Project design document form
(Version 11.0)

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

BASIC INFORMATION	
Title of the project activity	Nam Chien 2 Hydropower Project
Scale of the project activity	☒ Large-scale ☐ Small-scale
Version number of the PDD	04.2
Completion date of the PDD	24/06/2020
Project participants	1) North-western Power Investment and Development Joint Stock Company 2) Energy and Environment Consultancy Joint Stock Company 3) Swiss Carbon Assets Ltd.
Host Party	Viet Nam
Applied methodologies and standardized baselines	ACM0002: "Grid-connected electricity generation from renewable sources" Version 20.0
Sectoral scopes	1.Energy industries (renewable-/non-renewable sources)
Estimated amount of annual average GHG emission reductions	121,244 tCO_2

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

The project activity involves the construction of a dam, intake, tunnel, pressurized well, penstock, power house with 2 units and discharge channel in Chieng Muon and Chieng San communes, Muong La district, Son La province, Vietnam.

Prior to the implementation of the project activity, electricity in Vietnam is generated mainly from fossil fuel sources[1] and is solely distributed to consumers via the unique national electricity grid.

The project's purpose is to generate hydroelectricity from the Chien stream - a clean and renewable source to supply to the national grid via a Power Purchase Agreement (PPA) signed with the Electricity Corporation of Vietnam (EVN). The project's installed capacity and estimated annual gross power generation is 32 MW and 131,730 MWh, respectively. The net electricity generated (with an estimated annual volume of 130,413 MWh) will be supplied to the national grid via a newly constructed 110kV transmission line with a length of 6.0 km.

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

The project activity will generate renewable power with negligible GHG emissions, which will displace part of the electricity otherwise supplied by fossil fuel fired power plants. The project involves construction of a reservoir with an area of 26.7 ha and a power density of 119.85 W/m^2, accordingly. As the power density of this project is above 10 W/m^2, GHG emissions from the reservoir need not to be accounted in the project activity. Thus, this project activity generates GHG emission reductions up to a total expected CO_2 emission reduction of 848,708 tCO_2 over the second crediting period of 7 years.

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

General contributions towards national sustainable development:

- In recent years, Vietnam, especially the North of Vietnam, has suffered a critical electricity shortage as a consequence from rapidly increasing demand and insufficient supply, thereby imposing negative impacts on economic growth as well as on the daily lives of people. This project activity will be a contribution towards balancing the supply and demand gap. By exporting electricity directly to the national grid, it will help improve the quality of service and lessen the risks of power failure.
- Reducing reliance on exhaustible fossil fuel-based power sources and also reducing the import of fuels for the purpose of power generation.
- Modern and highly efficient turbines and generators are being used in the project and the power transmission will be at high voltage to ensure low losses. The project will accelerate the deployment of renewable energy technologies in Vietnam.

Contributions towards local sustainable development:

a) Economic well-being

Once commissioning, this proposed project will increase the industrial share in the economic structure of Son La province – a poor mountainous province in the Northern of Vietnam. This proposed project will pay an annual tax at an average of 14.18 billion VND to the local budget, accounting for about 0.16 % of GDP in 2007 of Son La province[2].

By supplying a stable electricity output, this project will facilitate the industrialisation process of the province and support economic development of local villages through fostering tourism, trade and services inside the province.

[1] Further details presented in Table 11.

[2] Total GDP in 2007 of Son La province quoted from Statistical Annual Book of Vietnam published by Statistical Publishing House 2008

After commissioning, this project will supply electricity to speed up the commissioning of other large infrastructure projects in the region, including the Son La, Huoi Quang and Ban Chat hydro power projects.

b) Social well-being

This project will contribute directly to improve the low-quality infrastructure systems of the Chieng Muon and Chieng San communes, where almost minority ethnics settle. The communes are categorised as mountainous communes with thin population, less developed and autarky agricultural economy. The project will upgrade existing roads and construct a new 110 kV transmission line together with a hydropower plant, which will reduce electricity losses and improve the quality of electricity supplying in the region. The communication system and clean water treatment serving for workers of the project during the both construction and operation phases will be shared with local people.

The majority of local residents living in the project area are the ethnic minorities like Thai, Mong and La Ha. They usually live in less favourable living conditions than those of Kinh ethnic – the majority of population in Vietnam. Thus, the project will contribute to improve their living standard that will fill the gap in development between different ethnic groups in Vietnam.

Besides, the project activity could result in the employment of the local people for the construction and operation later on. Therefore, this project activity will contribute directly to alleviate poverty in the region.

This demonstrates that the project activity will contribute positively towards sustainable development and that it is consistent with the general encouragement of the investment in exploitation of renewable energy resources in Vietnam set by the Government. Therefore, it satisfies the sustainable development criteria for CDM projects set by the DNA of Vietnam.

A.2. Location of project activity

A.2.1 Host party

Viet Nam

A.2.2 Region/ State/ Province etc

Son La province

A.2.3 City/ Town/ Community etc

Chieng Muon and Chieng San communes, Muong La district

A.2.4 Physical/ Geographical location

The project activity involves the construction of Nam Chien 2 hydropower plant which is located on the Chien Stream, which is the first branch of the Da river. This project has co-ordinates as follows:

Location	Northern latitude	Eastern longitude
Power house	21°28’42”	104°04’51”
Dam	21°30’00”	104°05’26”

The site of the project is showed in Figure 1.

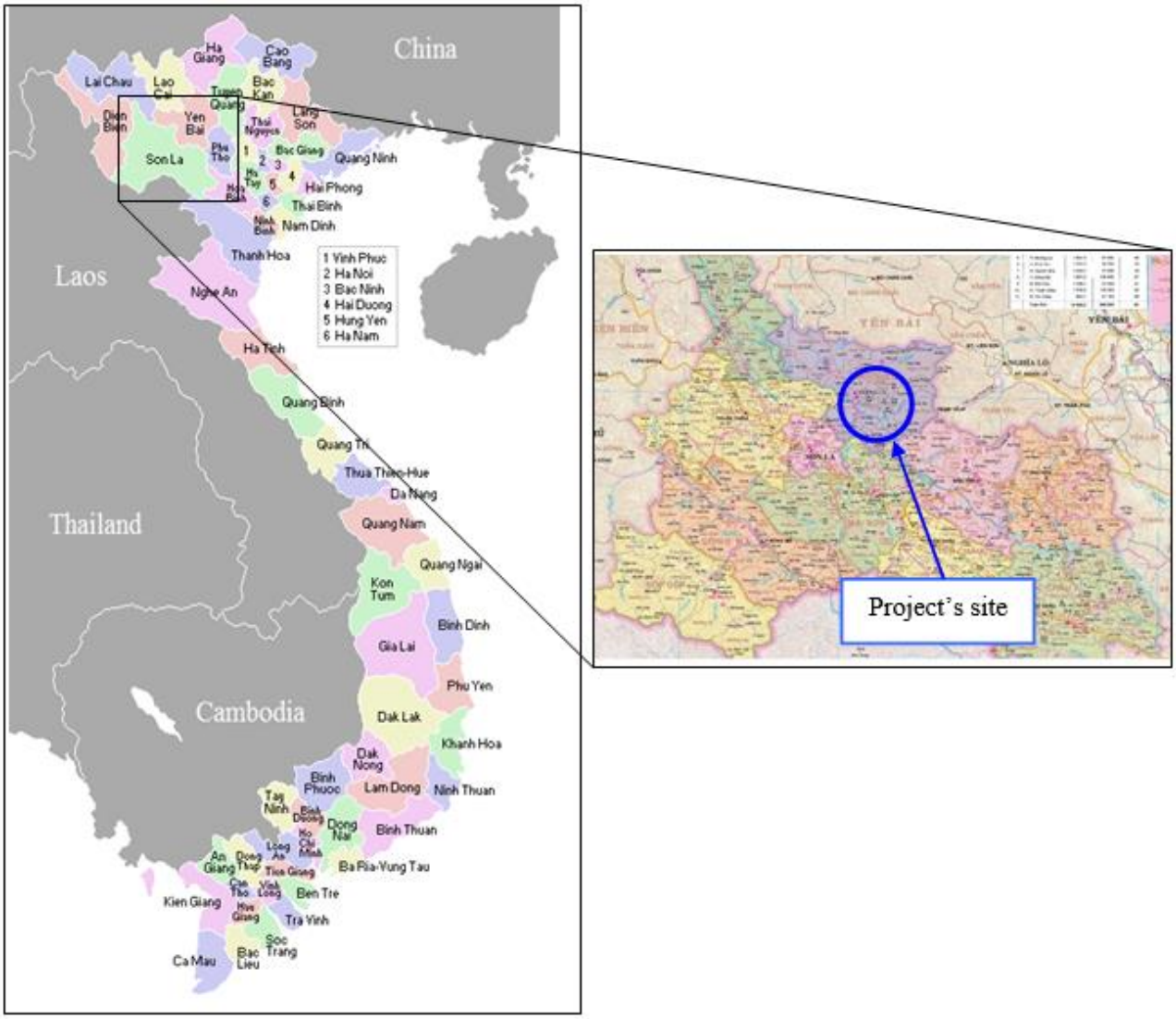

Figure 1: Map of the location of the project activity

A.3. Technologies/measures

Prior to the implementation of the proposed project, electricity supplied to the national grid is generated by the operation of grid-connected power plants. Electricity in Vietnam is generated mainly by firing coal, oil or gas and is solely distributed via the unique national electricity grid. All fuel fired power plants connected to the national grid use boiler rooms, steam heating boilers and steam turbines to generate electricity. In that technology cycle, GHGs are generated. Since hydro power generation technology is a renewable electricity generation technology which displaces fossil fuel fired power generation technology to supply electricity to the grid, the implementation of this project activity will generate emission reductions.

The project activity involves the construction of a dam, a canal intake, a penstock, a power house with 2 units and a discharge channel in order to convert potential flowing energy from the Chien stream into clean electrical energy, which will be supplied to the national grid at the connection point through an 110 kV transmission line with the length of 6.0 km. At the connection point, the power meter systems will be installed. They are a digital, bi-directional type and 35kV grid to measure the export and import electricity from and to Nam Chien 2 Hydropower plant. It also involves the construction of a reservoir with a power density about 119.85 W/m2 that is above the 10.00 W/m2 threshold established in Version 20.0 of ACM0002. Accordingly, GHG emissions from the reservoir need not to be accounted under this the project activity.

Figure 2 shows the layout of the project.

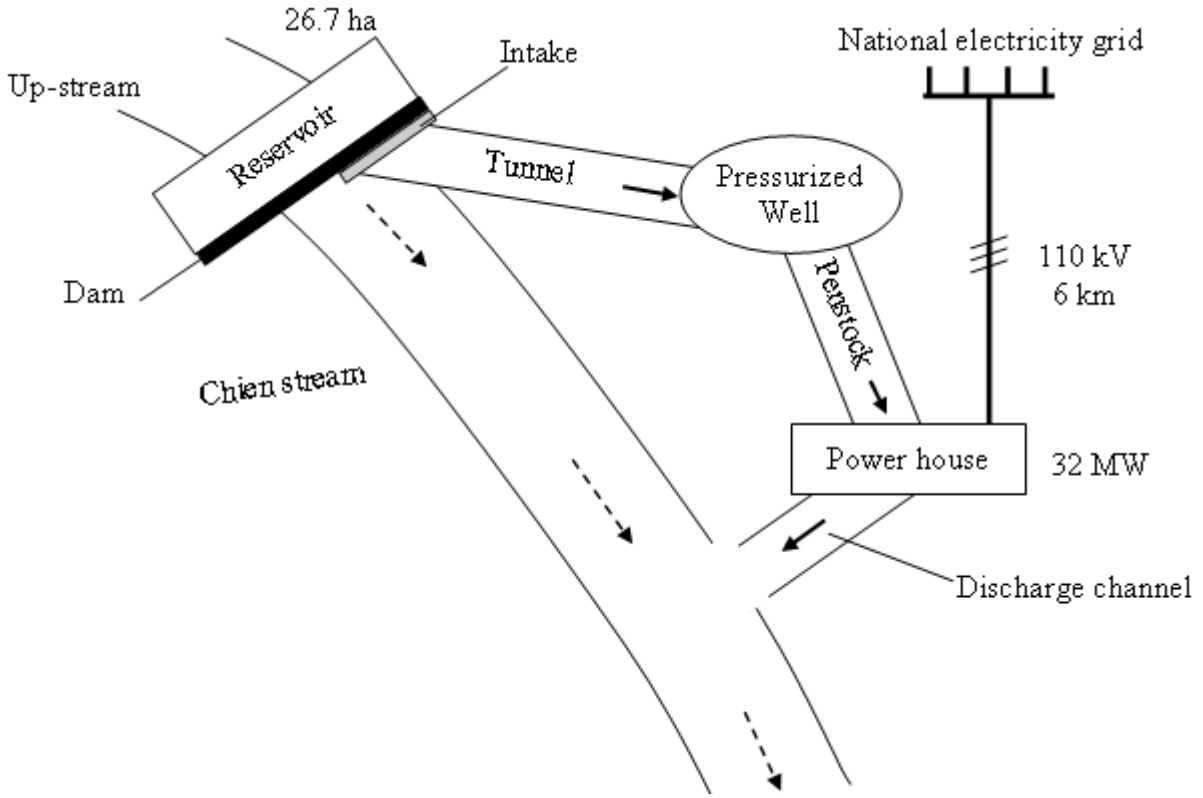

Figure 2: Nam Chien 2 hydropower plant's lay-out

The main technical parameters of the Nam Chien 2 Hydropower Project are shown in Table 1.

Table 1: Main technical parameters of the proposed project activity

Main parameters	Units	Values
1. Turbine		
• Type		Francis with vertical shaft
• Diameter of runner	m	1.47
• Rated net head	m	82.3
• Number of turbines	set	2
• Turbine discharge	m^3/s	22.36
• Efficiency	%	91.37
• Capacity	MW	16.49
• Speed	rpm	375
• Annual utilization hours	hour	4117
• Expected lifetime3	hour	150,000
• Manufacturer		Flovel Mecamdi Energy Private Limited
2. Generator		
• Number	set	2
• Type		Synchronous, 3 phases, vertical axis
• Rated voltage	kV	11
• Rated capacity	MW	16
• Efficiency	%	97
• Expected lifetime[4]	year	30
• Manufacturer		Sichuan Dongfeng Electric Machinery Works Co., Ltd
3. Transformer		
• Number	set	2

[3] The default lifetime in EB50, Annex 15

[4] The default lifetime in EB50, Annex 15

• Type		3 phases, 2 windings
• Rated capacity	MVA	20
• Primary voltage	kV	11
• Secondary voltage	kV	115
• Efficiency	%	>99.5
• Expected lifetime[5]	year	30
• Manufacturer		Hangzhou Qiantang River Electric Group Co., Ltd
4. Annual river flow	m^3/s	20.7

The main equipment utilized in this project is imported from India via Equipment Supply Contract No.11-HDTB/2007 dated 01 November 2007 between the Project Owner and Flovel Mecamidi Energy Private Limited. The project owner had chosen supplier via tender. All the turbines, alternators, transformers and other equipment are state-of-the-art technology and meeting the criteria of the tender document. The professional technicians and engineers from the equipment supplier will train the operational staff of the Nam Chien 2 Hydropower plant on the monitoring procedures, operation regulations, maintenance procedures, and other relevant operational knowledge before operating the power plant. Furthermore, there will be regularly internal training courses on monitoring and operation for the staff during the operation period.

The baseline scenario of this project activity is identical to the existing scenario mentioned above.

A.4. Parties and project participants

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Viet Nam (host)	North-western Power Investment and Development Joint Stock Company	No
Viet Nam (host)	Energy and Environment Consultancy Joint Stock Company	No
Viet Nam (host)	Swiss Carbon Assets Ltd.	No

A.5. Public funding of project activity

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

A.6. History of project activity

The proposed CDM project activity is neither registered as a CDM project activity nor included as a component project activity (CPA) in a registered CDM programme of activities (PoA);

The proposed CDM project activity is not a project activity that has been deregistered.

The proposed CDM project activity is not a CPA that has been excluded from a registered CDM PoA.

There is not 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 the proposed CDM project activity.

A.7. Debundling

Not applicable

[5] The default lifetime in EB50, Annex 15

SECTION B. Application of methodologies and standardized baselines

B.1. References to methodologies and standardized baselines

Applied methodology:

- ACM0002: Grid-connected electricity generation from renewable sources - Version 20.0 (https://cdm.unfccc.int/filestorage/A/G/0/AG07ZJQ3EXD42LT5YV9HR16M8KINPO/EB105_repan03_ACM0002.pdf?t=UWh8cThwdGs4fDDfakh0OFHKPFVRZi7AEZnW)

Related tools:

- Tool to calculate the emission factor for an electricity system – Version 7.0 (https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf)
- Tool for the demonstration and assessment of additionality – Version 7.0.0 (https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v7.0.0.pdf)
- Assessment of the validity of the validity off the original/ current baseline and update off the baseline at the renewable of the crediting period - Version 3.0.1 (http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-11-v3.0.1.pdf)

Standardized baseline:

Not applicable

B.2. Applicability of methodologies and standardized baselines

This proposed project is a grid-connected renewable power generation that is then applicable to apply Version 20.0 of ACM0002. More details of the comparison of the project's characteristics and the applicability criteria as specified in, Version 20.0 of ACM0002 is given in Table below.

Table 2: Comparison of project's characteristics and applicability conditions of Version 20.0 of ACM0002

No.	Applicability conditions in Version 20.0 of ACM0002	Characteristics of the project activity	Applicability condition met?
1	This methodology is applicable to grid-connected renewable energy power generation project activities that: a) Install a Greenfield power plant; b) Involve a capacity addition to (an) existing plant(s); c) Involve a retrofit of (an) existing operating plant(s)/unit(s); d) Involve a rehabilitation of (an) existing plant(s)/unit(s); or e) Involve a replacement of (an) existing plant(s)/unit(s).	The project activity consists in the installation of a new grid connected renewable power plants at a site where no renewable power plant was operated prior to the implementation of the project activity (green field plant)	Yes
2	The methodology is applicable under the following conditions: The project activity may include renewable energy power plant/unit of one of the following types: hydro power plant/unit with or without reservoir, wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit;	The project activity is the installation of new hydropower plant with an accumulation reservoir	Yes

No.	Applicability conditions in Version 20.0 of ACM0002	Characteristics of the project activity	Applicability condition met?
	In the case of capacity additions, retrofits, rehabilitations or replacements (except for wind, solar, wave or tidal power capacity addition projects) the existing plant/unit started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity expansion, retrofit, or rehabilitation of the plant/unit has been undertaken between the start of this minimum historical reference period and the implementation of the project activity.	The project activity is the installation of a new hydropower plant	Not applicable
3	In case of hydro power plants, one of the following conditions shall apply: a) The project activity is implemented in an existing single or multiple reservoir, with no change in the volume of any of the reservoir or	The project activity constructs a new single reservoir	Not applicable
	b) The project activity is implemented in existing single or multiple reservoirs, where the volume of the reservoir(s) is increased and the power density, calculated using equation (3), is greater than 4 $W/m^{2;}$ or	The project activity constructs a new single reservoir	Not applicable
	c) The project activity results in new single or multiple reservoirs and the power density, calculated using equation (3), is greater than 4 W/m^2	The power density of the project is 119.85 W/m^2	Yes
	d) The project activity is an integrated hydro power project involving multiple reservoirs, where the power density for any of the reservoirs, calculated using equation (3), is lower than or equal to 4 W/m^2, all of the following conditions shall apply: (i) The power density calculated using the total installed capacity of the integrated project, as per equation (4), is greater than 4 W/m^2; (ii) Water flow between reservoirs is not used by any other hydropower unit which is not a part of the project activity; (iii) Installed capacity of the power plant(s) with power density lower than or equal to 4 W/m^2 shall be: - Lower than or equal to 15 MW; and - Less than 10 percent of the installed capacity of	The project activity is not an integrated hydropower plant	Not applicable

No.	Applicability conditions in Version 20.0 of ACM0002	Characteristics of the project activity	Applicability condition met?
	integrated hydro power project.		
4	In the case of integrated hydro power projects, project proponent shall: a) Demonstrate that water flow from upstream power plants/units spill directly to the downstream reservoir and that collectively constitute to the generation capacity of the integrated hydro power project; or b) Provide an analysis of the water balance covering the water fed to power units, with all possible combinations of reservoirs and without the construction of reservoirs. The purpose of water balance is to demonstrate the requirement of specific combination of reservoirs constructed under CDM project activity for the optimization of power output. This demonstration has to be carried out in the specific scenario of water availability in different seasons to optimize the water flow at the inlet of power units. Therefore, this water balance will take into account seasonal flows from river, tributaries (if any), and rainfall for minimum five years prior to implementation of CDM project activity	This project activity is not an integrated hydropower plant	Not applicable
5	This methodology is not applicable to: a) Project activities that involve switching from fossil fuels to renewable energy at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site b) Biomass fired power plants/ units	It is a renewable energy project with no fuel-switch involved	Yes Yes
6	In the case of retrofits, rehabilitations, replacements, or capacity additions, this methodology is only applicable if the most plausible baseline scenario, as a result of the identification of baseline scenario, is “the continuation of the current situation, that is to use the power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance”.	The project activity is the installation of new hydropower plant	Not applicable

This comparison shows clearly that the proposed project activity fulfils all applicability criteria to be eligible under Version 20.0 of ACM0002.

B.3. Project boundary, sources and greenhouse gases (GHGs)

According to Version 20.0 of ACM0002, the spatial extent of the project boundary includes the Nam Chien 2 hydro power plant and all power plants connected physically to the national electricity grid to which the proposed project is also connected.

The flow diagram of the project boundary is shown in Figure 3.

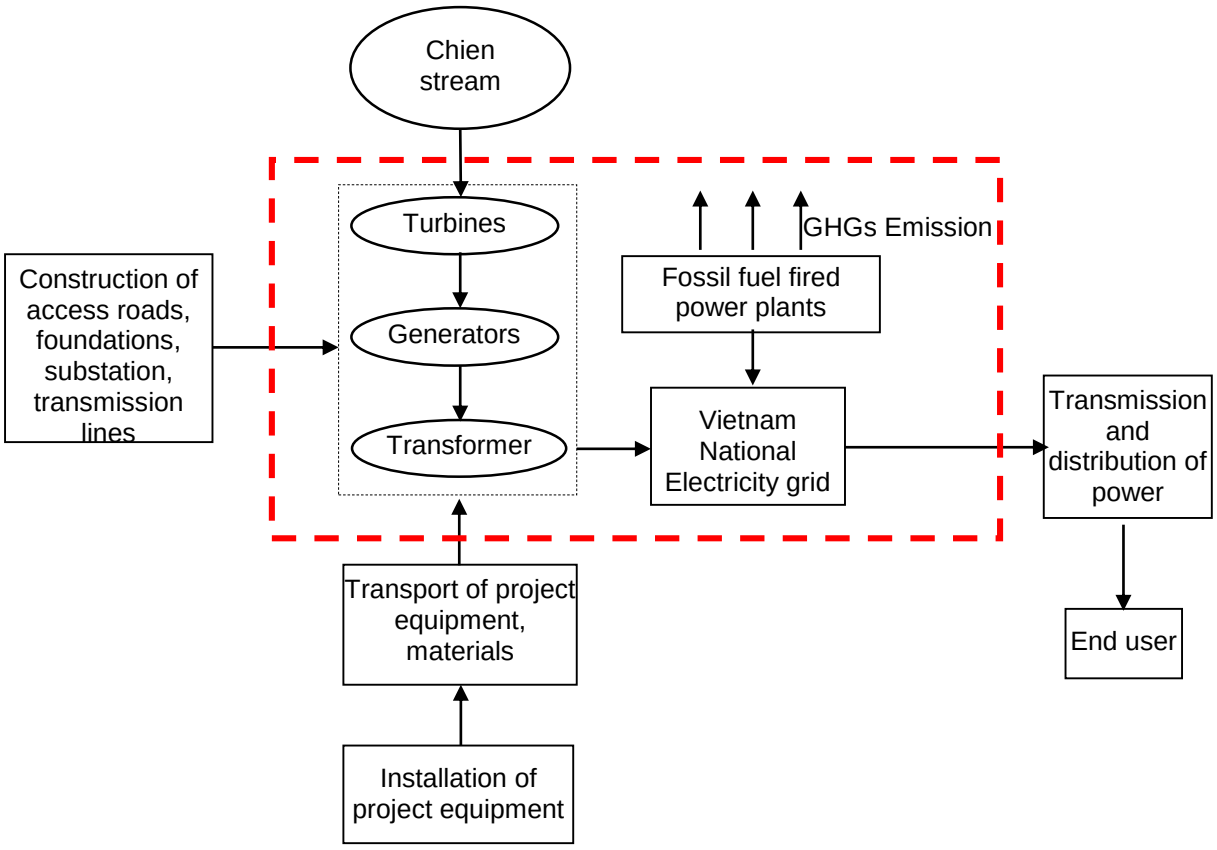

Figure 3: Project boundary

The GHGs and emission sources included in the project boundary are shown in Table 3.

Table 3: Sources and gases included in or excluded from the project boundary

	Source	Gas	Included?	Justification/Explanation
Baseline	CO_2 emission from electricity generation in fossil fuel fired power plants that is 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 Activity	For hydro power plants, emissions of CH_4 from the Reservoir	CO_2	No	Minor emission source
		CH_4	No	Main emission source. However, as the power density of the project is greater than 10 W/m^2 CH_4 emissions are neglected according to ACM0002.
		N_2O	No	Minor emission source

B.4. Establishment and description of baseline scenario

According to Version 20.0 of ACM0002, if the project activity is the installation of a new grid-connected renewable power plant, the baseline scenario is the following:

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

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

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

The analysis and description in B.5 and B.6 will support the baseline scenario shown above.

The latest report of Emission Factor of Vietnam Electricity System, published by Department of Climate Change, Ministry of Natural Resources and Environment of Vietnam on 12/03/2020 effects the baseline GHG emission, and the reassessment of the baseline emissions by applying the data of the latest report is presented in the section B.6 below.

CDM project standard for project activities, version 02.0, item 10 - Renewal of crediting period, paragraph 282, 283, 284 and 286 says that:

"282. The project participants shall demonstrate the validity of the original baseline or update it in accordance with paragraphs 283-286 below.

283. To demonstrate the validity of the original baseline or its update, the project participants are ***not required to re-assess the baseline scenario****. Instead, the project participants shall assess the GHG emission reductions or net anthropogenic GHG removals that would have resulted from that scenario";*

284. The project participants shall assess and incorporate the impact of national and/or sectoral policies and circumstances, existing at the time of requesting the renewal of the crediting period, on the current baseline GHG emissions, without reassessing the baseline scenario".

285. The requirements contained in paragraph 284 above are not applicable to a registered CDM project activity applying the valid version of an applicable approved standardized baseline that standardizes baseline scenario in accordance with paragraph 281 above.

286. If data and parameters used for determining the original baseline, that were determined ex ante and not monitored during the crediting period, are no longer valid, the project participants shall update such data and parameters in accordance with the "Methodological tool: Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period."

The stepwise procedure to assess the continued validity of the baseline and to update the baseline at the renewal of a crediting period is conducted following methodological tool "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting

period" (Version 03.0.1, EB 66, Annex 47). The tool consists of two steps. The first step provides an approach to evaluate whether the current baseline is still valid for the next crediting period. The second step provides an approach to update the baseline in case that the current baseline is not valid anymore for the next crediting period.

Step 1: Assess the validity of the current baseline for the next crediting period

The "Procedures for the renewal of the crediting period of a registered CDM project activity" approved by the CDM Executive Board require assessing the impact of new relevant national and/or sectoral policies and circumstances on the baseline.

The validity of the current baseline is assessed using the following sub-steps:

Step 1.1: Assess compliance of the current baseline with relevant mandatory national and/or sectoral policies

According to the registered PDD, in the absence of the project activity, electricity which will be supplied to the national grid would come from fossil fuel power plants. The generation of electricity by burning fossil fuels result in CO_2 emission into the atmosphere. Hence, the baseline scenario of the project is the electricity delivered to the grid by the project activity that otherwise would have been generated by the operation of grid-connected fossil fuel power plants and by the addition of new generation sources.

Electricity Law No. 28/2004/QH11 dated on 03/12/2004 and Law No. 50/2010/QH12 on "Economical and Efficient use of energy" dated on 17/06/2010 are the main laws that govern the electricity sector in Vietnam. Their implementation is regulated under Government Decree No. 14/2014/ND-CP on "Stipulating in detail the implementation of electricity law regarding electricity safety" dated on 26/02/2014. National policy and regulation does not mandate setting up renewable power plants from existing capacity. Thus it can be concluded that the current baseline scenario is in compliance with relevant mandatory national and sectoral policies.

Step 1.2: Assess the impact of circumstances

The circumstances existing at the time of requesting renewal of crediting period are the same as existing in the validation of the PA. Furthermore, this is a greenfield project activity and the baseline at validation was not the continuation of the existing scenario. Therefore, this step is not applicable for this project.

Step 1.3: Assess whether the continuation of use of current baseline equipment(s) or an investment is the most likely scenario for the crediting period for which renewal is requested.

This sub-step should only be applied if the baseline scenario identified at the validation of the project activity was the continuation of use of the current equipment(s) without any investment and, the projects proponents or third party (or parties) would undertake an investment later due, for example, to the end of the technical lifetime of the equipment(s) before the end of the crediting period or the availability of a new technology.

Since the baseline scenario identified during the validation of the project activity was electricity generation in power plants that are displaced due to the project activity and was not the continuation of use of the current equipment(s). This sub-step is not applicable for this project activity.

Step 1.4: Assessment of the validity of the data and parameter.

"Where emission factors, values or emission benchmarks are used and determined only once for the crediting period, they should be updated, except if the emission factors, values or emission benchmarks are based on the historical situation at the site of the project activity prior to the implementation of the project and cannot be updated because the historical situation does not exist anymore as a result of the CDM project activity".

In the registered PDD, the grid emission factor was calculated as per the combined margin approach described in the "Tool to calculate the emission factor for an electricity system" version 02.0. The grid emission factor was calculated as the weighted average of OM & BM; and was fixed ex-ante for the entire crediting period. Since the emission factors that were determined at the start of the first crediting period are not valid anymore, the data and parameters have been updated for the second crediting period.

The OM and BM was obtained from official data provided by DNA Vietnam on 12/03/2020. This is the most recent data available during the validation of renewal of crediting period.

Considering the guidance provided under this step, calculation of emission factor and baseline emissions are updated for the next crediting period as per step 2.

Step 2: Update the current baseline and the data and parameters

Step 2.1: Update the current baseline.

The current baseline scenario is still valid.

Step 2.2: Update the data and parameters.

As mentioned in step 1.4, all parameters regarding the grid emission factor are updated in the second crediting period.

B.5. Demonstration of additionality

CDM Project Standard for Project Activities, version 02.0, Item 10. Renewal of crediting period, Paragraph 280 states that:

"For renewal of crediting period of a registered CDM project activity, the project participants are not required to reassess the additionality of the project activity nor update the section of the PDD relating to additionality."

Nam Chien 2 Hydropower project is a registered CDM project. Therefore, the reassessment of the additionality is not required for renewing crediting period.

The following sections therefore are kept the same with the registered PDD.

According to Version 10.0 of ACM0002, the latest Version of the "Tool for the demonstration and assessment of additionality" shall be used to demonstrate the additionality of this project activity. Version 5.2 of the additionality tool includes the following steps:

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 Nam Chien 2 Hydropower Project with the total installed capacity of 32 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.

Alternative 3: Adding a new renewable energy power plant of equivalent power output other than this hydropower plant

The construction and operation of another type 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 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[6] which is the latest publicly information source listed all operated and planned power plants in Vietnam, there is not any fossil fired power plant with the equivalent and lower power output is constructed/under construction and/or planned in Vietnam or Son La province. According to the Electricity Law, the investment in electricity generation must be in line with the potential power generation projects listed in the latest Master plan. In the point of view for electricity development by Ministry of Industry and Trade[7], the common capacity of thermal power unit within next 10 years is 300 MW and in the future the higher capacity (600 MW and higher) will be chosen for the economic scale reason. It shows that the investment and operation of such thermal power plants with the capacity equal and below 32 MW is not realistic in Vietnam[8].

Furthermore, the Project Owner only has experience and right to invest and do business in hydroelectric power[9]. The construction of fossil fuel power plants by the project proponent is not a plausible investment option as the project participant has no know-how and experience as well as a 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[10].

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

Alternatives 1 and 4 are theoretically technically feasible and comply with Vietnamese current laws and regulations.

Hence, 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. Out of the two remaining options, Option II is also not applicable as there are no other credible and realistic baseline scenario alternatives other than electricity supply from the grid. Thus, the benchmark analysis (Option III) is chosen to prove additionality.

[6] Decision 110/QD-TTg dated 18 July 2007

[7] Industrial Review of Vietnam, http://irv.moit.gov.vn/News/PrintView.aspx?ID=15663

[8] For a comprehensive list of thermal power plants in Vietnam in English, please also see "Environmental issues of thermal power plants" presented by Dr. Hoang Duong Tung, Vietnam Environmental Protection Agency, Ministry of Natural Resources And Environment at the "Cleaner Coal Workshop on Solutions to Asia's Growing Energy and Environmental Challenges", 19-21 August 2008, Ha Long City, Vietnam, accessible at:

http://www.egcfe.ewg.apec.org/publications/proceedings/CleanerCoal/HaLong_2008/Day%202%20Session%201C%20-%20Huang%20Duong%20Tung%20Environmental%20Issues.pdf

[9] Business Registration License No.5500271984 issued by the Department of Planning and Investment of Son La

[10] Chapter VI - Master Plan VI

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. Out of the two remaining options, Option II is also not applicable as there are no other credible and realistic baseline scenario alternatives other than electricity supply from the grid. Thus, the benchmark analysis (Option III) is chosen to prove additionality.

Sub-step 2b – Option III: Apply benchmark analysis

In the following, Project IRR is used to demonstrate the Additionality of the project. Provided that the proposed project is financed by **both equity and loan** sources, the appropriate benchmark is WACC which represents the weighted average of the costs of various sources of financing in the financing structure. This benchmark represents the minimal required FIRR of the project to be economically attractive. The WACC benchmark is indicated in para 12, Annex: Guidance on Assessment of Investment Analysis, Annex 58, EB 51, "*Local lending rates or weighted average costs of capital (WACC) are appropriate benchmarks for a project IRR*". Thus, the project participant applies the following WACC equation to estimate the *required return on capital* as a benchmark for this project IRR:

$$WACC = \frac{E}{V} * \mathrm{R_e} + \frac{D}{V} * \mathrm{R}_d * (1 - T_c) \qquad (1)$$

Where:

R_e : cost of equity

R_d : cost of debt

E : Amount of equity in the project

D : Amount of debt in the project

V : Total investment cost (=E + D)

T_c : average enterprise tax rate

This WACC is the "*the cost of financing and required return on capital*" which is "*based on private equity investors/fund" required return on comparable projects*" as presented in Option III, Item (6)(b) of "*Tool for the demonstration and assessment of additionality*" version 5.2.

And it also reflects a common-practice approach in investment decision-making in Viet Nam as this approach was also introduced by the Ministry of Industry to conduct the financial analysis of IPP projects in Viet Nam[11].

Determine the cost of debt

The cost of debt is the interest rate for a long-term loan prevailed at the time of making the investment decision. The project participant chooses the lowest value of the range from 11.4% to 16.2% of the interest rates for long-term credit published in the Annual Report of the State Bank of Viet Nam. This report is published at the website of the State Bank annually (*www.sbv.gov.vn/)*. So the cost of debt used for benchmark derivation is conservative and standard value.

The applied cost of debt is 11.4% at the date of making the investment decision.

[11] Decision No. 2014/QĐ – BCN issued by the Ministry of Industry provides temporary guidelines for conducting the economic, financial and investment analysis and providing the purchasing-selling price frame for power generation projects.

Determine the cost of equity

To derive an appropriate cost of equity for electricity generation project type in Vietnam, the following well-known CAPM[12] standard formula, which describes the relationship between risk and expected return, is employed:

$$R_e = R_f + \beta * (R_{m,} - R_f) \quad (2)$$

Where:

$R_{e,}$	cost of equity for electricity generation project type
R_f	Risk free rate return
β	Beta of the security for electricity generation project type
$R_{m,} - R_{f,}$	Market risk premium

Risk free rate:

The risk free rate is understood as the rate of return on an asset that is theoretically free of any risks, therefore the rate of interest on government bonds are considered as risk free rates. Accordingly, the risk free rate has been taken from long term Vietnamese government bond rates available at the date of making the investment decision. The data on government bond rates is published on Asia Commercial Bank securities company website.

The risk free rate applied is 9.00% for 15 years term[13].

Beta:

Beta (β) indicates the sensitivity of the company to market risk factors. Beta represents the market risk for an asset and is calculated as the statistical measure of volatility of a specific asset/investment relative to the movement of a market group. The conventional approach for estimating beta of an investment is a regression of returns on investment against returns on a market index. For companies that are not publicly listed like North-western Power Investment and Development Joint Stock Company, the beta is determined by referring to beta values of publicly listed companies that are engaged in similar types of business. The project activity type is power generation; therefore, the applied beta for this project should be based on the beta values of listed power generation companies in Vietnam.

Due to the difference in capital structure (Dept/Equity) between these companies and North-western Power Investment and Development Joint Stock Company, the Beta applied for this CDM project has to be adjusted according to the following steps:

- Step 1 – It is obtained the Levered Betas of hydropower companies published in stock market with its own capital structures;

[12] In finance, the **Capital Asset Pricing Model (CAPM)** is used to determine a theoretically appropriate required rate of return of an asset, if that asset is to be added to an already well-diversified portfolio, given that asset's non-diversifiable risk. The model takes into account the asset's sensitivity to non-diversifiable risk (also known as systemic risk or market risk), often represented by the quantity beta (β) in the financial industry, as well as the expected return of the market and the expected return of a theoretical risk-free asset.

[13] http://www.acbs.com.vn/chungkhoan/?fn=bond/listbond22_.jsp

- Step 2 – The Beta is Unlevered according the average capital structure of the companies; The unlevered beta is the beta of a company without any debt. Unlevering a beta removes the financial effects from leverage[14].
- Step 3 – The Unlevered Beta is levered again according to the capital structure of the Nam Chien 2 Hydropower project. This Levered Beta was used for calculation of cost of equity of the Nam Chien 2 Project

Table 4: Betas of similar companies in hydro power generation[15].

Company name	Levered Beta of similar projects	D/E	Unlevered Beta	Levered Beta for CDM project
Vinh Son Song Hinh Hydropower Company	0.96	0.39	0.75	2.01
Ry Ninh II Hydropower JSC	0.42	1.24	0.22	0.59
Thac Ba Hydropower Company	1.28	0.08	1.21	3.24
Minimum Beta	**0.59**			

Risk Premium:

The most common approach for estimating the risk premium is to base it on historical data, in the CAPM model, the premium is estimated by looking at the difference between average return on stocks and the risk free rate return. The average return on stocks is defined as the compounded annual return.

Table 5: Market expected return calculation.

Market index (VN Index) as on 28-Jul-2000	100.00
Market index (VN Index) as on 02-Apr-2007	1071.30
No. of years	6.68
Compounded annual return	**42.60%**

Substituting

R_f = 9.00%;

R_m= 42.60%;

β = 0.59

in (2), we get the **cost of equity for power generation projects in Viet Nam at the date of decision making of the proposed project** as follows:

$$R_e = 28.95\%$$

This rate of the cost of equity for power generation sector meets the EB rules because it reflects a sector specific approach. It is calculated based on similar companies operating in power generation sector in Viet Nam therefore it reflects "*standard in the market, considering the specific characteristics of the project type (…)*" as stipulated in the guidance given in the latest additionality tool under sub-step 2b (5).

[14] http://www.investopedia.com/terms/u/unleveredbeta.asp

[15] The betas of these companies have been calculated by the project developer based on the published daily data. The link of sources are included in the attached excel sheet.

However, Ibbotson Associates, Inc. - a leading provider of independent investment research in major international markets has been published an annual "International Cost of Capital Perspectives Report" since 2001 that also provides a source for the expected rate on return on equity in Vietnam from an investor's point of view. In the report the costs of capital for Vietnam are displayed[16]. In total the report gives 12 different values for Vietnam (due to different calculation methods and investors background). The lowest value among all 12 values given in the report in 2006 is 21.87 %. Since this value is lower than the return on equity 28.95% calculated by CAPM for power generation projects in Viet Nam, 21.87% is applied as the expected rate on return on equity for the benchmark calculation.

Another survey by a securities company in Viet Nam recommends the range of 25% to 30% for cost of equity for power generation companies in Vietnam market[17]. Therefore, **the rate of 21.87% applied as the cost of equity for power generation projects in Viet Nam at the date of decision making of the proposed project is the most conservative value.**

The table below presents key assumption to calculate the benchmark - WACC according to formula (1)

Table 6: Key assumptions to calculate the benchmark

No	Parameter	Unit	Value
1	Total investment cost[18] of which • Construction and assembly costs • Equipment cost • Compensation cost • Other cost Contingency cost	billion VND	629.16 348.06 142.84 5.00 79.03 54.23
2	Project equity[19]	billion VND	188.75
3	Required return on equity[20]	%	21.87
4	Debt		
	• Total[21]	billion VND	440.41
	• Interest rate[22]	%	11.4
5	Average enterprise revenue tax[23]	%	19.13
6	**WACC**	**%**	**13.01**

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

The key assumptions used to calculate the project IRR of the proposed project are presented in Table below:

[16] The referenced report has been updated annually since 2001. The report that was published in May 2006 includes the data up to March 2006 and was available and valid at the date of the decision to implement the project activity. As the report includes proprietary information of the publisher, all relevant details of the report as well as the exact source have been submitted directly to the DOE for validation.

[17] The report by Anpha Securities Company has been submitted to the DOE.

[18] Investment licence No 24121000 002 for Nam Chien 2 Hydropower project issued by Son La People's Committee on 22 December 2006

[19] Decision No 30/2006/QD-BCN issued on 31 August 2006 by Ministry of Industry regulates that the investment capital of project owner (equity) in a power generation investment project must be accounted for at least 30% of the total investment cost

[20] Ibid., at 7

[21] Decision No 30/2006/QD-BCN issued on 31 August 2006 by Ministry of Industry regulates that the investment capital of project owner (equity) in a power generation investment project must be accounted for at least 30% of the total investment cost

[22] Annual Report of the State Bank 2006, p 42, the range of interest rate for long term credit is from 11.4 - 16.2%/year

[23] Government Decision No 24/2007/NĐ-CP on implementation of enterprise tax law issued on 14 Feb. 2007, Chapter V: Article 34 - Item 3.b and Article 35 - Item 5

Table 7: Key assumption for investment analysis

No	Parameter	Unit	Value
1	Gross capacity[24]	MW	32
2	Annual net electricity generation[25]	MWh	130,413
3	Total investment cost	billion VND	629.2
4	Total annual O&M cost[26]	billion VND	3.1
5	Construction period	months	35
6	Depreciation period of the plant[27]	year	20
7	Period of financial assessment[28]	year	40
8	Fair value[29]	Billion VND	0
9	Electricity price[30]	VND/kWh	602.3
10	• Resources tax[31]	%	2
11	Average enterprise revenue tax[32] • For the first 4 years • For the next 9 years • For the next 2 years For the remaining years	**%**	 0 5 10 28
12	**Project IRR without CDM**	**%**	**9.43**

This table shows that the project IRR of the project was lower than the benchmark at the time of decision making by the Management Board on 02 April 2007.

All financial data are available to the DOE for Validation.

Sub-step 2d: Sensitivity analysis

A sensitivity analysis of the project activity has been conducted to test the robustness of the above calculations. For the analysis the following parameters have been changed as they mainly influence the feasibility of the project activity:

- Annual export to the national grid
- O&M cost
- Investment cost.
- Feed-in price set by EVN

Table 7 shows the impact of variations in key factors on the project IRR considering a ±10% variation in the parameters.

[24] Investment licence

[25] Investment licence and the parasitic and loss load of 1%

[26] Decision No. 709/QD-NLDK issued on 03 April 2004 by the Ministry of Industry

[27] Prevailing common practice period for industrial investment project

[28] Project lifetime was approved in Decision No. 709/QD-NLDK (issued by the Ministry of Industry provides temporary guidelines for conducting the economic, financial and investment analysis and providing the purchasing-selling price frame for power generation projects)

[29] Because the project IRR calculations has reflected "the period of expected operation of the underlying project activity (technical lifetime)", So after 40 years, the fair value is no need to be considered according to *"Guidance on Assessment of Investment Analysis" (version 02)*, Annex 58, EB 51: **"or - if a shorter period is chosen - include the fair value of the project activity assets at the end of the assessment period"**

[30] The project owner expects that EVN will buy electricity generate from the proposed project activity at this tariff. It's an average of the feed-in-tariff offered by EVN for IPP hydropower plants in Viet Nam

[31] Ibid., at 12

[32] Government Decision No 24/2007/NĐ-CP on implementation of enterprise tax law issued on 14 Feb. 2007, Chapter V: Article 34 - Item 3.b and Article 35 - Item 5

Table 8: Sensitivity analysis

No	Parameter	Variation[33]	Project IRR	Likelihoods to happen
1	Annual amount of electricity exported to the national grid	10%	10.4%	Lower than the benchmark
		37.36%	13.01%	The probability of a 37.36% increase in annual export to the national grid is very unlikely. This is because the potential hydrology has been surveyed in long term basis. It is concluded that the hydrological condition is not possible to sustain a 37.36% annual increase compared with the current estimation for the entire crediting period. This option shall be discarded.
		-10%	8.4%	Lower than the benchmark
2	O&M costs	10%	9.4%	Lower than the benchmark
		-100.00%	9.85%	In the case of zero total O&M cost (or 100% decrease of O&M Cost), the Project IRR is 9.85% that is still lower than the benchmark. This option shall be discarded.
		-10%	9.5%	Lower than the benchmark
3	Investment costs	10%	8.5%	Lower than the benchmark
		-28.04%	13.01%	The probability of a 28.04% decrease in the total investment cost is not likely to happen because the inflation, average consumer prices in 2006, 2007 and 2008[34] show an annual increase of 7.5%, 8.3% and 24% respectively. And in fact, the total Investment cost estimated at time of Jan 2009 is 624 billion VND[35] (or only 0.8% decreasing) so this option shall be discarded.
		-10%	10.5%	Lower than the benchmark
4	Feed in price set by EVN	10%	10.5%	Lower than the benchmark
		36.50%	13.01%	The probability of a 36.50% increase in feed in tariff annually is very unlikely because the PPA contract will be signed with EVN with a fixed feed in tariff for long term. However, it should be comparable with the tariffs applied for other hydropower projects under fixed feed-in tariffs applied for long-term PPAs for other hydropower projects that are around 603.79VND/kWh[36]. And in fact, the feed in tariff which has been negotiate between EVN and the Project Owner is 606.3 VND/kWh[37] (or only 0.7% increasing) so this option shall be discarded. This option shall be discarded.
		-10%	8.4%	Lower than the benchmark

[33] ±10% is selected according to the Decision No. 709/QĐ – NLDK issued by the Ministry of Industry, dated 13 April 2004 to provide temporary guidelines for conducting the economic, financial and investment analysis and providing the purchasing-selling price frame for power generation projects. It is also common-practice for sensitivity analysis for additionality demonstration. Furthermore, ±10% is also a common practice rate for sensitivity analysis of a CDM project

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

[35] The Report on Management Board's Meeting about Investment cost.

[36] The statistic data of the feed-in tariffs applied for other hydropower projects best available up to the date of submission of the PDD is submitted to the DOE

[37] Negotiation on electricity price between EVN and the PO in September 2007.

The sensitivity analysis shows that the project IRR of the project was considerably lower than the benchmark in all cases.

In conclusion, the proposed CDM project activity is unlikely to be financially attractive.

Step 3: Barrier analysis

Not applied.

Step 4: Common practice analysis

Sub-step 4a: Analyse 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 and was entered into force 15 days after the issuance date, 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.

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, Vietnam Construction Code - TCXDVN 285:2002).

According to Vietnam Construction Code - TCXDVN 285:2002 "Irrigation projects - Major standards on designing"38 which regulates the criteria for construction contractors, design steps and warranty period for construction works activities, hydropower projects are categorized as follows**.**

Table 9: Groups of hydropower projects according to Vietnam Construction Code - TCXDVN 285:2002

Group	Installed capacity
I	equal and larger 300 MW
II	equal and larger 50 MW but smaller 300 MW
III	smaller 50 MW but equal and larger 5MW
IV	smaller 5 MW but equal and larger 0.2MW
V	up to 0.2MW

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 defining the jurisdictions to approve the Master Plans and management hierarchy for small scale hydropower projects, hydropower projects having installed capacity within the range 1 MW to 30 MW are categorised as small-scale projects.

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

Table 10: Groups of hydropower projects serving for common practice analysis

Group	Installed capacity	Referred regulations
A	equal and larger 300 MW	Vietnam Construction Code - TCXDVN 285:2002
B	larger 100 MW and smaller 300 MW	Vietnam Construction Code - TCXDVN 285:2002 and Prime's Minister Decision No 176/2004/QD-TTg

[38] Construction Code regulates the basic technical standards that are mandatory for construction activities in Vietnam

C	equal and larger 50 MW and equal and smaller 100 MW	Vietnam Construction Code - TCXDVN 285:2002
D	smaller 50 MW and larger 30MW	Vietnam Construction Code - TCXDVN 285:2002 and Decision of Ministry of Industry - No: 3454/QD-BCN, Prime's Minister Decision No 176/2004/QD-TTg
E	equal and smaller 30 MW and larger 5MW	Vietnam Construction Code - TCXDVN 285:2002 and Decision of Ministry of Industry - No: 3454/QD-BCN, Prime's Minister Decision No 176/2004/QD-TTg
F	up to 5MW	Vietnam Construction Code - TCXDVN 285:2002 and Decision of Ministry of Industry - No: 3454/QD-BCN, Prime's Minister Decision No 176/2004/QD-TTg

According to Table 10, this proposed project activity falls into Group D which are *similar scale and take place in a comparable environment* to the proposed project activity.

According to the most recent available data, there are no hydropower plants belong to Group D constructed and/or commissioned since August 2001 up to the date of submission of the project proposal to validation . So, the range between 30 MW and 100 MW (combination of group C and D) has been chosen for analysis.

Hydropower plants which belong to this range but were developed without CDM are listed in Table below.

Table 11: Hydropower plants which belong to range (30 MW to 100 MW) were developed in Vietnam[39]

No	*Name*	*Capacity MW*	*Construction starting year*	*Commissioning year*
1	*Srokphu Mieng*	*51.0*	*Nov. 2003[40]*	*2006*
2	*Quang Tri*	*64.0*	*Aug. 2003[41]*	*Nov.2007*
3	Vinh Son	66.0	*Sep.1991*	*1994*[42]
4	Song Hinh	70.0	*Nov.1995*	*2000*[43]
5	Can Don	77.6	*May. 2000[44]*	*Jan.2004*

Because the Vinh Son, Song Hinh and Can Don hydropower projects started construction before 2001, they are excluded from this common practise analysis. Thus, only Srokphu Mieng and Quang Tri projects are relevant in this analysis.

Table 11.1: Hydropower plants which belong to range (30 MW to 100 MW) were developed in Vietnam[45]

No	*Name*	*Capacity MW*	*Elec. outputs 10^3 MWh*	*Construction starting year*	*Commis-sioning year*	*Investor during the investment and construction period*

[39] List of powerplants supplied by Institute of Energy

[40] http://www.idico.com.vn/?id_pnewsv=353&lg=vn&start=0

[41] http://vietnamnet.vn/kinhte/2007/03/672725/

[42] List of powerplants supplied by Institute of Energy

[43] List of powerplants supplied by Institute of Energy

[44] http://hungvuongsc.com/Coms/SJD_Info/Company.aspx

[45] List of powerplants supplied by Institute of Energy

0	**The proposed project**	**32**	**131.73**	**Jun.2007**	**2010**	*North-western Power Investment and Development Joint Stock Company*
A. Invested and constructed by state-owned companies or joint stock companies which are either state-owned or whose major shares held by the government						
1	Srokphu Mieng	51.0	228	Nov. 2003	2006	Vietnam Urban and Industrial Zone Development Investment Corporation[46] (State-owned Corporation belongs to Ministry of Construction)
2	Quang Tri	64.0	217.4	Aug. 2003	Nov.2007	EVN (Electricity of Vietnam)

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

The existence of these hydropower plants does not contradict the result of the benchmark analysis stating that the proposed project is financially unattractive, because of the following reasons:

These projects have been invested in by either large state-owned corporations or joint stock companies whose majority shares held by large state-owned corporations. Such companies do not face:

1. The state-owned corporations mentioned above are among the largest state-owned power and construction corporations in Vietnam. They are financed by the state budget as well as their investment activities. Therefore, they have substantial experiences in designing, investing, constructing and operating hydropower plants.
2. The state-owned corporations mentioned above were established according to the Prime Minister's Decisions No 90/TTg and 91/TTg dated on 07th March 1994. The formulation of these corporations is to aim at developing power and construction industries in order to meet national socio-economic development goals and strategies and to implement development tasks assigned by their ministries and/or Prime Minister in certain development periods. Therefore, the key target of these corporations is to serve as the governmental tool for macroeconomic interferences rather a profit making[47].

Besides, all the above listed projects have been constructed when energy demand was very urgent to meet the “hot” development growth rates of Vietnam but the price of labour, construction materials, machine is quite cheap and stable. Thus, these project owners could invest in these projects to pursuit the development strategy of the government of Vietnam. In recent years, Vietnam has been suffered with high inflation with a sharply increase in prices of construction materials. As a result, the government has promulgated the tightening monetary policy to reduce the annual growth rate in order to control inflation. It therefore gets more difficult to arrange sufficient loan for a non-attractive investment project.

As demonstrated in Section B5, this project is not an attractive alternative. Without the additional revenue from CDM, it will be non-attractive investment project.

Implementation timeline of the proposed project activity

The incentive from the CDM was seriously considered in the decision of the North-western Power Investment and Development Joint Stock Company to proceed with the project activity. It was

[46] http://rol.vn/weben/sanpham/chitiet/530/gioithieu/

[47] http://vi.wikipedia.org/wiki/Tổng_công_ty_91

reflected via the Company's action to secure the CDM status by sending official letters to the People's Committee of Son La Province (the highest provincial authority) and the DNA notifying the CDM project and requesting for their support in developing the proposed project as a CDM project activity on 08 February 2007. Subsequently, the People's Committee sent an official letter to the DNA on 05 March 2007 verifying the request from the Company. This was prior to the start date of the project which is defined as the date of signing the construction contract on 16 June 2007.

The project owner was sure of receiving a positive validation opinion as the rejection rate of comparable hydro power projects all over the world and especially in Asia was exceptionally low. The circumstances of the project that are presented in this PDD demonstrate clearly that the project is eligible under the CDM. For that reason the project owner did not see any relevant risk of receiving a negative validation opinion and the commitment of funds in advance was not questioned. Furthermore the project owner took all required measures to ensure proper implementation of the CDM project, e.g. by hiring a CDM consultant and by starting negotiations on an emission reduction purchase agreement. Any feedback received during the development of the project supported the opinion of the project owner regarding the appropriateness of the project to be successfully validated.

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

Table 12: Major milestones in developing the investment project and CDM application

Development of the hydropower project	To be taken to achieve CDM registration	Time	Implication on CDM
I. Legal & administrative formality to be endorsed as the project owner			
	Learnt about CDM via CDM public events and publications from the DNA	2006	
Finalising Feasibility Study		01 Aug 06	
Environmental Impact Assessment (EIA) report was approved by the Provincial People's Committee - PPC (the highest local authority)		16 Oct 06	
	A stakeholder consultation meeting to consult public opinions on the social and environmental impacts of the hydropower project to develop the project as a CDM activity	20 Oct 06	The local people and local authorities have attended the meeting. Evidence for CDM early consideration
	Signing the CDM development and registration contract	18 Dec 06	CDM early consideration evidence
Issuing the Certificate of Investment for the project by PPC		22 Dec 06	The investor was officially endorsed as the project owner
II. Activities/ Procedures to make the decision and start the project activity			
	Submitting an official letter by the project owner to notify the CDM project and also to request the PPC to verify and support for the CDM project submission to the DNA	08 Feb 07	CDM early consideration evidence
	Submitting an official letter verifying and supporting the	05 Mar 07	CDM early consideration evidence

	CDM project by the PPC to DNA		
	Issuing the Investment Decision on implementing the project by the Management Board	02 Apr 07	Date of making Investment Decision
	Receiving the Letter of Intent for the purchase of CERs	25 May 2007	
Signing the Contract for construction of main works of the hydropower project (dams, intake, .etc)		16 Jun 07	Starting date of project activities
	Submission of CDM project to DNA	29 Aug 07	
Signing the Negotiation report on the purchasing of the power generated by the hydropower project signed with EVN		01 Sep 07	
	Signing the Letter of Intent for the purchase of CERs	01 Oct 07	
Signing the Credit contract		04 Oct 07	
Signing the Contract for supply of technological equipment and technical services		01 Nov 07	
	Issuing the LOA by the DNA	08 Nov 07	
	Signing the ERPA	09 Jun 08	

In conclusion, the proposed project is additional.

B.6. Estimation of emission reductions

B.6.1. Explanation of methodological choices

The reduced emission is calculated in accordance with the approved consolidated baseline methodology Version 20.0 of ACM0002.

I. Project emissions *(PE_y)*

According to the ACM0002 Version 20.0, the project emission for the Hydropwer project is:

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

Where:

PE_y	=	Project emissions in year y (tCO_2e/yr)
$PE_{FF,y}$	=	Project emissions from fossil fuel consumption in year y (tCO_2/yr)
$PE_{GP,y}$	=	Project emissions from the operation of dry, flash steam or binary geothermal power plants in year *y* ($t\ CO_2e/yr$)
$PE_{HP,y}$	=	Project emissions from reservoirs of hydropower plants in year *y* (tCO_2e/yr)

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

According to paragraph 33 of ACM0002 – version 20.0, for all renewable energy power generation project activities, emissions due to the use of fossil fuels for the backup generator can be neglected. The project activity is a renewable power plant. Therefore, emission from fossil fuel combustion is zero.

$$PE_{FF,y} = 0$$

Project emissions from the operation of dry, flash steam or binary geothermal power plants ($PE_{GP,y}$)

These emissions only apply for geothermal project activities. The proposed project is a hydro power plant that does not operate geothermal power plants, therefore, $PE_{GP,y} = 0$

The above project emission calculation equation therefore can be shortened as follows:

$$PE_y = PE_{HP,y}$$

Emissions from water reservoirs of hydro power plant ($PE_{HP,y}$)

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

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

Where:

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

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

$$PE_{HP,y} = \frac{\mathrm{EF}_{\mathrm{Res}} \cdot TEG_y}{1000}$$

Where:

$PE_{HP,y}$	Emission from reservoir expressed as tCO_2e/year
EF_{Res}	Default emission factor for emissions from reservoir of hydro power plants in year y ($kgCO_2e$/MWh)
TEG_y	Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year *y* (MWh).

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

$$PE_{HP,y} = 0$$

II. Baseline emissions (BE_y)

Baseline emissions include only CO_2 emissions from electricity generation from fossil fuel fired power plants that are displaced due to the project activity, calculated as follows:

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

Where:

BE_y	Baseline emissions in year *y* (tCO_2/yr).
$EG_{PJ,y}$	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh/yr)

EF_{grid} Factor for grid connected power generation in year *y* calculated using the latest version of the "Tool to calculate the emission factor for an electricity system".

Calculation of $EG_{PJ,y}$

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

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

Where:

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

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

Therefore, the baseline emissions are calculated as follows:

$$BE_y = EG_{facility,y} . EF_{grid,CM,y}$$

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

For this renewal crediting period, the emission factor is calculated using:

- Latest national data: The published data by the host country DNA of Vietnam, Department of Climate Change, Ministry of Natural Resources and Environment of Viet Nam on 12/03/2020; on emission factor of Viet Nam national grid in 2018; and
- Lastest calculation too: The Version 07.0 of "Tool to calculate the emission factor for an electricity system" valid from 31/08/2018 onward.

The Emission Factor of Viet Nam Electricity System in 2018 was calculated and published by DNA of Vietnam, Department of Climate Change, Ministry of Natural Resources and Environment of Viet Nam on 12/03/2020 using Version 07.0 of "Tool to calculate the emission factor for an electricity system", including:

The operating margin emission factor: $EF_{grid,OM,y} = 0.8795\ tCO_2/MWh$

And build margin emission factor: $EF_{grid,BM,y} = 0.9465\ tCO_2/MWh$

The combined emission factor is calculated as follows:

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

Where:

w_{OM}: Weighting of OM emission factor (%)

w_{BM}: Weighting of BM emission factor (%)

However, the DNA report applied the weighting factors of both OM and BM emission are 0.5, which is not applicable for the second and third crediting period.

According to the Version 07.0 of "Tool to calculate the emission factor for an electricity system", the following default values are used in the renewal crediting period:

$$w_{OM} = 0.25 \text{ and } w_{BM} = 0.75$$

So in the renewal crediting period, the CM emissions factor is derived as follows:

$$\mathbf{EF_{grid,CM,y} = 0.25 \times 0.8795 + 0.75 \times 0.9465 = 0.9297\ tCO_2/MWh}$$

The CM emission factor shall be fixed for the second crediting period

III. Leakage

The main emissions potentially giving rise to leakage in the context of electric sector projects are emissions arising due to activities such as power plant construction and upstream emissions from

fossil fuel use (e.g. extraction, processing, and transport. According, to ACM0002, Version 20.0 these emission sources are neglected, therefore leakage of the project is neglected

IV. Emission reductions (ER_y)

Emission reductions are calculated as follows:

$$ER_y = BE_y – PE_y$$

Where:

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

B.6.2. Data and parameters fixed ex ante

Data / Parameter	**Cap_{BL}**
Data unit	MW
Description	Installed capacity of hydropower plant before the implementation of the project activity.
Source of data	Project site
Value(s) applied	0
Choice of data or measurement methods and procedures	The project activity constructs a new hydropower plant, so Cap_{BL} is considered to be zero according to Version 20.0 of ACM0002.
Purpose of data	For calculating the power density (PD)
Any comment	

Data / Parameter	**A_{BL}**
Data unit	m^2
Description	Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full. For new reservoir, this value is zero.
Source of data	Project site
Value(s) applied	0
Choice of data or measurement methods and procedures	The project activity builds a new reservoir, so A_{BL} is considered to be zero according to Version 20.0 of ACM0002.
Purpose of data	For calculating the power density (PD)
Any comment	

Data / Parameter	**$EF_{grid,OM,y}$**
Data unit	tCO_2/MWh
Description	Operating 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 07.0”
Source of data	Data published by DNA Viet Nam (http://www.dcc.gov.vn/van-ban-phap-luat/1058/He-so-phat-thai-luoi-dien-Viet-Nam-2018.html)
Value(s) applied	0.8795
Choice of data or measurement methods and procedures	The $EF_{grid,OM,y}$ was calculated and published by Ministry of Natural resources and Environment, Department of Climate Change on 12/03/2020
Purpose of data	For calculation of $EF_{grid,CM,y}$

Any comment	

Data / Parameter	**$EF_{grid,BM,y}$**
Data unit	tCO_2/MWh
Description	Building margin CO_2 emission factor for grid connected power generation in year *y* calculated using the lastest version "Tool to calculate the emission factor for an electricity system, version 07.0"
Source of data	Data published by DNA Viet Nam (http://www.dcc.gov.vn/van-ban-phap-luat/1058/He-so-phat-thai-luoi-dien-Viet-Nam-2018.html)
Value(s) applied	0.9465
Choice of data or measurement methods and procedures	As per the "Tool to calculate the emission factor for an electricity system, version 07.0" The **$EF_{grid,BM,y}$** was calculated and published by Ministry of Natural resources and Environment, Department of Climate Change on 12/03/2020
Purpose of data	For calculation of ***$EF_{grid,CM,y}$***
Additional comment	

Data / Parameter	**$EF_{grid,CM,y}$**
Data unit	tCO_2/MWh
Description	Combined margin Emission Factor of Vietnamese national electricity grid
Source of data	Data published by DNA Viet Nam (http://www.dcc.gov.vn/van-ban-phap-luat/1058/He-so-phat-thai-luoi-dien-Viet-Nam-2018.html)
Value(s) applied:	0.9297
Choice of data or measurement methods and procedures	As per the "Tool to calculate the emission factor for an electricity system", Version 07.0 and the $EF_{grid,OM,y}$ and $EF_{grid,BM,y}$ are calculated and published by Ministry of Natural resources and Environment, Department of Climate Change on 12/03/2020
Purpose of data	Calculation of baseline emissions
Additional comment:	Fixed for the second crediting period.

B.6.3. Ex ante calculation of emission reductions

Project emissions (PE_y)

As mentioned in Section B.6.1, the project emission for the proposed project activity is calculated as follows:

$$PE_y = PE_{HP,y} \ (tCO_2/year)$$

Where:

$PE_{HP,y}$: Emission from reservoir (tCO_2/year)

Emission from water reservoir ($PE_{HP,y}$)

The proposed project activity involves the construction of a new hydropower plant with capacity (Cap_{PJ}) of 32 MW and a new reservoir with surface (A_{PJ}) of 26.7 ha, thus A_{BL} = 0 and Cap_{BL} = 0.

The power density of the project activity is derived as follows:

$$PD = \frac{C_{apPJ} - C_{apBL}}{A_{PJ} - A_{BL}} = \frac{32 \times 10^6 - 0}{26.7 \times 10^4 - 0} = 119.85 \ (W/m^2)$$

As power density of reservoir is greater than 10 W/m^2, the project emission is zero; and the monitoring of total electricity output shall be excluded from the monitoring plan.

$$PE_{HP,y} = 0$$

Therefore,

$$PE_y = 0$$

Baseline emissions (BE_y)

Baseline emissions are calculated as follows:

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

Where:

BE_y	Baseline emissions in year *y* (tCO_2/yr).
$EG_{PJ,y}$	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year *y* (MWh/yr), and equal to 130,413 MWh/yr
$EF_{grid,CM,y}$	= 0.9297 tCO_2/MWh

Therefore:

$$BE_y = (130,413 - 0) \times 0.9297 = 121,244 \ (tCO_2/year)$$

Leakage

As it is stated in ACM0002 Version 20.0, this emission is neglected

Emission reductions (ER_y)

Emission reduction in year *y* is calculated as follows:

$$ER_y = BE_y - PE_y = 121,244 – 0 = 121,244 \ (tCO_2/year)$$

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

Table 13: Emission reduction of the project activity

Year	Baseline emissions (t CO_2e)	Project emissions (t CO_2e)	Leakage (t CO_2e)	Emission reductions (t CO_2e)
2017 (11 October to 31 December)	27,238	0	0	27,238
2018	121,244	0	0	121,244
2019	121,244	0	0	121,244
2020	121,244	0	0	121,244
2021	121,244	0	0	121,244
2022	121,244	0	0	121,244
2023	121,244	0	0	121,244
2024 (01 January to 10 October)	94,006	0	0	94,006
Total	848,708	0	0	848,708
Total number of crediting years	7 years			
Annual average over the crediting period	121,244	**0**	**0**	121,244

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

Data/Parameter	$EG_{y, export}$
Data unit	MWh

Description	Electricity supplied by the proposed hydropower plant to the national grid.
Source of data	Direct measurement at the project connection point
Value(s) applied	130,413
Measurement methods and procedures	Two-way power meters will be installed at the grid-connected point to measure the amount of electricity supplied to the grid by the proposed hydropower plant by the positive direction. The readings of electricity meter will be continuously measured and monthly recorded. The recorded data will be confirm by the joint balance sheet which will be signed by the representatives of EVN and the project owner. Electronic data will be archived within the crediting period and 2 years after the end of the crediting period.
Monitoring frequency	Continously measurement by power meter and monthly recording
QA/QC procedures	The uncertainty level of this data is low. The measurement/ monitoring equipment should be complied with national standard and technology. These equipment and systems should be calibrated and checked in accordance with relevant laws of the host country.
Purpose of data	For the determination of $EG_{facility,y}$,
Additional comment	For $EG_{facility,y}$, = $EG_{y, export}$ - $EG_{y, import, 110kV}$ - $EG_{y, import, 35kV}$

Data/Parameter	$EG_{y, import, 110kV}$
Data unit	MWh
Description	Electricity supplied by the 110kV grid to the proposed hydropower plant
Source of data	Direct measurement at the project connection point
Value(s) applied	0
Measurement methods and procedures	Two-way power meters will be installed at the grid-connected point to measure the amount of electricity supplied by the grid to the proposed hydropower plant by the reverse direction. The readings of electricity meter will be hourly measured and monthly recorded. The recorded data will be confirm by the joint balance sheet which will be signed by the representatives of EVN and the project owner. Electronic data will be archived within the crediting period and 2 years after the end of the crediting period.
Monitoring frequency	Continously measurement and at least monthly recording
QA/QC procedures	The uncertainty level of this data is low. The measurement/ monitoring equipment should be complied with national standard and technology. These equipment and systems should be calibrated and checked in accordance with relevant laws of the host country.
Purpose of data	For $EG_{facility,y}$, = $EG_{y, export}$ - $EG_{y, import, 110kV}$ - $EG_{y, import, 35kV}$
Additional comment:	

Data/Parameter	**$EG_{y, import, 35kV}$**
Data unit	MWh
Description	Electricity supplied by the 35kV grid to the proposed hydropower plant
Source of data	Direct measurement at the project connection point
Value(s) applied	0
Measurement methods and procedures	The power meters will be installed at the grid-connected point to measure the amount of electricity supplied by the 35kV grid to the proposed hydropower plant. The readings of electricity meter will be monthly recorded. Double checking by the invoice issued by EVN to ensure the consistency. Hardcopy of invoice from EVN will be archived within the crediting period and 2 years after the end of the crediting period.
Monitoring frequency	Monthly recording
QA/QC procedures	The uncertainty level of this data is low. 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 every 2 year.
Purpose of data	For $EG_{facility,y}$, = $EG_{y, export}$ - $EG_{y, import, 110kV}$ - $EG_{y, import, 35kV}$
Additional comment	

Data/Parameter	$EG_{facility,y}$
Data unit	MWh

Description	Net electricity supplied by the proposed hydropower plant to the national grid
Source of data	Calculating from $\mathbf{EG_{y,\ import,\ 35kV}}$, $\mathbf{EG_{y,\ import,\ 110kV}}$ and $EG_{y,\ export}$
Value(s) applied	130,413
Measurement methods and procedures	Calculating by subtracting $\mathbf{EG_{y,\ import,\ 35kV}}$ and $\mathbf{EG_{y,\ import,\ 110kV}}$ from $EG_{y,export}$. Data will be archived within the crediting period and 2 years after the end of the crediting period. The measurement/ monitoring equipment is calibrated and checked following the local requirements.
Monitoring frequency	Continously measurement and monthly recording
QA/QC procedures	The uncertainty level of this data is low
Purpose of data	For CERs calculation
Additional comment	

Data/Parameter	$\mathbf{A_{PJ}}$
Data unit	m^2
Description	Area of the single or multiple reservoirs measured in the surface of the water, after the implementation of the project activity, when the reservoir is full.
Source of data	Project site.
Value(s) applied	267,000
Measurement methods and procedures	Measured by the observation equipment
Monitoring frequency	Once at the beginning of each crediting period
QA/QC procedures	The uncertainty level of this data is low.
Purpose of data	For the calculation of PD
Additional comment	

Data/Parameter	$\mathbf{Cap_{PJ}}$
Data unit	W
Description	Installed capacity of the hydro power plant after the implementation of the project activity.
Source of data	Project site
Value(s) applied	32,000,000
Measurement methods and procedures	Manufacture's nameplate
Monitoring frequency	Yearly
QA/QC procedures	
Purpose of data	For the calculation of PD
Additional comment	

B.7.2. Sampling plan

Not applicable

B.7.3. Other elements of monitoring plan

According to Version 20.0 of ACM0002, there is no need to monitor leakage under this project activity.

Although the power density of the project is higher than 10 W/m^2, the surface area of the reservoir will be monitored annually by the third party. The area in the result report will be compared with the design reservoir dimensions to confirm whether or not the actual surface area substantially deviates from the design surface area.

The baseline emission factor of Vietnam National Grid ($EF_{grid,CM,y}$) is fixed ex-ante (detail in Section B.6), therefore the main data to be monitored is $EG_{facility,y}$. $EG_{facility,y}$ will be calculated according to this formula below:

$$EG_{facility,y,} = EG_{y,\ export} - EG_{y,\ import,\ 110kV} - EG_{y,\ import,\ 35kV}$$

The electricity generated from the project activity will be sold to the EVN for the complete project lifetime under a long-term PPA with EVN.

The electricity generated from the project activity before entering into the grid at the grid interconnection point will be measured by a digital kilowatt hour (kWh) meter. The power meters at the 110 kV connection point are bi-directional nature and the power meter at 35 kV point is one way measured. The metering system includes the main system and a back-up system. The back-up system will be used in case of failing of the main meter.

Data from the operating meters will be measured hourly. Additionally, monthly manual readings will be taken from the operating meters.

Monthly, EVN staff and staff of the operation division of the power plant will cross-check manual meter readings with the electronically recorded data and prepare and sign a joint balance sheet which indicates the amount of power fed into the grid within that month.

This joint balance sheet is also the basis of payment by the EVN to the project proponent. Hence, the monitoring plan is well integrated into the standard EVN procedures.

For further details see Appendix 5.

SECTION C. Start date, crediting period type and duration

C.1. Start date of project activity

16/06/2007.

This is date of signing the construction contract for main works (dam and water intake) that is the earliest contract signed by the project owner to commit for the project's expenditures.

C.2. Expected operational lifetime of project activity

40 years 0 months

C.3. Crediting period of project activity

C.3.1. Type of crediting period

Renewable
The second crediting period

C.3.2. Start date of crediting period

11/10/2017

C.3.3. Duration of crediting period

7 years 0 months

SECTION D. Environmental impacts

Pursuant to Environment Protection Law of Vietnam 2005 (Article 20) and Decree No. 80/2006/ND-CP on details of regulations and guidance on implementing some Articles of the Environment Protection Law of Vietnam 2005 issued on 09 August 2006, the Environmental Impact Assessment (EIA) for this project has been carried out. The EIA reports have already been approved by the Son La People Committee on Decision No 2580/QD-UBND dated 16 October 2006.

Furthermore, based on the impact assessments of the proposed project, the EIA report proposes that the mitigation measures shall be conducted during the construction and operation phases in order to minimize the negative impacts and ensure the long-term benefits from this project.

The surface water license is to be obtained from the Ministry of Natural Resources & Environment before operation as this is mandatory for this type of project in Viet Nam.

D.1. Analysis of environmental impacts

The environmental impacts and mitigation measures are summarized as follows.

Environmental Impacts

Impact on land

The proposed project will occupy about 86.25 ha of land for arrangement of project structures, in which, the area of long-term occupied land for reservoir and plant is 52.98 ha and the remain is temporary occupied land for construction period. Most of land is forestry land and the little remain is agricultural land. No historical culture and archaeological places exist in the project site.

No household has to be resettled under the project.

Impact on water flow

The project will create a small reservoir with an area of about 26.7 ha. The water flow of the Chien stream will be affected in quality and quantity, especially during the reservoir filling period, the stream flow will be reduced. However the reservoir regulates water level on the daily basis only but not seasonally, the impact is not considerable.

When commissioning, the reservoir will be used for the purpose of generating electricity but is also helpful to regulate water for irrigation purpose in the region. The flow regime in the reservoir area as well as downstream areas behind the powerhouse will be more stable which in turn can create favourable conditions for fishery.

So the main impact on water quality is the disposal of septic wastewater discharging from the work camps and waste oil from the truck and vehicle during the construction phase.

Impacts on ecological system

After commissioning, the forest area which is temporarily occupied will be reforested, combining with perennial and fruit-tree planting. The reservoir will adjust local climate to be more moderate. This fine weather not only has positive impacts on local people health but also has favorable impacts on surrounding flora system.

Impacts on flora

The Nam Chien 2 Hydropower Project does not cross-out any natural conservation areas, national forests or specialized forest. The main impacts on flora are:

- Vegetation will be removed at the construction sites
- Construction activities will require removal of fruit-trees.
- The temporary increase in workers to the construction site will increase the potential for illegal fuel-wood and non-timber forest product collection.

In the project location, there is only poor forest, agricultural land with low output will be occupied. So this impact is evaluated at low level.

Impacts on fauna

The main impacts on fauna are:

- There is an increased potential for illegal wildlife hunting in association with the temporary increase in workers.
- Construction activities will disturb the habitat of terrestrial animals immediately adjacent to the project site. This may result in movement of wildlife from the project vicinity to other forested areas. However, in this project's site, there is not any valuable and rare animal. So this is a minor impact.

Impacts on aquatic life

The impacts on quality of water will affect in aquatic species on quantity and quality. Besides that, the aquatic life will change from river regime to reservoir regime, which can make good condition for developing the fishery.

Impacts on local environment surrounding the construction site

During the construction period, the project's activities such as material exploitation, material transportation, mine explosion, and road construction as well as the concentration of workers will have certain negative impacts on local environments, namely local air and noise pollutions.

However, these impacts are temporary and will be terminated after commissioning the construction phase.

D.2. Socio-economic impacts

Negative impacts

Negative impacts is mainly occupied land, the proposed project will occupy about 86.25 ha. Most occupied land is most forest land and least agricultural. The occupied land will be compensated adequately under the government law.

Positive impacts

As presented in Section A.2

Mitigation measures to reduce negative impacts

Construction phase

- *Waste collection and treatment*
  - Implement regular collection and treatment of solid and liquid wastes, including the construction of a dumping area
  - Conduct reforestation in the temporarily occupied areas and strengthen the slopes to avoid erosions, after accomplishing the construction of main works.
  - Conduct awareness on the environmental protection for workers and local people.
- *Local pollution*
  - Dust removal measures will be taken such as spraying water along the roads.
  - All means/vehicles for transport of construction materials must be covered in order to minimize dust dispersion.
  - All transport equipment/vehicles and machines must have operational certifications issued by the Directorate for Standards and Quality.
- *On socio-economic impacts:*
  - Implement the compensation plan for the local impacted people according to the government law.

Operational phase

Preventive measures and reaction towards environment problems: Install monitoring equipment to monitor absorption and distortion of water rising and water quality released from the plant and propose suitable preventive measures if required.

Conclusion

The main negative impacts on environment happen due to the construction activities. However, all these impacts will be mitigated by implementing mitigation measures and then will be terminated after accomplishing the construction phase. Preventive and mitigation measures are planned to conduct during the operation period to reduce and prevent any negative impacts.

SECTION E. Local stakeholder consultation

E.1. Modalities for local stakeholder consultation

The following stakeholders have been consulted since the initial stage of forming the investment project idea:

- People Committee of Son La province (highest local authority):
    - granting the project activity by issuing the investment license No. 24121000 002 for Nam Chien 2 Hydropower project issued on 22 December 2006
    - after approving the EIA report submitted by the North-western Power Investment and Development Joint Stock Company at the Decision No. 2580/QD – UBND dated 16 October 2006, the People Committee of Son La was informed about the CDM development of the project and supported to develop this project as a CDM project activity via issuance of the official verification letter no 421/UBND-KTN which was sent to Vietnam DNA on 05 March 2007.
- Local people in the project area in Chieng Muon and Chieng San communes, Muong La district, Son La province involved directly and actively in commenting on the project and the negotiations on impacted lands and assesses due to the project activity. The inventories on the damages, and negotiations on compensation have been organised with each household until a mutual agreement has been reached with each affected household. Then the aggregated plan and budget for compensation has been validated and verified by the People's Committee of Muong La District.

Following the national CDM modalities, the local people of Chieng Muon and Chieng San communes were involved in the consultation process.

On 20 October 2006, a meeting between the project owner and the following representatives of the local people was held in order to consult local people on the social-economic and environment impacts of the proposed project in order to develop this project as a CDM activity. The attendances at the meeting are well represented for the local people, including:

- Commune's People Council: The members of Commune People Council are elected by residents in commune. So the Council opinions officially represent for opinions of the local people.
- Commune's People Committee (CPC): CPC is the lowest administration level in Vietnam administrative hierarchy. Chairman of CPC is elected by the Commune People Council, so he well represents the commune's interest.
- Commune's communist party committee secretary: this is one of the key government bodies in making development strategies at the communal level.
- Village's representative: head of village, secretary of young union, head of farmers' association, head of women's association. Such associations are NGOs and represent the interests of different groups.

Then the internal meetings of local commune were organised subsequently to announce the proposed project activity in non-technical and local language to local residents.

E.2. Summary of comments received

Comments of the representatives of local people and local authority are summarized as follows:

- All stakeholders agreed that this clean and renewable project will certainly contribute to sustainable development and environment protection in the region and in Vietnam. Therefore,

they fully support the project to develop under the CDM and recommend the project owner to complete necessary procedures to submit the project to the DNA and to the EB for registration.

- The local people can benefit from infrastructure improvement such as electricity access and clean water system at the early phase of the construction that will maintain during the operation phase.
- The local people expect that the project activity will offer new jobs to local people during both construction and operation phases and project owner will minimise negative impacts during the construction phase as committed.
- The local people expect that the lands and assesses damaged by the project will be compensated adequately.
- The project owner should implement its committed activities to minimise negative impacts during the construction phase.

E.3. Consideration of comments received

The comments of the above mentioned organisations are carefully reviewed. All of them are positive comments without any main concerns or any objections.

To address the requests from local people, the project's owner committed to:

- use local human resources for appropriate jobs in the construction and operation phases;
- seriously apply and implement mitigation activities as stated in the EIA report in order to minimise negative impacts on local environment.
- comply with existing regulation on compensations and agreements with households to implement a fair and reasonable plan. The project owner has negotiated and reached an agreement with each impacted households. Then a compensation budget and plan has been approved by the People's Committee of Muong La District at the Decision 1374/QD-UBND dated 17 October 2007. The payment to each household is made under the supervision of the Committee on Resettlement and the People's Committees of Chieng Muon and Chieng San communes.

SECTION F. Approval and authorization

The LOA for the project activity has been issued by Viet Nam DNA on 27/05/2014
(Please refer to https://cdm.unfccc.int/Projects/DB/RWTUV1267024124.41)

Appendix 1. Contact information of project participants

Organization name	**North-western Power Investment and Development Joint Stock Company**
Country	Viet Nam
Address	Chieng San commune, Muong La district, Son La province
Telephone	+ 84 22 2214 286
Fax	
E-mail	
Website	
Contact person	Vu Trong Vinh

Organization name	**Energy and Environment Consultancy Joint Stock Company**
Country	Viet Nam
Address	Floor 8. Diamond Flower Tower, 48 Le Van Luong, Hanoi
Telephone	+84 4 6666 9753
Fax	
E-mail	registration@eec.vn
Website	www.eec.vn
Contact person	Dang Hong Hanh

Organization name	**Swiss Carbon Assets Ltd**
Country	Switzerland
Address	Technoparkstr. 1, Zurich
Telephone	+ 41 43 501 35 50
Fax	+ 41 43 501 35 99
E-mail	registration@southpolecarbon.com
Website	
Contact person	Renat Heuberger

Appendix 2. Affirmation regarding public funding

No public funding from the Annex I parties is involved in the project activity

Appendix 3. Applicability of methodologies and standardized baselines

No further informationn

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

Data sources using to calculation $EF_{CM,\ grid}$ has been referred to the published data of DNA Viet Nam. The link is accessible at:

http://www.dcc.gov.vn/van-ban-phap-luat/1058/He-so-phat-thai-luoi-dien-Viet-Nam-2018.html

Appendix 5. Further background information on monitoring plan

Details of the monitoring information can be seen as follows:

A. Description of technical equipment

The metering system will be installed at the connecting point in 110kV side of the transformer station. They are digital meters bi-directly with the accuracy at least 0.5 S.

The meter type used is an electronic 3 phase and details on the technical equipment can be found in the hard copy document “Technical explanation for metering system” as developed by the project proponent and approved by EVN.

Power metering equipment should be collocated and installed according to “Technical Design for Electric Metering System” for Nam Chien 2 Hydropower Plant (HPP). Before the power metering equipment puts into operation, The North-western Power Investment and Development Joint Stock Company (project owner) and EVN should check and accept it. Each terminal block of these equipment is sealed with lead to prevent all the unallowable interferences.

This proposed project will supply the electricity to the national grid at the 110 kV voltage level. The metering system includes the main system and 2 back-up systems:

- Main system: CTC power meters located at the 110 kV feeder of Nam Chien 2 Transformer Station for measuring the total electricity export and import at 110 kV level.
- First backup system: CTP1 power meters located at the 110 kV feeder of Nam Chien 2 Transformer Station for measuring the total electricity export and import at 110 kV level Second backup system: CTP21, CTP22 power meters, in which
  - CTP21: Measure the total electricity generated by first generation unit
  - CTP22: Measure the total electricity generated by second generation unit

For measuring the Total electricity generation, there are two separately power meter located at the output of each generation output (TE1, TE2). The total electricity generation can be calculated by summing up the values of these 2 meters.

In addition, there is also a metering system (M1) for measuring the electricity imported from 35 kV grid for emergency case.

The following figure mentions the position of installed meter equipment as the connected point.

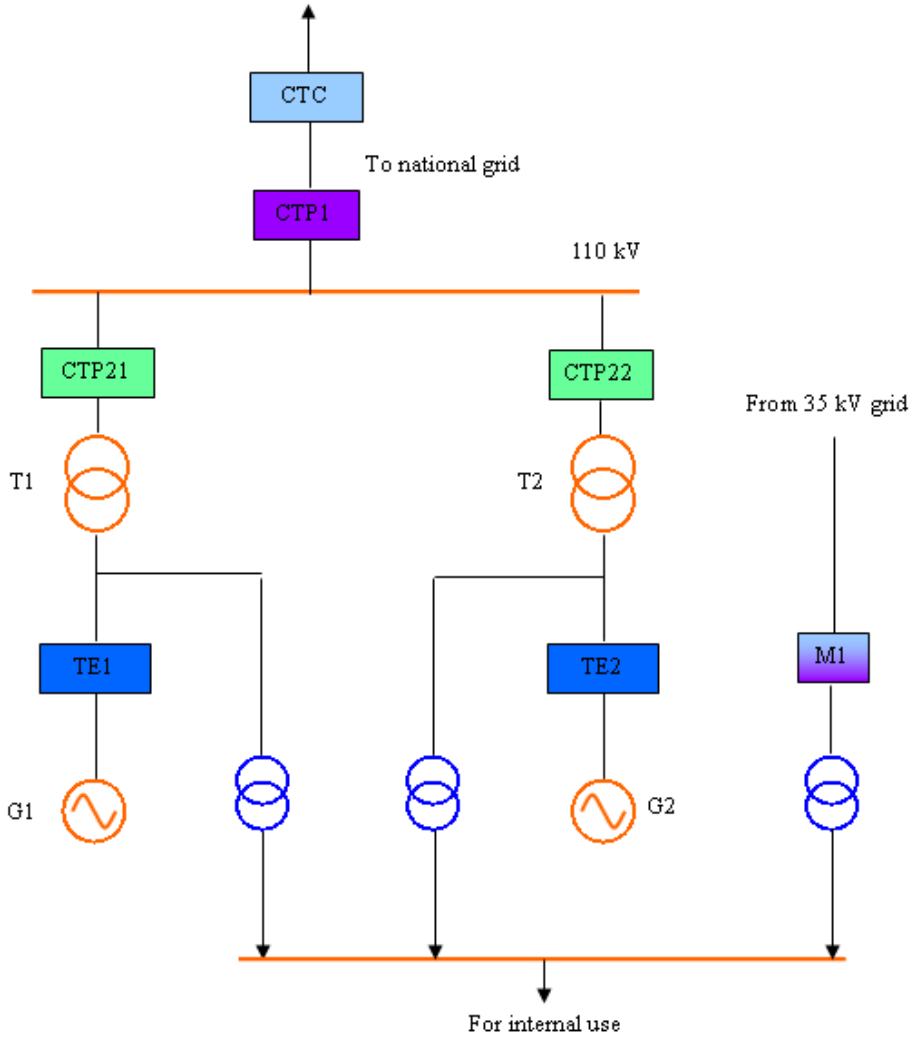

Figure 4: Position of installed meter equipment as the connected point

B. Monitoring organization

The structure of the monitoring group is as follows:

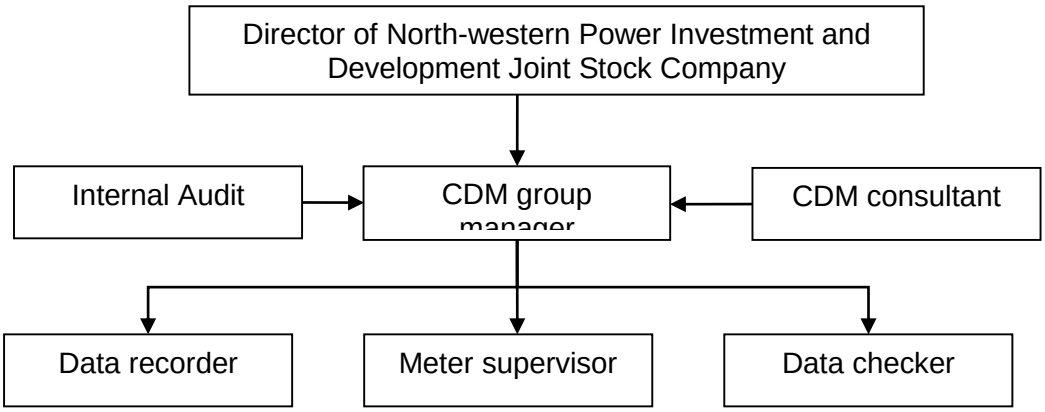

Figure 5: Structure of the monitoring group

The responsibilities of each person involved are elaborated as follows:

Table 14. Group members and their responsibilities

Person	Responsibility
Director of the North-western Power Investment and Development Joint Stock Company	Check and sign the monitoring report annually
CDM group manager	Managing the whole CDM business of Nam Chien 2 power plant, guiding and supervising data recorder after trained by CDM consultant.
CDM consultant (VNEEC)	Providing CDM group manager training and technical support about CDM monitoring plan.
Internal auditor	Check the monitoring procedure at least once in a year
Data recorder	Collecting and recording data every month.
Meter supervisor	Checking power meter periodically according to relevant regulation.
Data checker	Double checking the collected data measured by power meter.

C. Monitoring procedure

The steps of monitoring the electricity supplied to the grid and the electricity imported from grid and consumed by the proposed project are as follows:

(1) Persons in charge of data record and meter supervisor from Nam Chien 2 power plant together with staff from EVN shall read and collect data from main power meters and backup power meters at the end of every month, the result or the joint balance sheet will be signed by both parties and kept respectively;

(2) The data from the backup meters will be cross checked with the data from main power meter. Data will be filled in the form provided by VNEEC.

(3) The Project Owner provides electricity sales invoice to EVN, and keeps the copy of invoice.

(4) EVN provided the invoice to the Project Owner (if available according to the power meter M1).

(5) The Project Owner shall hire the assigned department of Department of Natural Resources and Environment or other third party for measuring the surface area of reservoir at the normal water level yearly.

(6) The Project Owner provides the record of main, backup power meters, surface area of reservoir and copy of invoices to the verifier of DOE.

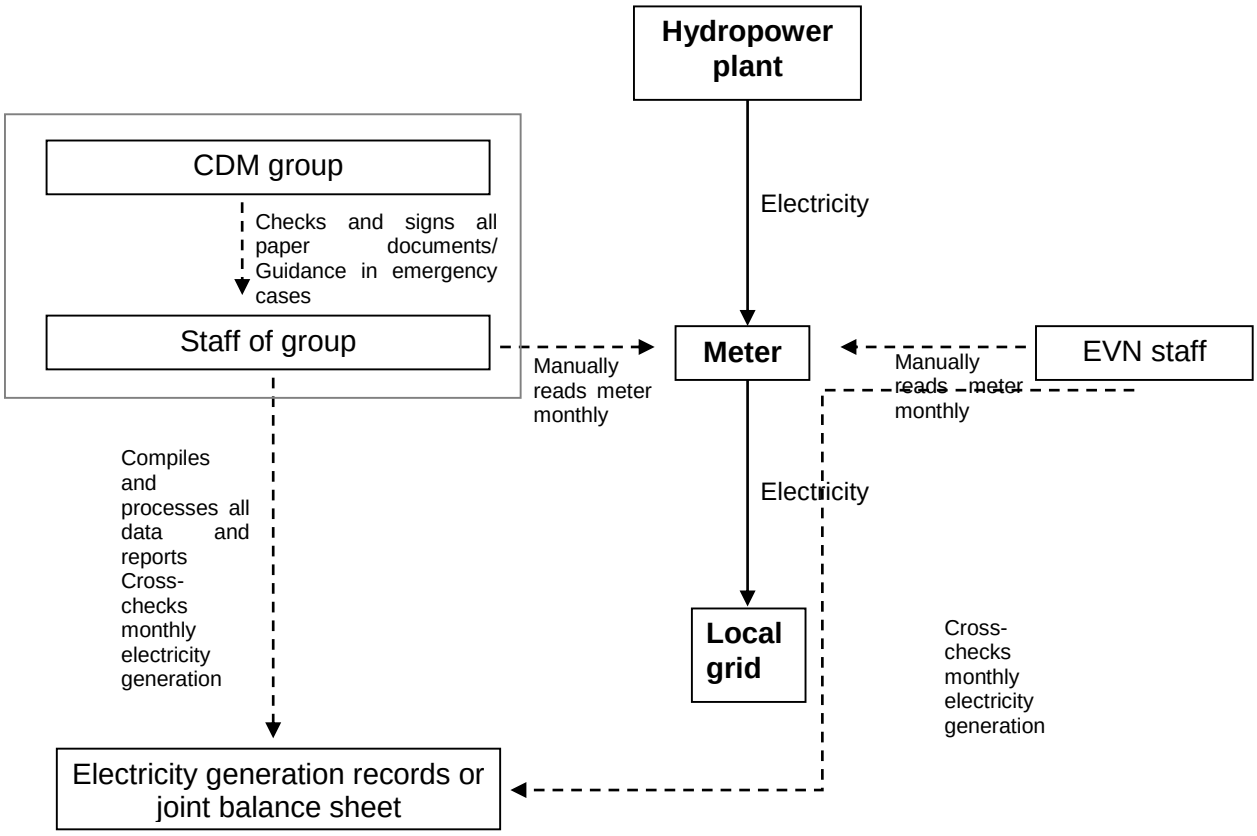

Figure 6: Monitoring process

D. Calibration of metering equipment

The power meters will be calibrated and verified pursuant to relevant national standards. The calibration standard, validity period and calibration frequency are listed in the below table:

Table 15: Calibration standard of power meters

No.	Decision	Calibration standard	Validity period	Calibration frequency
1	Decision No. 228/QD-TDC on "promulgating metrological technical standard of Viet Nam" issued by Directorate for Standards, Metrology and Quality under Ministry of Science and Technology of the Socialist Republic of Viet Nam on 06/02/2013	DLVN 39:2012 - "Power meters - Verification and calibration procedures"	06/03/2013 – 31/12/2019	Every two years
2	Decision No. 2739/QD-TDC on "promulgating metrological technical standard of Viet Nam" issued by Directorate for Standards, Metrology and Quality under Ministry of Science and Technology of the Socialist Republic of Viet Nam on 23/12/2019	DLVN 39:2019 - "Power meters - Verification and calibration procedures"	01/01/2020 – now	Every three years

The calibration will be conducted by the authorized third party. After every calibration, the meters will be sealed so that no illegal interference is possible.

E. Data recording and archiving procedures

- The CDM group appointed by The Project Owner shall keep monitored data in electronic archives at the end of every month. Paper documents should be stored in electronic format. Electronic documents should be printed out and kept.
- The Project Owner shall keep the copy of electricity sales/purchase invoices (the original electricity sales/purchase invoices shall be kept by Finance Department of The project owner).
- In order to help verifiers obtain documents and information related to the emission reduction of the proposed project, the project owner shall prepare an index of the data documents and monitoring report.
- All the data and information in the form of paper documents shall be archived by the CDM group, with at least one copy backup for each datum.

All the data shall be kept for 2 years after the crediting period.

F. Emergency procedures

In case of any unforeseen event that is not covered under this monitoring plan, staff of the CDM group shall inform the manager and the director. The manager and director are then responsible to ensure that the cause for the unforeseen event is detected, the event is remedied and for the period of time in which the unforeseen event has occurred uncertainty in data gathered is limited as much as possible.

In the case the error of main meter exceeds allowed level, the backup meter will be used to measure output of electricity exporting to grid.

In case of both main and back-up metering systems are in failure, the project owner and the power company (EVN) will jointly calculate a conservative estimate of power supplied to the grid. The assumptions used to estimate net electricity supply to the grid will be signed by both a representative of the project owner as well as a representative of the power company (EVN).

G. Training

Before the start of the project activity VNEEC will in close collaboration with the director of the power plant to develop a training manual and training course for the staff of CDM Group that will clearly lay out rules and procedures for all activities related to metering, data recording and processing, data archiving and preparation of monitoring reports.

Appendix 6. Summary report of comments received from local stakeholders

Not applicable

Appendix 7. Summary of post-registration changes

Not applicable

- - - - -

Document information

Version	*Date*	*Description*
11.0	31 May 2019	Revision to: • Ensure consistency with version 02.0 of the "CDM project standard for project activities" (CDM-EB93-A04-STAN); • Make editorial improvements.
10.1	28 June 2017	Revision to make editorial improvement.
10.0	7 June 2017	Revision to: • Improve consistency with the "CDM project standard for project activities" and with the PoA-DD and CPA-DD forms; • Make editorial improvement.
09.0	24 May 2017	Revision to: • Ensure consistency with the "CDM project standard for project activities" (CDM-EB93-A04-STAN) (version 01.0); • Incorporate the "Project design document form for small-scale CDM project activities" (CDM-SSC-PDD-FORM); • Make editorial improvement.
08.0	22 July 2016	EB 90, Annex 1 Revision to include provisions related to automatically additional project activities.
07.0	15 April 2016	Revision to ensure consistency with the "Standard: Applicability of sectoral scopes" (CDM-EB88-A04-STAN) (version 01.0).
06.0	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.
05.0	25 June 2014	Revision to: • Include the Attachment: Instructions for filling out the project design document form for CDM project activities (these instructions supersede the "Guidelines for completing the project design document form" (Version 01.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for the application of the methodology (ies) to the project activity in B.7.4 and Appendix 1; • Change the reference number from F-CDM-PDD to CDM-PDD-FORM; • Make editorial improvement.
04.1	11 April 2012	Editorial revision to change version 02 line in history box from Annex 06 to Annex 06b.

Version	*Date*	*Description*
04.0	13 March 2012	Revision required to ensure consistency with the “Guidelines for completing the project design document form for CDM project activities” (EB 66, Annex 8).
03.0	26 July 2006	EB 25, Annex 15
02.0	14 June 2004	EB 14, Annex 06b
01.0	03 August 2002	EB 05, Paragraph 12 Initial adoption.

Decision Class: Regulatory
Document Type: Form
Business Function: Registration
Keywords: project activities, project design document