) approved by the Prime Minister in July 2007.

According to the Master Plan of Electricity Expansion for period of 2006-2015 with perspective to 2025 - EVN (Master Plan VI) approved by the Prime Minister in July 2007 (Chapter VII) (the latest publicly information source listed all operated and planned power plants in Vietnam), there is no fossil fuel power plant with the equivalent or lower power output is constructed/under construction and/or planned in Vietnam. It shows that the investment and operation of such thermal power plants with the capacity equal and below 22 MW is not realistic in Vietnam.

Furthermore, within the scope of the Renewable Development Program (REDP), only renewable energy projects will be considered to receive the loan under the lending scheme. The construction of fossil fuel power plants thus will not be a plausible investment option as the project participant has no plan for investing in a fossil fuel power plant.

Alternative 3 cannot be the baseline scenario because the project location does not provide sufficient renewable resources except for the water resource.

Sub–step 1b. Consistency with mandatory laws and regulations:

All alternatives mentioned above are technically feasible and comply with Vietnamese current laws and regulations. However, Alternative 2 and 3 are not realistic and credible alternatives as explained above.

Hence, only Alternatives 1 and 4 are further considered as realistic and credible alternatives.

STEP 2 – Investment Analysis

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. As there are no other credible and realistic baseline scenario alternatives other than electricity supply from the grid, Option II is also not applicable. Thus, the benchmark analysis (Option III) is chosen to demonstrate additionality.

Step 2b: Applying benchmark analysis

For this CPA, it has been selected the Equity IRR as the most suitable economic indicator or FIRR.

Following paragraph 15 of the "Guidelines on the Assessment of Investment Analysis" Version 05, EB62, Annex 5, it has been selected as a benchmark the default value of the return on equity provided in Appendix A of the Guidelines. For Energy Industries (Group 1) projects in Vietnam, this value is 12.75%

Step 2c: Calculation and comparison of financial indicators

The parameters used in the FIRR calculations are presented in Table 5.

Table 5: Parameters for FIRR calculation

	Item	Unit	Value	Source	Date
I	**Project technical details**				
	Installed capacity	MW	22	Engineering Design, General Description	08/2009
	Project expected lifespan	years	30	Engineering Design, General Description & Decision 2014.QD-BCN	08/2009 06/2007

	Item	Unit	Value	Source	Date
	Annual gross generation	MWh	82,750	Engineering Design, General Description, page 178	08/2009
	Plant load factor	%	42.94%	Calculated	
II	**Investment costs**		**454,615**		
	Construction cost	mil. VND	260,923	Engineering Design, Total Investment	08/2009
	Equipment cost	mil. VND	148,692	Engineering Design, Total Investment	08/2009
	Project management cost	mil. VND	2,778	Engineering Design, Total Investment	08/2009
	Consultancy cost	mil. VND	7,522	Engineering Design, Total Investment	08/2009
	Other cost	mil. VND	13,052	Engineering Design, Total Investment	08/2009
	Contingency (10% a.m. costs)	mil. VND	21,648	Engineering Design, Total Investment	08/2009
III	**Costs arising during operation and Taxes**				
	Annual O&M Cost		1.5% of Investment costs	Decision 2014/QD-BCN	13/06/2007
	Annual insurance		1% of Investment costs	Decision 28/2007/QD/BTC	04/2007
	Resources tax		2% of revenue calculated using the taxable tariff	Decision 16/2008/QD-BTC and Engineering Design, Total Investment	4/14/2008 08/2009
	Taxable tariff	VND/kWh	750	Engineering Design, Volume 1, General Description	08/2009
	Depreciation for Equipment	year	10	Engineering Design, Volume 2, Hydrology, Economics and Energy	08/2009
	Depreciation for others	year	20	Engineering Design, Volume 2, Hydrology, Economics and Energy	08/2009
	Residual value of fixed asset	mil. VND	0	The fixed asset is fully depreciated after 20 years	
	Enterprise's revenue tax			Circular No. 42/2007/TT-BTC	27/04/2007
	For the first 4 years		0%	Engineering Design, Volume 2, Hydrology, Economics and Energy, page 52	08/2009
	For the next 9 years		5%	Engineering Design, Volume 2, Hydrology, Economics and Energy, page 52	08/2009
	For the next 2 years		10%	Engineering Design, Volume 2, Hydrology, Economics and	08/2009

	Item	Unit	Value	Source	Date
				Energy, page 52	
	For the remaining years		25%	Engineering Design, Volume 2, Hydrology, Economics and Energy, page 52	08/2009
IV	**Project revenue**				
	Electricity Sales (per year)	MWh	81,923	Volume 2, Hydrology, Economics and Energy, for the electricity own use and transmission loss of 1%, page 50	08/2009
	Electricity tariff	VND/kWh	786.78	4.5UScent/kWh based on Engineering Design, General Description, page 50, converted to VND using the exchange rated provided in the same report	08/2009
V	**Financing structure**				
	Debt interest Rate	%	15.0%	PP's board decision consistent with IMF document describing the prevalent interest rates in Viet Nam at the time of the investment decision	23/12/2009 10/12/2009
	Equity ratio	%	50%	Guideline # 18 on the assessment of Investment Analysis (EB 62 Annex 5)	

Comparison of the FIRR of the CPA with the benchmark FIRR

The comparison of the FIRR of the CPA, Pa Chien Hydropower Project with the benchmark FIRR of 12.75% is presented in Table 6.

Table 6: Results of financial analysis

Pa Chien Hydropower Project		
Financial Internal Rate of Return (IRR) over a 30 year period	Without CDM revenues	7.59%[32]
Benchmark		12.75%

[32] The project equity IRR has been determined in a conservative manner by not taking into account the depreciation of fixed asset after refurbishment in year 20th as cash outflow. It is common practice in hydropower projects in the host country that refurbishment is conducted in year 20th of the project lifecycle.

The results indicate that the FIRR of Pa Chien Hydropower Project is below the 12.75% benchmark without CDM revenues, thus the proposed project is not financially attractive and is therefore is eligible for inclusion in REDP PoA. This analysis also shows that additionality is robust over a wide range of potential benchmark values.

Sensitivity Analysis:

The sensitivity analysis is carried out in connection with four main risks to the project:

- Capital cost
- Energy generation
- Tariff
- Operation and Maintenance cost

In the sensitivity analysis, four above parameters is considered in the critical assumptions. The results of the sensitivity analysis for the FIRR are shown in Table 7 below, while Figure 6, 7, 8 and 9 provide a graphic depiction.

Table 7: Impact of variations in assumptions on the IRR without CDM revenues

No	Parameter	Variation	Project IRR	Likelihoods
1	Investment cost	+10%	6.14%	Below benchmark
		- 10%	9.36%	Below benchmark
		-24.35%	12.75%	The probability of a 24.35% decrease in the investment cost is not likely to happen because the statistic CPI of housing materials construction has been increased for the last few years. Especially for 2008 the general CPI has already increased more than 20%.
2	Energy generation	-10%	5.83%	Below benchmark
		10%	9.35%	Below benchmark
		29.17%	12.75%	The probability of a 33.69% increase in annual energy generation is very unlikely. This is because the potential hydrology has been surveyed in long term basis. The current estimate by the Institute of Energy Science (http://www.ies.vn/en/), an experienced consultant, is the most likelihood and an increase of 29.17% is not possible.
3	Electricity Tariff	-10%	5.79%	Below benchmark
		10%	9.38%	Below benchmark
		28.61%	12.75%	As mentioned in Decision 18/2008/QD-BCN, as the fuel price to be used to calculate variable cost for ACT will be limited by a ceiling rate of 110% of the average fuel prices in the previous year (Appendix 2). It is expected that the electricity tariff will not exceed 10% of the previous tariff. Thus, a variable of 28.61% in the tariff is unlikely happened.
4	O&M Costs	+10%	7.40%	Below benchmark
		-10%	7.78%	Below benchmark
		N.A.%	12.75%	Even if the O&M costs were to be set at zero, the FIRR would have a value of 9.48%, which is below the benchmark.

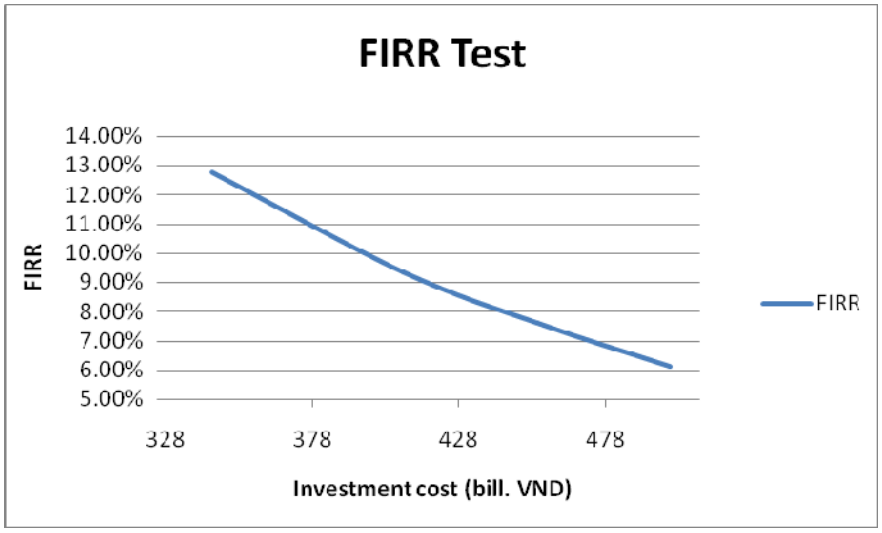


Figure 6: Sensitivity of FIRR to investment cost

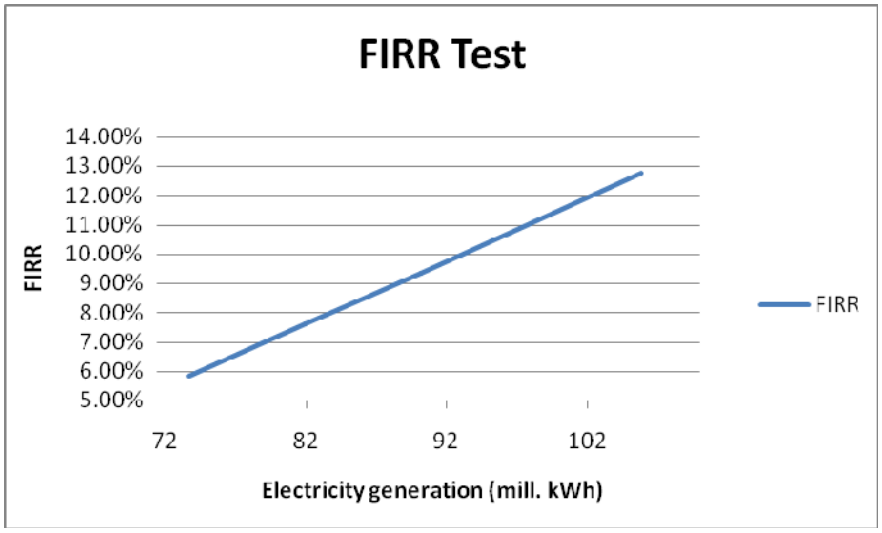


Figure 7: Sensitivity of FIRR to Annual Generation

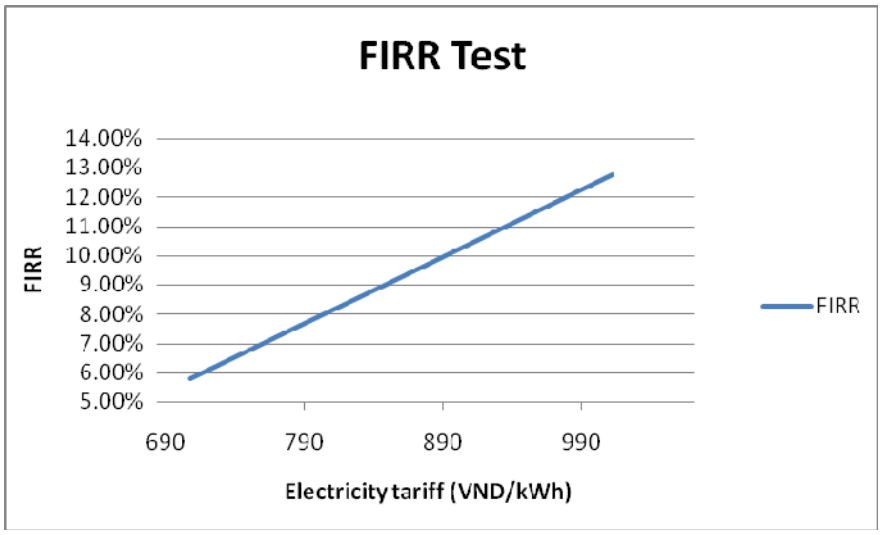


Figure 8: Sensitivity of FIRR to Tariff

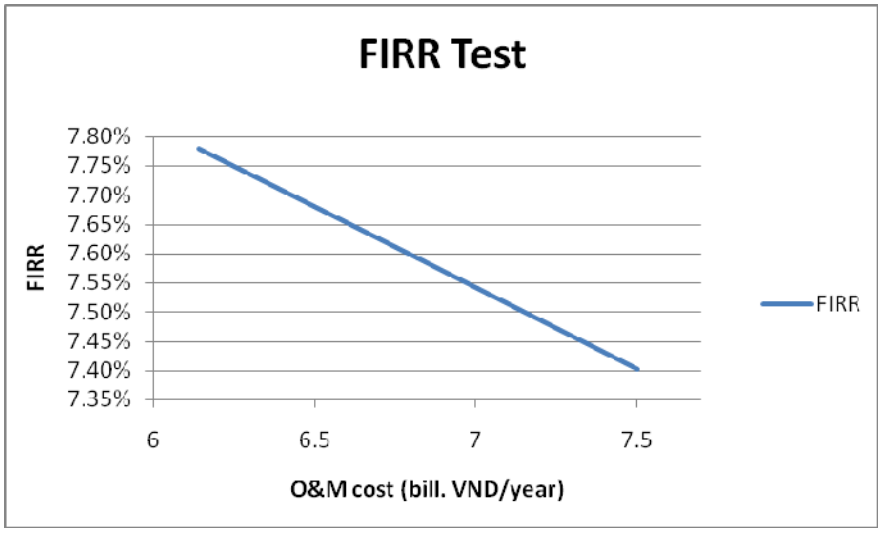


Figure 9: Sensitivity of FIRR to O&M Costs

Outcome of Step 2: **The proposed CDM project activity is unlikely to be financially attractive.**

STEP 3 – Barrier Analysis

The additionality is demonstrated through investment analysis. Hence, the barrier analysis is not required.

STEP 4 – Common practice analysis

Sub-step 4a: Analyze other activities similar to the proposed project activity

Government Decree No 45/2001/ND-CP on power generation and consumption, which was issued on 02 August 2001 created a legal basis to allow other entities to invest in and generate electricity rather than only state-owned entities as previously regulated. Before that time, all power plants have been invested from the state budget sources and operated by state owned companies.

Hence, any hydropower projects that have started the construction activities before August 2001 are not subject to this analysis. Besides, all hydropower projects that have started construction activities after the start date of CPA (08/12/2010) are not included in the analysis.

To classify the projects listed against the criteria: *similar scale, and take place in a comparable environment with respect to regulatory framework, investment climate,* the most relevant regulations which regulate the legal entities, the investment management procedures, and the technical designs and construction standards for hydropower projects in different scales (Prime's Minister Decision No 176/2004/QD-TTg, Decision of Ministry of Industry - No 3454/QĐ-BCN, Viet Nam Construction Code -
TCXDVN 285:2002).

According to the Prime's Minister Decision No 176/2004/QD-TTg which defines the legal entities against the project scales, private entities are not encouraged to invest in hydropower projects with capacity above 100 MW. Furthermore, according to the Decision of Ministry of Industry - No 3454/QĐ-BCN dated 18 October 2005 on defining the jurisdictions to approve the Master Plans

and management hierarchy for small scale hydropower projects, hydropower projects having installed capacity within the range from 1 to 30 MW are categorized as small scale projects.

To serve the purpose of this analysis and in order to categorize hydropower projects in correspondence with the existing regulations mentioned above, hydropower projects are categorized into groups as follows:

Table 8: Groups of hydropower projects serving for common practice analysis

Group	Installed capacity
A	≥ 300 MW
B	≥ 100 MW and < 300 MW
C	≥ 50 MW and < 100 MW
D	≥ 30 MW and < 50 MW
E	≥ 5 MW and < 30 MW
F	< 5MW

Source: Vietnam Construction Code – TXDVN 285:2002 (File 19) Ministry of Industry No. 3454/QD-BCN, 2005 (File 39)

The PoA include CPA with installed capacity up to 30 MW. According to Table 8, a typical CPA can then falls into Groups E or F of small scale hydropower projects in Vietnam.
The common practice analysis is carried out as per paragraph 47 of the "Tool for demonstration and assessment of additionality", Version 06.1.0. Accordingly, the following stepwise approach is used:

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

The installed capacity of the CPA is 22 MW, hence the applicable capacity range is 11 - 33 MW.

Step 2: In the applicable geographical area, identify all plants that deliver the same output or capacity, within the applicable output range calculated in Step 1, as the proposed project activity and have started commercial operation before the start date of the project. Note their number Nall. Registered CDM project activities shall not be included in this step.

The selected geographical area is Vietnam. The following table presents a list of 82 power plants with installed capacity up to 50 MW that are implemented in Vietnam after 2001 and before 08/12/2010.

Table 9: Power projects implemented after 2001 and before 08/12/2010 (capacity up to 50 MW)

#	Name of power plant	Capacity (MW)	Technology	Commissioning date	CDM (Yes/No)	Investor	Ownership (Private/ Public?)	Investment before removal of interest rate cap (Yes/No)
1	Cấm Sơn Tai SHP	4.5	Hydro	Feb-07	No	Cam Son Hydropower JSC	Private	Yes
2	Đrây H'Linh 2 SHP	16	Hydro	Feb-07	No	No.3 Electricity-Hydro Power JSC	Private	Yes
3	Nà Lơi SHP	9	Hydro	May-07	No	Na Loi Hydro Power JSC under No.7 Song Da Group	Private + state capital	Yes
4	Thác Trắng SHP	6	Hydro	Jun-07	No	No.11 Song Da Company	Private + state capital	Yes
5	Ry Ninh II SHP	8.1	Hydro	Jun-07	No	Ry Ninh II HydroPower JSC	Private	Yes
6	Khe Diên	9	Hydro	Jun-07	No	Song Ba Power	Private	Yes

#	Name of power plant	Capacity (MW)	Technology	Commissioning date	CDM (Yes/No)	Investor	Ownership (Private/ Public?)	Investment before removal of interest rate cap (Yes/No)
	SHP					Investment and Development Company		
7	EaKrông Rou SHP	28	Hydro	Jun-07	No		Public	Yes
8	Suối sập 2 SHP	14.4	Hydro	Jul-07	Yes	Truong Thanh Construction Company	Private	Yes
9	Nậm Tha 6 SHP	6	Hydro	Jul-07	Yes	Phuc Khanh JSC	private	Yes
10	Ngòi Xan 1 SHP	10.5	Hydro	Sep-07	Yes	Nam Tien JSC	private	Yes
11	Iagrai 1 SHP	7.5	Hydro	Sep-07	No	Gia Lai Quoc Cuong JSC	Private	Yes
12	Sông Pha SHP	7.5	Hydro	Sep-07	No	Đa Nhim- Hàm Thuận- Đa Mi Hydro Power JSC	Public	Yes
13	Nà Lòa SHP	6	Hydro	Oct-07	No	Cao Bang Metallurgy and HydropPower JSC	Private	Yes
14	Đăkrơsa SHP	7.5	Hydro	Nov-07	No	Đăkrơsa Hydropower JSC	Private	Yes
15	Krông Hin Tai SHP	5	Hydro	Jan-08	No	Krông Hin Tai HydroPower JSC	Private	Yes
16	Định Bình Tai SHP	6.6	Hydro	Jan-08	No	Unknown	Unknown	Yes
17	Ngòi Đường SHP	5	Hydro	Mar-08	Y	Lao Cai HydroPower JSC	Private	Yes
18	Đăk Pi Hao 2 SHP	9	Hydro	Mar-08	No	Gia Lai Electricity Company	Public	Yes
19	Krong Kmar SHP	12	Hydro	May-08	No	Song Da Investment and Development Company (Song Da IDC)	Private + state capital	Yes
20	Đak Ru SHP	7.5	Hydro	Jun-08	No	N&S Co., LTD	Private	Yes
21	Khe Diên SHP	9	Hydro	Jun-08	No	Song Ba Power Investment and Development Company	Private	Yes
22	So lo 1 SHP	5.2	Hydro	Jul-08	Yes	Mai Chau JSC, private Vitol S.A	private	Yes
23	Cốc Đàm SHP	7.5	Hydro	Jul-08	Yes	Hoang Son JSC	private	Yes
24	Iagrai 3 SHP	7.5	Hydro	Jul-08	Yes	Song Da 4 JSC under Song Da Group	Private + state capital	Yes
25	Ngòi Xan 2 SHP	8.1	Hydro	Aug-08	No	Nam Tien Trading and Construction JSC	Private	Yes
26	Đrây H'Linh 3 SHP	6	Hydro	Feb-09	No	Lilama 45-3	Private + state capital	Yes
27	ĐakPône 2 SHP	3.6	Hydro	Feb-09	Yes	No.3 Electricity Company (PC3-INVEST)	Private + state capital	Yes
28	Ayun Hạ SHP	3	Hydro	Mar-09	No	Ayun Hạ Hydro Power JSC	Unknown	Yes
29	Nậm Hô SHP	7.5	Hydro	May-09	No	Unknown	Unknown	Yes
30	An Điềm SHP	5.4	Hydro	May-09	Yes	Song Vang JSC	private	Yes
31	Ry Ninh SHP	3.6	Hydro	May-09	No	Ry Ninh HydroPower SHP	Private	Yes
32	Sông Ông	8.1	Hydro	May-09	No	Sông Ông HydroPower JSC	Private	Yes
33	Nậm Tục 2 SHP	3	Hydro	Jun-09	No	Nậm Tục HydroPower JSC	Private	Yes
34	Bình Điền SHP	44	Hydro	Jun-09	No	Bình Điện Hydropower JSC	Private + state capital	Yes
35	Ta Niet	3.6	Hydro	2009	Yes	Ta Niet JSC,	private	Yes

#	Name of power plant	Capacity (MW)	Technology	Commissioning date	CDM (Yes/No)	Investor	Ownership (Private/ Public?)	Investment before removal of interest rate cap (Yes/No)
						private RCEE		
36	Pac Khuoi	8	Hydro	2007	Yes	Cao Bang JSC (BOO)	Private	Yes
37	Dasiat	13.5	Hydro	2008	Yes	Northern hydropower JSC	Public	Yes
38	Khe Soong	3.6	Hydro	2009	Yes	An Sinh JSC, private	private	Yes
39	Suoi Tan	5.5	Hydro	2009	Yes	Suoi Tan JSC	private	Yes
40	So Lo	8.7	Hydro	2009	Yes	Mai Chau JSC	private	Yes
41	Muong Sang	2.4	Hydro	2009	Yes	Mường Sang JSC	private	Yes
42	Phu mau	5.6	Hydro	2006-2008	Yes	Tan An Ltd, private	private	Yes
43	Nam Pung	8.1	Hydro	2009	Yes	Nam Pung JSC	private	Yes
44	Ha Nang	11	Hydro	2009	Yes	Thien Tan JSC	private	Yes
45	Za Hung	30	Hydro	2009	Yes	Dat Phuong JSC	private	Yes
46	Nam Mo 3	10	Hydro	2009	Yes	Northern investment and development Company	private	Yes
47	Ho Nui Coc	1.5	Hydro	2009	Yes	Nui Coc JSC	private	Yes
48	Nam Toong	30	Hydro	2009	Yes	Northern electricity development JSC No3	private	Yes
49	An Diem 2	15	Hydro	2009	Yes	Song Vang JSC	private	Yes
50	Fertilizer and chemical HaBac (coal fire power plant)	36	Thermal	2002	No	Ha Bac JSC	Private	Yes
51	Fertilizer Phu My (natural gas power plant)	23	Thermal	2003	No	Phu My JSC	Private + state capital	Yes
52	Diesel Amata (FO fire)	13	Thermal	2001	No	Unknown	Private	Yes
53	Diesel Ca Mau (DO fire)	20.1	Thermal	1975-2005	No	Unknown	Private + state capital	Yes
54	Bảo Lộc SHP	24.5	Hydro	Dec-09	No	Bao Loc HydroPower JSC	Private	No
55	Nậm Ngần SHP	13.5	Hydro	Jul-09	Yes	Nậm Mu JSC	private	Yes
56	Đăk Rung SHP	8	Hydro	Aug-09	Yes	Viet Nguyen JSC	private	Yes
57	Tà Làng SHP	4.5	Hydro	Aug-09	No	BaK Can Material Construction and Production JSC	Private	Yes
58	Za Hung SHP	30	Hydro	Oct-09	No	Za Hung Joint Venture	Public	Yes
59	Nậm Pia SHP	15	Hydro	Oct-09	Yes	Lam Son Ltd	private	Yes
60	Nậm Chiến 2 SHP	32	Hydro	Dec-09	Yes	Tay Bac JSC	private	No
61	Nậm Đông III SHP	15.6	Hydro	Jan-10	No	No.3 The North Electricity Investment and Development Company	Public	No
62	Trà Linh 3 SHP	7.2	Hydro	Feb-10	Yes	699 Construction JSC	private	No
63	Nậm Chim 1 SHP	16	Hydro	Mar-10	Yes	Song Lam Construction and Investment JSC	Unknown	No
64	Nam Khot	14	Hydro	2010	Yes	Nam Khot JSC	private	No
65	Ha Rao Quan	6.4	Hydro	2010	Yes	Song Cau JSC	private	No
66	Muong Kim	13.5	Hydro	2010	Yes	Hanoi Electricity equipment JSC	private	No
67	H'Mun	16.2	Hydro	2010	Yes	Gia Lai JSC	private	No
68	Ea Drang 2	6.4	Hydro	2010	Yes	Dal Lak power company	public	No
69	La Hieng 2	18	Hydro	2010	Yes	Phu Yen JSC	private	No

#	Name of power plant	Capacity (MW)	Technology	Commissioning date	CDM (Yes/No)	Investor	Ownership (Private/ Public?)	Investment before removal of interest rate cap (Yes/No)
70	Dak Ne	8.1	Hydro	2010	Yes	Trung Dong JSC	private	No
71	Dak Glun	18	Hydro	2010	Yes	Sai Gon machine JSC	private	No
72	Nam Khoa 3	18	Hydro	2010	Yes	Linh Linh JSC	private	No
73	Dak Srong 2	24	Hydro	2010	Yes	Hoang Anh Gia Lai JSC	private	No
74	Pa khoang	2.4	Hydro	2010	Yes	Duc Thanh JSC	private	No
75	Suoi sap 3	14	Hydro	2010	Yes	Bac Minh JSC	private	No
76	Nam Pung	8.1	Hydro	2009	Yes	Nam Pung JSC	private	No
77	Nam Ly 1	5.1	Hydro	2010	Yes	SOMECO Ha Giang JSC	private	No
78	Dak Mi 4c	18	Hydro	2010	Yes	IDICO JSC	private	No
79	Seo Chong Ho	21.7	Hydro	2010	Yes	Viet-Trung JSC	private	No
80	Song Nhiem 3	10	Hydro	2010	Yes	LICOGI JSC	private	No
81	Song Mien 5	16.5	Hydro	2010	Yes	Song Mien 5 JSC	private	No
82	Suoi Lum 1	20	Hydro	2010	Yes	Nam Lum JSC	private	No

Source: Electricity Regulatory Authority of Vietnam (ERAV), MOIT - DNA Vietnam, etc.

From the above list, only power plants with installed capacity between 11 – 33 MW and non-CDM projects are considered in the analysis, which are presented in the below table.

Table 9: Power projects implemented after 2001 and before 08/12/2010 and not registered as CDM project activities

#	Name of power plant	Capacity (MW)	Technology	Commissioning date	CDM (Yes/No)	Investor	Ownership (Private/ Public?)	Investment before removal of interest rate cap (Yes/No)
1	Đrây H'Linh 2 SHP	16	Hydro	Feb-07	No	No.3 Electricity-Hydro Power JSC	Private	Yes
2	EaKrông Rou SHP	28	Hydro	Jun-07	No		Public	Yes
3	Krong Kmar SHP	12	Hydro	May-08	No	Song Da Investment and Development Company (Song Da IDC)	Private + state capital	Yes
4	Fertilizer Phu My (natural gas power plant)	23	Thermal	2003	No	Phu My JSC	Private + state capital	Yes
5	Diesel Amata (FO fire)	13	Thermal	2001	No	Unknown	Private	Yes
6	Diesel Ca Mau (DO fire)	20.1	Thermal	1975-2005	No	Unknown	Private + state capital	Yes
7	Bảo Lộc SHP	24.5	Hydro	Dec-09	No	Bao Loc HydroPower JSC	Private	No
8	Za Hung SHP	30	Hydro	Oct-09	No	Za Hung Joint Venture	Public	Yes
9	Nậm Đông III SHP	15.6	Hydro	Jan-10	No	No.3 The North Electricity Investment and Development Company	Public	No

Source: Electricity Regulatory Authority of Vietnam (ERAV), MOIT - DNA Vietnam, etc.

The above table yields to 9 power plants, hence Nall = 9.

Step 3: Within plants identified in Step 2, identify those that apply technologies different that the technology applied in the proposed project activity. Note their number Ndiff.

All 9 power plants (out of which 06 hydro plants) identified in Step 2 are analysed as follows:

- 03 power plants are thermal, hence they are excluded because they use different technology that the technology applied in the project activity
- 04 power plants use public capital or mix of private and public capital, so they are excluded from the common practice analysis as compared to the project that uses exclusively private capital.
- 01 hydro power plant was developed in a different investment environment benefiting from a low interest rate. The investment climate has changed at the date of investment decision of the CPA. Further details on the investment environment are discussed in below Sub-step 4b.

Based on the above analysis, Ndiff is 8.

Step 4: Calculate factor F=1-Ndiff/Nall representing the share of plants using technology similar to the technology used in the proposed project activity in all plants that deliver the same output or capacity as the proposed project activity.
The proposed project activity is a common practice within a sector in the applicable geographical area if both the following conditions are fulfilled: (a) the factor F is greater than 0.2 and (b) Nall-Ndiff is greater than 3.

F = 1 – Ndiff/Nall = 1 – 8/9 = 0.1 < 0.2
Nall – Ndiff = 9 – 8 = 1 < 3

From the analysis, it is clearly demonstrated that the project is not a common practice.

Sub-step 4b: Discuss any similar Options that are occurring

As per the "Tool for demonstration and assessment of additionality", "if similar activities are identified above, then it is necessary to demonstrate why the existence of these activities does not contradict the claim that the proposed project activity is financially/economically unattractive or subject to barriers. This can be done by comparing the proposed project activity to the other similar activities, and pointing out and explaining essential distinctions between them that explain why the similar activities enjoyed certain benefits that rendered it financially/economically attractive (e.g., subsidies or other financial flows) and which the proposed project activity cannot use or did not face the barriers to which the proposed project activity is subject. Essential distinctions may include a serious change in circumstances under which the proposed CDM project activity will be implemented when compared to circumstances under which similar projects were carried out. For example, new barriers may have arisen, or promotional policies may have ended, leading to a situation in which the proposed CDM project activity would not be implemented without the incentive provided by the CDM. The change must be fundamental and verifiable".

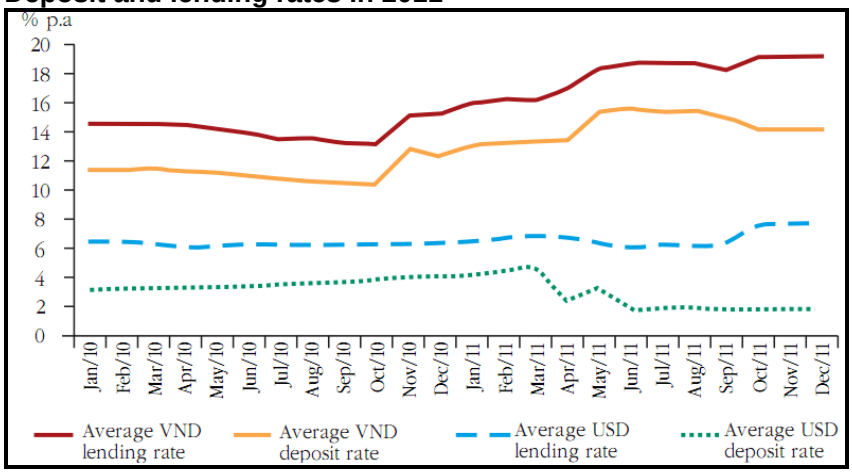
The existence of the 06 hydropower plants does not contradict the result of the benchmark analysis stating that the proposed project is financially unattractive" as demonstrated above.

The common feature of all these private developed projects between 2001 and November 2009 is that they all benefited from a different investment environment. At that period, Vietnam's Civil Code stipulates that financial institutions cannot charge lending rates exceeding 1.5 times the base (prime) rate set by the State Bank of Vietnam (SBV). During much of 2009 (until Nov 2009), therefore, the maximum lending rate was capped at 10.5 percent (7 times 1.5). After that period, the SBV allowed loan rates to be negotiated between the lender and the borrower. As a result, in

some cases, loan rates are said to have risen from a subsidized 6 percent to a negotiated 16–18 percent, before declining to 14 - 15 percent[33].

As shown is the Step 2 (investment analysis, the loan agreement between Pa Chien Hydropower JS Company (Pa Chien CPA implementer) and BIDV (local bank) provides the financing arrangements of the CPA. The project is financed with 20% equity and 80% debt at a floating interest rate which is updated based on the market interest at time of calculating the interest. The period after the investment decision date saw a sharp increase in the commercial annual lending rate, which was at 15.27% as of end-2010 and at 18.5% as of end-June 2011 and continued to increase progressively until the end of 2011.[34]

Deposit and lending rates in 2011



Source: Annual Report 2011, State Bank of Vietnam

This is a serious, fundamental and verifiable change in circumstances under which the proposed CPAs will be implemented when compared to circumstances under which similar projects were carried out.

Therefore, it can be concluded all small size hydropower projects implemented before the start date of the CPA were developed in a more favorable investment environment where lending was cheaper. This is not the case in the PoA with high interest rate that results from the liberalization of lending rates. The proposed PoA and CPAs are promoted in an investment environment which is challenging and more difficult as the financial cost has increased due to higher interest rate from commercial banks.

[33] International Monetary Fund. 2010. Vietnam: 2010 Article IV Consultation—Staff Report and Public Information Notice. Page 6, footnote 4.

[34] Annual Report 2011, State Bank of Vietnam, page 32: http://www.sbv.gov.vn/portal/ShowProperty?nodeId=/UCMServer/CNTHWEBAP01162395542//idcPrimaryFile&revision=latestreleased

Additionality checklist

The following items are checked if participation in the program has addressed some of the barriers faced by these kind of projects in Vietnam:

Key Criteria	Yes/No
FIRR of the CPA in the absence of the CDM incentive is below the benchmark rate	Yes, see Step 2 discussed above.
CPA has access to loan from participating banks under REDP, and participating banks have a refinance agreement with WB-REDP/MOF	Yes, the CPA accessed loan from the participant bank and the participating bank has a refinance agreement with WB-REDP/MOF
Participating developers and bank attended the training and capacity development programs conducted by MOIT	Yes, the developer and the bank attended the training and capacity building programs conducted by MOIT.

Timeline of the CPA

The table below summarizes the milestones in the investment process of Pa Chien Hydropower Project, in connection with the REDP.

Table 10: Details of the time line of CPA design and implementation

Date	Activities	Remarks
28 November 2007	Son La PPC issued approval for the selection of project owner for Pa Chien HPP	
19 November 2008	Muong La district people' committee issued approval for the Environmental Protection Commitment (EPC) report	
27 November 2008	Son La department of industry and trade issued the appraisal report for the Basic Design of the project activity	
16 June 2009	Signing the Financing Agreement with the Government of Vietnam on REDP	
09 July 2009	Son La PPC issue the investment license for the project activity	
August 2009[35]	Engineering Design documentation was completed (all books are on this date)	
November 2009	Removal of the lending rate cap by SBV, allowing loan rates to be negotiated between the lender and the borrower.	
10 December 2009	**Decision by Chairman of Board of Pa Chien Hydropower JS Company to invest in the project activity**	**Investment decision date**
30 December 2009	**Submission of PoA/CPA documents for validation and global stakeholder comment**	**GSP date, Starting date of PoA**
11 September 2010	Stakeholder consultation meeting was organized in Chieng San commune	
December 2010	Appraisal report under the REDP for the project activity by the world bank	

[35] This was only the date of print-out and hand-over of the documentation. All the assumptions and calculations were completed and given to the Project Owner prior to the Board Decision

Date	Activities	Remarks
December 2010	Technical Due Diligence Report prepared by Mr. Ho Sy Du, concluding that the project design is reasonably technically sound.	
07 December 2010	REDP hydro simulation model with consideration of environmental flow requirement	
08 December 2010	**Civil construction contract for the spillway dam and related items was signed between the project owner and third party company**	**Starting date of CPA**
February 2011	Refinancing application summary was completed by BIDV	
February 2011	BIDV Son La issued the Technical Due Diligence Report signed by Pham Thi Kim Dung, Director of BIDV Son La	
25 February 2011	Publication of the EMP, EP, and RP at Son La department of natural resources and environment, Muong La district division of natural resources and environment, and Chieng San commune people's committee	
02 March 2011	MOIT submitted request for approval for the procurement plan for the project activity	
05 March 2011	MOIT issued request for approval for the refinancing loan to the world bank for the project activity	
16 March 2011	BIDV company submitted the application for refinancing to WB	
21 March 2011	World bank issued approval for the procurement plan submitted by the MOIT	
30 March 2011	MOIT submitted the request for approval for the EMP, EP, and RP to world bank	
31 March 2011	World bank issued approval for the EMP, EP, RP submitted by MOIT	
04 April 2011	AU Refinancing Application Package Review Checklist signed by the AU Manager Mr Chu Ba Thi and the PMB Safeguards Specialist Ms. Pham Huong Giang	
18 May 2011	Loan contract between the project owner and BIDV	
05 May 2013	Power purchase agreement was signed with grid utility company	

It can be seen that CDM consideration was made due to the difficulty to approach a financing source which assures the financial viability of the project (in terms of loan amount and interest rate)[36], and the process started before the investment decision was made.

Considering the situation that only with CDM revenues the project can be implemented, the CPA is additional.

[36] Decision of Chairman of Board of Management of Pa Chien Hydropower JSC was made on the basis of the Engineering Design Documentation to invest in the project activity despite increased interest rate at time of investment decision.

Appendix 1. Contact information of CPA implementers

Organization name	**Pa Chien Hydropower JS Company (CPA implementer)**
Country	Vietnam
Address	Lot No. 2, Le Duc Tho street, Group 13, Quyet Thang ward, Son La city, Son La province
Telephone	Landline: +84 (0223) 753072; Mobile: + 84 0913512232
Fax	
E-mail	pachienjsc@gmail.com
Website	
Contact person	Mr. Tran Ngoc Son, Chairman

Appendix 2. Affirmation regarding public funding

The CPA does not receive any public funding.

Appendix 3. Further background information on ex ante calculation of emission reductions

Vietnam's DNA issued the Official Dispatch No. 513/KTTVBDKH on 28/05/2013, providing the national grid emission factor for 2011 with related data on OM and BM for data vintage 2009, 2010, and 2011.

Below are tables summarizing data provided by Vietnam's DNA in the above mentioned Dispatch.

IPCC DEFAULT CO_2 EMISSION FACTORS FOR COMBUSTION

Fuel type	NET CALORIFIC VALUE (NCV) (TJ/Gg)			Source of data
	Default value	95% confidence interval		
		Lower	Upper	
Coal (Anthracite)	26.70	21.60	32.20	2006 IPCC Guidelines on National GHG Inventories, Volume 2: Energy, Chapter 1, Table 1.2, Page 1.18
Other Bituminous Coal	25.80	19.90	30.50	
Tail Gas	-	-	-	
Gas/Diesel Oil	43.00	41.40	43.30	
Residual Fuel Oil	40.40	39.80	41.70	
Natural Gas	48.00	46.50	50.40	

Fuel type	Effective CO_2 emission factor (kg/TJ)			Source of data
	Default value	95% confidence interval		
		Lower	Upper	
Coal (Anthracite)	98,300	94,600	101,000	2006 IPCC Guidelines on National GHG Inventories, Volume 2: Energy, Chapter 1, Table 1.4, Page 1.23, 1.24
Other Bituminous Coal	94,600	89,500	99,700	
Tail Gas	-	-	-	
Gas/Diesel Oil	74,100	72,600	74,800	
Residual Fuel Oil	77,400	75,500	78,800	
Natural Gas	56,100	54,300	58,300	

ELECTRICITY GENERATED FROM LOW-COST/MUST-RUN SOURCES:

Low-cost/Must-run Ratio (2007-2011)

Year	2007	2008	2009	2010	2011	Total for period 2007-2011
Hydropower (MWh)	22,385,232	25,933,762	29,033,871	24,241,216	35,185,329	136,779,410
Total power (MWh)	66,348,589	74,689,636	81,369,303	91,224,603	100,851,857	414,483,988

Year	2007	2008	2009	2010	2011	Period 2007-2011
Low-cost/Must-run Ratio	33.74%	34.72%	35.68%	26.57%	34.89%	33.00%

DATA USED FOR CALCULATION OF OM EMISSION FACTOR

For 2009:

Group plants	Fuel consumption	Net electricity supplied to national power grid	Type of fuel	Net calorific value (NCV)	Effective CO2 emission factor	Amount of CO2 emission
	Coal, Oil : kton Gas: 10^3 m^3	MWh		TJ/Gg	kg/TJ	t CO_2
Coal power plant	6,927.29	9,841,579	Coal (Anthracite)	21.60	94,600	14,154,947
Gas Turbine		36,714,493				0
Gas Turbine powered by gas	*7,251.87*	*25,471,686*	Natural Gas	46.50	54,300	12,817,426
Gas Turbine powered by oil	*21.83*	*71,304*	Gas/Diesel Oil	41.40	72,600	65,613
Tail gas	*0*	*11,171,503*	Tail Gas	-		0
Oil thermal power plant	444.99	1,635,351	Residual Fuel Oil	39.80	75,500	1,337,150
Diesel using FO	0.18	0	Residual Fuel Oil	39.80	75,500	541
Diesel using DO	2.41	10,000	Gas/Diesel Oil	41.40	72,600	7,244
Imported		4,102,080				
Total	**14,648.57**	**52,303,503**				**28,382,922**

For 2010:

Group plants	Fuel consumption	Net electricity supplied to national power grid	Type of fuel	Net calorific value (NCV)	Effective CO2 emission factor	Amount of CO2 emission
	Coal, Oil : kton Gas: 10^3 m^3	MWh		TJ/Gg	kg/TJ	t CO_2
Coal power plant	9,075.79	14,624,274	Coal (Anthracite)	21.60	94,600	18,545,106
Gas Turbine		44,051,812				0
Gas Turbine powered by gas	*8,664.36*	*31,073,369*	Natural Gas	46.50	54,300	15,313,953
Gas Turbine powered by oil	*63.43*	*209,306*	Gas/Diesel Oil	41.40	72,600	190,648
Tail gas	*0*	*12,769,136*	Tail Gas	-		0
Oil thermal power plant	664.97	2,648,763	Residual Fuel Oil	39.80	75,500	1,998,168
Diesel using FO	0.99	0	Residual Fuel Oil	39.80	75,500	2,975
Diesel using DO	2.16	9,036	Gas/Diesel Oil	41.40	72,600	6,492
Imported		5,599,230				
Total	**18,471.70**	**66,933,115**				**36,057,342**

For 2011:

Group plants	Fuel consumption	Net electricity supplied to national power grid	Type of fuel	Net calorific value (NCV)	Effective CO2 emission factor	Amount of CO2 emission
	Coal, Oil : kton Gas: 10^3 m^3	MWh		TJ/Gg	kg/TJ	t CO_2
Coal power plant	11,836.03	18,057,709	Coal (Anthracite)	21.60	94,600	24,185,270
Gas Turbine		41,157,471				0
Gas Turbine powered by gas	*7,644.37*	*28,793,277*	Natural Gas	46.50	54,300	13,511,156
Gas Turbine powered by oil	*96.79*	*403,092*	Gas/Diesel Oil	41.40	72,600	290,916
Tail gas	*0*	*11,961,103*	Tail Gas	-		0
Oil thermal power plant	332.7	1,338,219	Residual Fuel Oil	39.80	75,500	999,730
Diesel using FO	0.38	0	Residual Fuel Oil	39.80	75,500	1,142
Diesel using DO	16.67	63,650	Gas/Diesel Oil	41.40	72,600	50,104
Imported		5,003,000				
Total	**19,926.94**	**65,620,049**				**39,038,319**

DATA FOR CALCULATION OF BM EMISSION FACTOR FOR YEAR 2011

Name of power plant	Operation year (dd/mm/yy)	Net electricity supplied to national power grid (MWh)	Type of fuel	Amount of consumed fuel	Net calorific value	Emission factor of fuel	Amount of emission
				Coal, DO, FO: kton; Gas: 10^6 m^3	TJ/Gg	kg/TJ	t CO_2
Se San 4A	11/2011	150,055.21	Hydropower				
Dong Nai 3	2011	254,398.10	Hydropower				
An Khe	2011	521,474.48	Hydropower				
Son Dong	2011	1,115,687.39	Coal (Anthracite)	806.96	21.60	94,600	1,648,910
Nhon Trach 2	2011	1,764,978.90	Natural Gas	385.55	46.50	54,300	681,446
Formosa 2	22/08/2011	187,662.50	Other Bituminous Coal	194.79	19.9	89,500	346,931
Cam Pha	15/05/2011	3,445,956.19	Coal (Anthracite)	2,390.60	21.60	94,600	4,884,856
Srepok 3	09/2010	1,097,445.28	Hydropower				
Son La	12/2010	4,945,860.51	Hydropower				
Cua Dat	2010	451,024.10	Hydropower				
Hai Phong	2010	2,158,000.00	Coal (Anthracite)	1,029.35	21.60	94,600	2,103,333
Quang Ninh	2010	1,854,096.20	Coal (Anthracite)	923.29	21.60	94,600	1,886,614
Buon Tua Srah	12/2009	339,183.29	Hydropower				
Song Ba Ha	11/2009	791,915.30	Hydropower				
Se San 4	2010	1,644.65					
Pleikrong	04/2010	494,000.00	Hydropower				
Uong Bi Expansion (7)	09/2009	1,355,854.73	Coal (Anthracite)	645.69	21.60	94,600	1,319,377
Total		**20,929,236.83**					**12,871,467**

Combined Emission Factor:

Simplified Combined Margin Emission Factor for 2011

Build Margin CO_2 Emission Factor in year 2011	BM	tCO_2/MWh	0.6150
Average Operating Margin CO_2 Emission Factor (2009, 2010, 2011)	OM	tCO_2/MWh	0.5598
Simplified Combined Margin CO_2 Emission Factor in year 2011	**CM**	**tCO_2/MWh**	**0.5874**

Appendix 4. Further background information on monitoring plan

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

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

- **Supervise the project implementation**

The monitoring officer will supervise the implementation of the project as per the specifications mentioned in the CPA-DD and ensure that the technical specifications are not different from the one mentioned in the included CPA-DD. Any such deviations will be flagged to the C/ME as necessary.

- **Supervise and verify metering and recording**

The monitoring officer will coordinate with the plant manager to ensure and verify adequate metering and recording of data, including power delivered to the grid. The officer will also pay close attention to correct functioning of the meters, ensure their accuracy through their calibration at regular intervals as required and their maintenance.

- **Collection of additional data, sales / billing receipts**

The monitoring officer will collect sales receipts for power delivered to the grid, billing receipts for power delivered by the grid to the hydropower station and additional data such as the daily operational reports of the hydropower station. Any major breakdowns or plant shut downs will be recorded along with reasons for the same. The officer will also notify if there are any events/incidents that deviate the project descriptions and/or CDM requirements during each monitoring period mainly with respect to implementation of the monitoring plan prescribed in the CPA-DD.

- **Calculation of emission reductions**

The monitoring officer will calculate the annual emission reductions on the basis of net power supply to the grid. The monitoring officer will be provided with a calculation template in electronic form by the project's CDM advisors.

- **Preparation of monitoring report**

The monitoring officer will annually prepare a monitoring report (as per the standard format suggested by the EB) which will include, among other things, a summary of daily operations, metering values of power supplied to and received from the grid, copies of sales/billing receipts, a report on calibration, calculation of emission reductions and comparison of actual emission reductions with the projected ones in the CPA-DD and the reasons for any significant deviations .

Support:
The monitoring officer will receive the support from the CDM Advisor in his/her responsibilities through the following actions:

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

The monitoring officer will also receive the support from down-line technical staff in collecting data and checking operational status of technological equipment as set out in the monitoring plan.

Appendix 5. Summary report of comments received from local stakeholders

Not applicable.

Appendix 6. Summary of post-registration changes

7th monitoring period:

- Frequency of calibration was every 1 year in line with the signed power purchase agreement in 2013. In 2018, the frequency of calibration was changed to every 2 years in accordance with the Circular No. 23/2013/TT-BKHCN dated 26/09/2013 by Vietnamese Ministry of Science and Technology and this had eventually been accepted by the grid company.[37] Furthermore, due to Circular No. 07/2019/TT-BKHCN dated 26/07/2019 by the Vietnamese Ministry of Science and Technology, from 01/01/2020 meters shall be calibrated every 3 years.

These changes have been updated in the revised CPA-DD version 07, dated 14/12/2020.

[37] This Circular took effect as of 15/01/2013. The grid company may request specific power plants to calibrate meters more often than legal requirements. They only allowed Pa Chien to calibrate meters every 2 years in 2018.

Document information

Version	*Date*	*Description*
09.0	31 May 2019	Revision to: • Ensure consistency with version 02.0 of the "CDM project standard for programmes of activities" (CDM-EB93-A07-STAN); • Make editorial improvements.
08.1	20 October 2017	Editorial revision to remove appendix "Applicability of methodologies and standardized baselines" from the main part of the form which had been mistakenly kept in the previous version.
08.0	28 June 2017	Revision to: • Remove appendix "Applicability of methodologies and standardized baselines" as the appendix is not relevant at the CPA level; • Make editorial improvement.
07.0	7 June 2017	Revision to: • Improve consistency with the "CDM project standard for programmes of activities" and with the PDD and PoA-DD forms; • Make editorial improvement.
06.0	24 May 2017	Revision to: • Ensure consistency with the "Standard: CDM project standard for programme of activities" (CDM-EB93-A07-STAN) (version 01.0); • Incorporate the "Component project activity design document form for small-scale component project activities" (CDM-SSC-CPA-DD-FORM); • Make editorial improvement.
05.0	15 April 2016	Revision to ensure consistency with the "Standard: Applicability of sectoral scopes" (CDM-EB88-A04-STAN) (version 01.0).
04.0	9 March 2015	Revision to: • Include provisions related to statement on erroneous inclusion of a CPA; • Include provisions related to delayed submission of a monitoring plan; • Provisions related to local stakeholder consultation; • Provisions related to the Host Party; • Make editorial improvement.
03.0	25 June 2014	Revisions to: • Include the Attachment: Instructions for filling out the component project activity design document form for CDM component project activities (these instructions supersede the "Guidelines for completing the component project activity design document form" (Version 01.0)); • Include provisions related to standardized baselines; • Add contact information on a CPA implementer and/or responsible person/ entity for completing the CDM-CPA-DD-FORM in A.13. and Appendix 1; • Add general instructions on post-registration changes in paragraph 4 and 5 of general instructions and Appendix 6;

Version	*Date*	*Description*
		• Change the reference number from F-CDM-CPA-DD to CDM-CPA-DD-FORM; • Make editorial improvement.
02.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the component project activity design document form" (EB 66, Annex 16).
01.0	27 July 2007	EB 33, Annex 42 Initial adoption.

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