



**Monitoring report form for CDM project activity
(Version 09.0)**

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

MONITORING REPORT

Title of the project activity	Nam Chien 2 Hydropower Project		
UNFCCC reference number of the project activity	3442		
Version number of the PDD applicable to this monitoring report	04.2		
Version number of this monitoring report	1.0		
Completion date of this monitoring report	22/11/2021		
Monitoring period number	1st monitoring period under 2 nd crediting period		
Duration of this monitoring period	11/10/2017 – 31/12/2020		
Monitoring report number for this monitoring period	1		
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)		
Amount of GHG emission reductions or net anthropogenic GHG removals achieved by the project activity in this monitoring period	Amount achieved before 1 January 2013	Amount achieved from 1 January 2013 until 31 December 2020	Amount achieved from 1 January 2021
	Not applicable	343,811 tCO ₂ e	Not applicable
Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the PDD	391,302 tCO ₂ e		

SECTION A. Description of project activity

A.1. General description of project activity

Nam Chien 2 Hydropower Project is located in Chieng Muon and Chieng San communes, Muong La district, Son La province, Vietnam. The installed capacity and estimated annual gross power generation of Nam Chien 2 Hydropower Project is 32 MW and 131,730 MWh, respectively.

The electricity in Viet Nam is generated mainly from fossil fuel sources and is solely distributed to consumers via the unique national electricity grid. The project's purpose is to generate and supply renewable electricity to the national grid via the Power Purchase Agreement (PPA) signed with Electricity of Vietnam (EVN). The net electricity generated from this project (annual estimated volume is 130,413 MWh) is supplied to the national grid.

The project activity involves the construction of a dam, intake, tunnel, pressurized well, penstock, power house with two-units and a discharge channel in order to convert potential flowing energy from the stream into clean electrical energy

The construction of Nam Chien 2 Hydropower Plant started in June 2007 and it was completed in October 2009. On 17/10/2009, the plant started to supply electricity to the national grid. Nam Chien 2 Hydropower Plant was registered as CDM project on 11/10/2010 with the PDD version 2.2 dated 25/01/2010. The first crediting period was from 11/10/2010 to 10/10/2017. The second crediting period from 11/10/2017 to 10/10/2024 has been renewed on 25/09/2020 with PDD version 04.2 dated 24/06/2020.

The implementation of the project is listed in the table below

Table 1: The list of key events of Nam Chien 2 Hydropower Plant

Date	Key events
06/2007	Start of construction
17/10/2009	Commissioning date
11/10/2010	Registration date
11/10/2010 – 10/10/2017	The first crediting period
11/10/2017 – 10/10/2024	The second crediting period
25/09/2020	Renewal date for 2 nd crediting period
11/10/2017 – 31/12/2020	1 st monitoring period under 2 nd crediting period

The project activity generates renewable power with negligible greenhouse gas (GHG) emissions, which displaces part of the electricity otherwise supplied by fossil fuel fired power plants. Thus, this project activity generates GHG emission reductions up to a total expected CO₂ emission reduction of 848,708 tCO_{2e} over the second crediting period of 7 years.

A.2. Location of project activity

The Nam Chien 2 Hydropower Plant is located on Chien Stream in Chieng Muon and Chieng Sang communes, Muong La district, Son La province, Vietnam. Chien Stream is the first branch of Da River.

The geographic coordination of the plant:

Northern latitude: 21° 30' 36"
 Eastern longitude: 104° 06' 16"

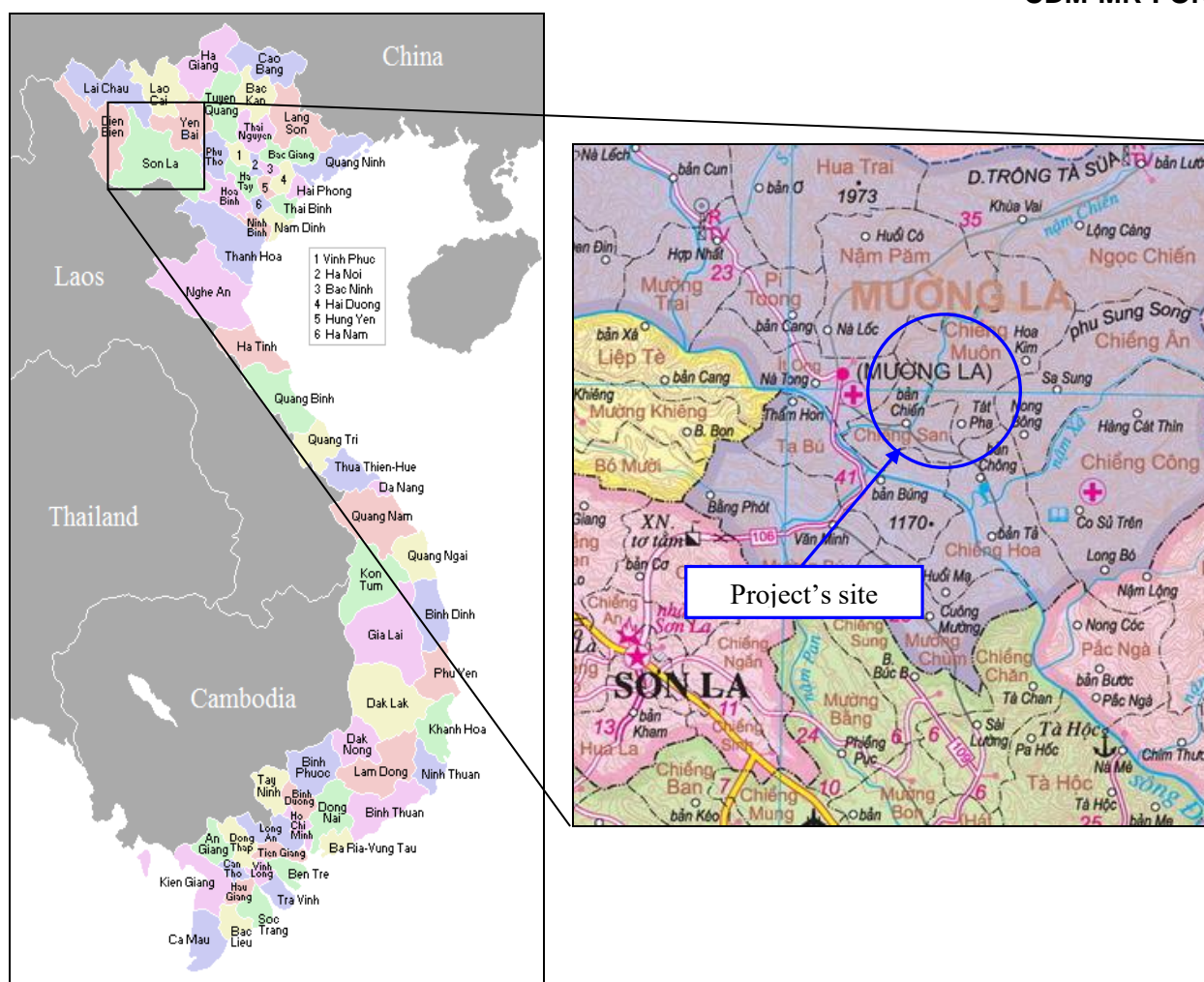


Figure 1: Map of the location of the project activity

A.3. 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 Party)	North-western Power Investment and Development Joint Stock Company	No
Viet Nam (host Party)	Energy and Environment Consultancy Joint Stock Company	No
Switzerland	Swiss Carbon Assets Ltd.	No

A.4. References to applied methodologies and standardized baselines

Applied methodology:

- ACM0002: Grid-connected electricity generation from renewable sources - Version 20.0 (https://cdm.unfccc.int/filestorage/A/G/O/AG07ZJQ3EXD42LT5YV9HR16M8KINPO/EB105repan03_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
(<https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-11-v3.0.1.pdf>)

Standardized baseline:

Not applicable

A.5. Crediting period type and duration

Type of crediting period: Renewable

Duration of the second crediting period corresponding to this monitoring period: from 11/10/2017 to 10/10/2024.

SECTION B. Implementation of project activity

B.1. Description of implemented project activity

1. Description of the installed technology, technical process and equipment

The project involves the construction of a dam, intake, tunnel, pressurized well, penstock, power house with 2 units, a discharge channel and installation of new hydro turbines and generators in order to convert potential energy available in the river flow into electrical energy.

Figure 2 shows the layout of the project.

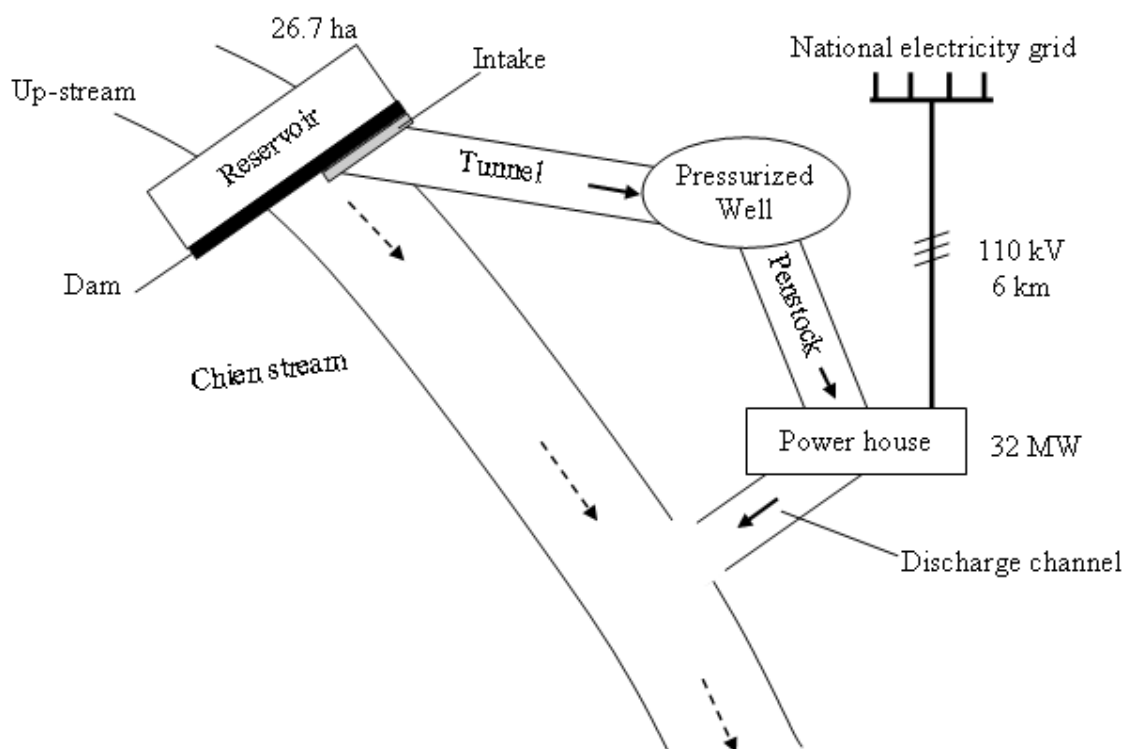


Figure 2: Project lay-out

The main technical parameters of the Nam Chien 2 Hydropower Plant are shown in the table below:

Table 2: Main technical parameters of the proposed project activity¹

Main parameter	Unit	Value
1. Turbine		
• Type	--	Francis with vertical shaft
• Rated net head	m	82.3
• Number of turbines	set	2
• Turbine discharge	m ³ /s	22.36
• Capacity	MW	16.49
2. Generator		
• Number	set	2
• Type	--	Synchronous, 3 phases, vertical axis
• Rated voltage	kV	11
• Rated capacity	MW	16
3. Transformer		
• Number	set	2
• Type	--	3 phases, 2 windings
• Rated capacity	MVA	20
• Primary voltage	kV	11
• Secondary voltage	kV	115

2. Information on the implementation status of the project activity during this monitoring period

Nam Chien 2 Hydropower Plant has started operating on 17/10/2009 and the project has been registered as the CDM project by UNFCCC on 11/10/2010.

In this monitoring period from 11/10/2017 – 31/12/2020, Nam Chien 2 Hydropower Plant has been in safe and stable operation state.

3. Information on any request for prior approval by the Board of changes to the registered CDM project activity

Not applicable

B.2. Post-registration changes

B.2.1. Temporary deviations from the registered monitoring plan, applied methodologies, standardized baselines or other methodological regulatory documents

Not applicable

B.2.2. Corrections

Not applicable

B.2.3. Changes to the start date of the crediting period

Not applicable

B.2.4. Inclusion of monitoring plan

Not applicable

¹ The Equipment Supply Contract No.11-HDTB/2007 signed between the Project Owner and Flovel Mecamidi Energy Private Limited on 01 November 2007.

B.2.5. Permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other methodological regulatory documents

Permanent changes to the registered monitoring plan:

The 35 kV transmission line is no longer in use since commissioning date of Nam Chien 2 hydropower plant on 17/10/2009, as under the letter from Vietnam Electricity Electric Power Trading Company dated 24/11/2009 which states why 35 kV is not required to use. Therefore, the permanent change to the registered monitoring plan has been applied to remove the 35kV line, 35 kV power meter and monitoring parameter $EG_{y,import,35kV}$ from the monitoring plan. This change has been approved by EB on 07/01/2021².

B.2.6. Changes to project design

Not applicable

B.2.7. Changes specific to afforestation or reforestation project activity

Not applicable

SECTION C. Description of monitoring system

Monitoring equipment:

The following diagram indicates the power meter location:

² <https://cdm.unfccc.int/Projects/DB/RWTUV1267024124.41/history>

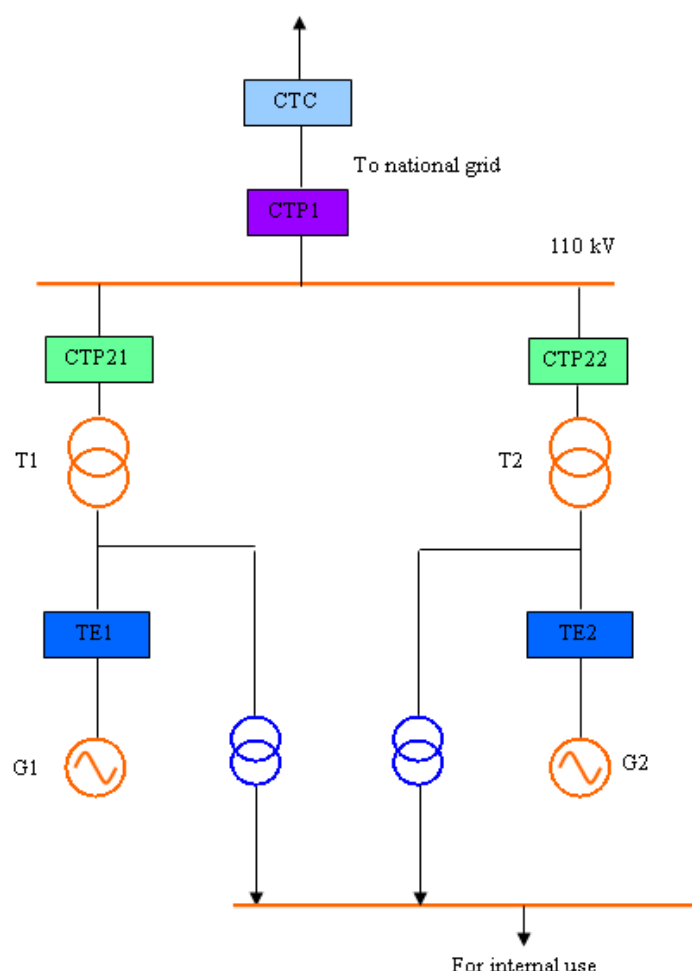


Figure 3: Meter diagram

Where:

- CTC : Main power meter
- CTP1 : The first backup power meter
- CTP21 : The second backup meter measures electricity generated by the first generation unit
- CTP22 : The second backup meter measures electricity generated by the second generation unit.
- T1, T2 : Transformers
- G1, G2 : Generators
- TE1, TE2 : Generator power meters measure total electricity generated by the plant (including the electricity supplied to grid and the electricity supplied to internal use). These meters are used to operation purposes only, these are not be used to determine electricity exported/imported between EVN and the PO. The power density of Nam Chien 2 HPP is higher than 10 W/m² so no need to monitor these meters.

The details of power meters are as follow:

Table 3: Monitoring equipment

Power meter	Type	Position	Function	Record frequency	Calibration party and frequency

Main power meter: CTC (Bay 171)	Elster A1700	110kV Nam Chien 2 Transformer Station	Amount of electricity exported by Nam Chien 2 Hydropower Plant and amount of electricity consumed by the plant when generators stop operation	At 24:00 on the last day of each month	Third party, every two years
The first backup power meter: CTP1 (Bay 171)	Elster A1700	110kV Nam Chien 2 Transformer Station	Amount of electricity exported by Nam Chien 2 Hydropower Plant and amount of electricity consumed by the plant when generators stop operation	At 24:00 on the last day of each month	Third party, every two years
The second backup power meter: CTP21 (Bay 131)	Elster A1700	110kV output of the first transformer	Amount of electricity exported by the first generator unit and amount of electricity consumed from the grid when generators stop operation	At 24:00 on the last day of each month	Third party, every two years
The second backup power meter: CTP22 (Bay 132)	Elster A1700	110kV output of the second transformer	Amount of electricity exported by the second generator unit and amount of electricity consumed from the grid when generators stop operation	At 24:00 on the last day of each month	Third party, every two years

The power meters of Nam Chien 2 Hydropower Plant have been installed and calibrated by Northern Electrical Testing Company (belongs to EVN) and then sealed up to prevent any illegal interference.

Monitoring Procedure:

The project owner and VNEEC have developed and implemented the monitoring procedure formalized as a monitoring manual. The manual is used by monitoring staff as a reference, for data collection, supervision, verification and records.

1. Data collection procedures

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:

- The electricity supplied by the project to the grid is automatically monitored by the meter systems (main and backup). The data is measured continuously.
- Data recorder, meter supervisor from Nam Chien 2 Hydropower Plant with staff from EVN should read and collect data from main power meter on the first day of every month, the result is signed by both parties and kept in records.
- Project Owner provides electricity sales invoice to EVN and keeps the copy of invoices.
- Project Owner provides the record of main, backup power meter and copy of invoices to DOE for verification.

2. Organizational structure, roles and responsibilities of personnel.

Project Owner has setup a special CDM group to take charge of data collection, supervision, recording and verification. CDM group director is trained by CDM consultation organizations and gets technical support from CDM consultation organizations. The structure of monitoring group is as follows:

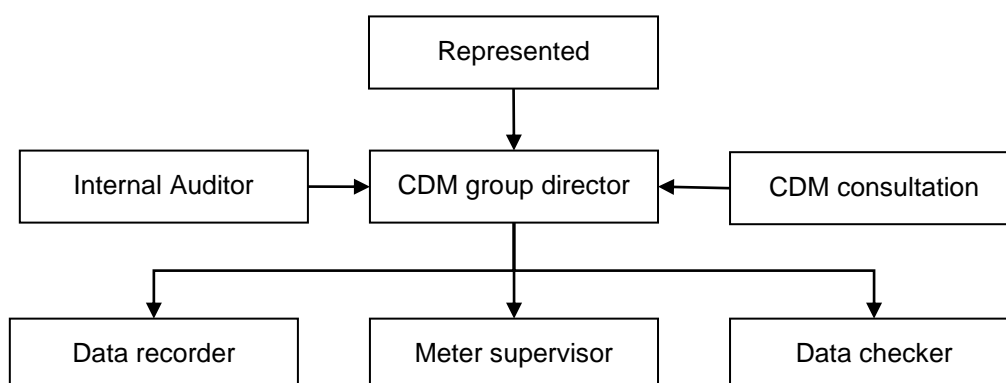


Figure 4: Structure of monitoring group

The details of members in CDM group are as follow:

Table 4: Group members and their responsibilities

Function	Name	Job Title	Responsibility
Represented	Vu Trong Vinh	General Director of North-western Power Investment and Development Joint Stock Company	Legal representative of North-western Power Investment and Development Joint Stock Company
CDM group leader	Truong Viet Ha	Director of Nam Chien 2 Hydropower Plant	Managing the whole CDM business of Nam Chien 2 Hydropower Plant, guiding and supervising data recorder after trained by CDM consultation.
	Bui Cong Sau		
Internal auditor	Nguyen Duc Thang	Deputy Director of Nam Chien 2 Hydropower Plant	Check the monitoring procedure.
	Nguyen Van Tuan		
	Hoang Van Thu		
CDM consultation	Nguyen Tien Hai	VNEEC - Technical Manager	Providing CDM group director training and technical support about CDM monitoring plan.
Data recorder	Le Thanh Son	Staff member	Collecting and recording data every month.
	Tran Quoc Thinh	Staff member	
	Le Van Hung	Staff member	
	Nguyen Huu Thuong	Staff member	
Meter supervisor	Ha Tran Phuong	Shift leader	Checking power meter periodically according to relevant regulation.
	Bui Van Quan	Team leader	
	Bui Duy Hoat	Team leader	
	Nguyen Vi Trong	Team leader	
	Bui Huy Hao	Team leader	
Data checker	Nguyen Minh Ngoc	Staff member	Double checking the collected data measured by power meter.
	Pham Thi Thu	Staff member	
	Do Duc Trong	Staff member	
	Le Van Nho	Staff member	
	Pham Duc Giang	Staff member	

3. Emergency procedures for the monitoring system.

The main and backup power meters are used in order to record the electricity generated to the grid. These power meters are calibrated at least once every two years. Monthly, the representatives of EVN and the Project Owner check the result in both main and backup power meters.

The discrepancy between the main power meter and the backup one is determined. If the discrepancy is larger than the specific error value allowed, then the EVN and Project Owner would follow the steps for dealing with inaccuracy of the meters as described below in order to determine the amount of the electricity supplied to the grid

- Conduct calibration on power meters by qualified party to judge which one is in trouble.
- 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).

Emergency case.

During the monitoring period from 11/10/2017 to 31/12/2020, the project activity was in safe and stable operation state. There was no emergency case occurred in this monitoring period.

4. Quality Assurance and Quality Control

4.1 Training

All staffs working for CDM group are trained and the training records are kept. Through the training, the staffs receive the necessary knowledge of the installation, examination and maintenance of electricity and machine; being familiar with the operating principle and basic structure of equipment; masters the cause and solution of common problems and the basic knowledge of CDM and monitoring requirements.

During the operating period, Project Owner holds irregularly scheduled training to improve staff's professional level.

The new staff is not allowed to operate or maintain the equipment until they pass the exams and master the knowledge and skills after training mentioned above.

CDM monitoring training contents:

- Monitoring organization
- File system
- Connection point
- Monitoring parameters
- Monitoring method
- Guideline against dispute resolution
- Data management
- Calibration and maintenance
- Monitoring report
- Internal audit
- Management review

History of CDM training in Nam Chien 2 Hydropower Plant:

- VNEEC has cooperated with Nam Chien 2 Hydropower Plant to establish CDM group which has full responsibility for CDM monitoring as well as data management. The training course has been held on 17/08/2010 and it has provided Nam Chien 2 staff all necessary information to monitor plant.
- On 23/05/2011 and 30/12/2011, CDM group leader (Director of Nam Chien 2 Hydropower Plant) has conducted the meeting for CDM monitoring training. The purpose of meeting is to improve the quality of monitoring and operating. CDM group members including group leader, internal audit, shift leader, monitoring and operating staff have attended the meeting.
- After three training courses, all staffs have got necessary knowledge and skills to operate and monitor Nam Chien 2 HPP according to CDM regulations, no further training is required.

4.2. Data Management

- The CDM group appointed by Nam Chien 2 Hydropower Plant keeps monitored data in electronic archives at the end of every month. Paper documents are stored in electronic format and copied by CD. Electronic documents are printed out and archived.
- Nam Chien 2 Hydropower Plant archives the copy of electricity sales/purchase invoice (the original electricity sales/purchase invoice will be kept by Project Owner).
- All the data and information in the form of paper documents are archived by the CDM group, with at least one copy backup for each datum.
- All of the data should be kept for 2 years after the crediting period.

4.3 Calibration and Maintenance

Project Owner has signed an agreement with EVN that stipulates quality control process of measurement and calibration in order to ensure measurement precision. Periodical power meter inspection and on-site check should be implemented according to the relevant guidance of the EVN. After inspection and on-site check, power meters must be sealed after examination and identification by both of Project Owner and EVN, either party cannot remove the seal or modify any power meter when the other party (or its authorized representative) is absent.

➤ ***History of power meters of Nam Chien 2 Hydropower Plant in the operating period (11/10/2017 – 31/12/2020)***

Detailed information of each power meter can be found in below table:

**Table 5: Details of main and back-up power meters (Bay 171)
(CTC and CTP1)**

Technical details	Main power meter CTC	First backup power meter CTP1
<i>Operating period</i>	<i>11/10/2017 – 13/09/2018</i>	<i>11/10/2017 – 13/09/2018</i>
Serial number	09027365	08116921
Model	Elster – A1700	Elster – A1700
Accuracy	0.2s	0.5s
Status during verification period	Good	Good
Manufacturer	UK	UK
Date of 2017 calibration	20/07/2017	20/07/2017
Date of 2018 calibration	04/07/2018	04/07/2018
<i>Operation period</i>	<i>13/09/2018 – 31/12/2020</i>	<i>13/09/2018 – 31/12/2020</i>
Serial number	15014032	18055228
Model	Elster – A1700	Elster – A1700
Accuracy	0.2s	0.5s

Status during verification period	Good	Good
Date of 2018 calibration	13/09/2018	13/09/2018
Date of 2019 calibration	15/05/2019	15/05/2019
Date of 2020 calibration	19/05/2020	19/05/2020
2020 calibration validity	18/05/2022	18/05/2022
Calibration entity	Northern Electrical Testing Company	Northern Electrical Testing Company
Calibration frequency regulated by the national authority	At least every 3 years	At least every 3 years

Table 6: Technical details of the second backup power meters (Bay 131 and 132) (CTP21 and CTP22)

Technical details	Second backup power meter (Bay 131) – CTP21	Second backup power meter (Bay 132) – CTP22
<i>Operating period</i>	<i>11/10/2017 – 13/09/2018</i>	<i>11/10/2017 – 13/09/2018</i>
Serial number	08116827	08116861
Model	Elster – A1700	Elster – A1700
Accuracy	0.2s	0.5s
Status during verification period	Good	Good
Manufacturer	UK	UK
Date of 2017 calibration	20/07/2017	20/07/2017
Date of 2018 calibration	04/07/2018	04/07/2018
<i>Operation period</i>	<i>13/09/2018 – 31/12/2020</i>	<i>13/09/2018 – 31/12/2020</i>
Serial number	18055232	18055227
Model	Elster – A1700	Elster – A1700
Accuracy	0.2s	0.5s
Status during verification period	Good	Good
Date of 2018 calibration	13/09/2018	13/09/2018
Date of 2019 calibration	15/05/2019	15/05/2019
Date of 2020 calibration	19/05/2020	19/05/2020
2020 calibration validity	18/05/2022	18/05/2022
Calibration entity	Northern Electrical Testing Company	Northern Electrical Testing Company
Calibration frequency regulated by the national authority	At least every 3 years	At least every 3 years

4.5. Management Review

Management review of the project is made at least once a year to review monitoring and internal audits. The purpose of the management review is to improve performance of quality management. As concluded in the management review reports, during this monitoring period, Nam Chien 2 hydropower plant is in good operation state. The quality of operation and monitoring of staffs is improved. All the staff followed the operation guidance of hydropower plant and CDM monitoring manual.

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante

Data/Parameter	Cap _{BL}
Unit	MW
Description	Installed capacity of hydropower plant before the implementation of the project activity.
Source of data	This is a green-field project. This value does not exist prior to the implementation of the project activity.
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 zero according to version 20.0 of ACM0002.
Purpose of data/parameter	For calculating the power density (PD)
Additional comments	

Data/Parameter	A _{BL}
Unit	m ²
Description	Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full. 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/parameter	For calculating the power density (PD)
Additional comments	

Data/Parameter	EF _{grid,OM,y}
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/parameter	For calculation of EF _{grid,CM,y}
Additional comments	

Data/Parameter	EF _{grid,BM,y}
Unit	tCO ₂ /MWh
Description	Building margin CO ₂ emission factor for grid connected power generation in year y calculated using the latest 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/parameter	For calculation of $EF_{grid,CM,y}$
Additional comments	

Data/Parameter	$EF_{grid,CM,y}$
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/parameter	Calculation of baseline emissions
Additional comments	Fixed for the second crediting period.

D.2. Data and parameters monitored

Data/Parameter	$EG_{y, export}$
Unit	MWh
Description	Electricity supplied by the proposed hydropower plant to the national grid.
Measured/calculated/default	Measured
Source of data	Direct measurement at the project connection point
Value(s) of monitored parameter	370,385
Monitoring equipment	Two-way power meters as mentioned in Section C, Item 4.3
Measuring/reading/recording frequency	Continuously measurement by power meters and monthly recording
Calculation method (if applicable)	Not applicable
QA/QC procedures	The uncertainty level of this data is low. The measurement/ monitoring equipment are complied with national standard and technology. These equipment and systems are calibrated and checked in accordance with relevant laws of the host country.
Purpose of data/parameter	For the determination of $EG_{facility,y}$.
Additional comments	

Data/Parameter	$EG_{y,import,110kV}$
Unit	MWh
Description	Electricity supplied by the 110kV grid to the proposed hydropower plant

Measured/calculated/default	Measured
Source of data	Direct measurement at the connection point
Value(s) of monitored parameter	576
Monitoring equipment	Two-way power meters as mentioned in Section C, Item 4.3
Measuring/reading/recording frequency	Continuously measurement by power meters and monthly recording
Calculation method (if applicable)	Not applicable
QA/QC procedures	The uncertainty level of this data is low. The measurement/ monitoring equipment are complied with national standard and technology. These equipment and systems are calibrated and checked in accordance with relevant laws of the host country.
Purpose of data/parameter	For the determination of $EG_{facility,y}$.
Additional comments	

Data/Parameter	$EG_{facility,y}$
Unit	MWh
Description	Net electricity supplied by the proposed hydropower plant to the national grid
Measured/calculated/default	Calculated
Source of data	Calculating from $EG_{y, import, 110kV}$ and $EG_{y, export}$ $EG_{facility,y} = EG_{y, export} - EG_{y, import, 110kV}$
Value(s) of monitored parameter	369,809
Monitoring equipment	Two-way power meters as mentioned in Section C, Item 4.3
Measuring/reading/recording frequency	Monthly recording
Calculation method (if applicable)	Calculating by subtracting $EG_{y, import, 110kV}$ from $EG_{y, export}$.
QA/QC procedures	The uncertainty level of this data is low. The measurement/ monitoring equipment are complied with national standard and technology. These equipment and systems are calibrated and checked in accordance with relevant laws of the host country.
Purpose of data/parameter	For the calculation of baseline emissions
Additional comments	

Data/Parameter	A_{PJ}
Unit	m ²
Description	Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full.
Measured/calculated/default	Measured
Source of data	Direct measurement at the project site
Value(s) of monitored parameter	384,000
Monitoring equipment	Measured by the third party
Measuring/reading/recording frequency	Once at the beginning of each crediting period

Calculation method (if applicable)	Measured from topographical surveys, maps, satellite pictures
QA/QC procedures	The uncertainty level of this data is low. The data recorded are archived and stored during and at least two years after the crediting period
Purpose of data/parameter	For the calculation of PD
Additional comments	

Data/Parameter	Cap_{PJ}
Unit	W
Description	Installed capacity of the hydro power plant after the implementation of the project activity.
Measured/calculated/default	Measured
Source of data	Project site
Value(s) of monitored parameter	32,000,000
Monitoring equipment	Manufacture's nameplate
Measuring/reading/recording frequency	Yearly
Calculation method (if applicable)	Not applicable
QA/QC procedures	-
Purpose of data/parameter	For the calculation of PD
Additional comments	

D.3. Implementation of sampling plan

Not applicable

SECTION E. Calculation of emission reductions or net anthropogenic removals

E.1. Calculation of baseline emissions or baseline net removals

Baseline emissions include only CO₂ emissions from electricity generation by fossil fuel fired power that are displaced due to the project activity. It is calculated as follows:

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

Where:

BE _y	Baseline emissions in the monitoring period (tCO ₂ e)
EG _{facility, y}	Quantity of net electricity generation supplied by Nam Chien 2 Hydropower Plant to the grid during the monitoring period (MWh)
EF _{grid, CM, y}	Combined margin CO ₂ emission factor of the national electricity grid in year y (tCO ₂ /MWh)

In this monitoring period (01/10/2017 - 31/12/2020), Nam Chien 2 Hydropower Project has supplied to the grid a total net electricity of EG_{facility, y} = 369,809 MWh.

The baseline emission factor EF_{grid, CM, y} = 0.9297 tCO₂e/MWh.

The baseline emission (BE_y) for the monitoring period is calculated as follows:

$$BE_y = 369,809 \times 0.9297 = 343,811 \text{ tCO}_2\text{e (round down)}$$

E.2. Calculation of project emissions or actual net removals

Emission from reservoir:

For hydropower project activity that results in new 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.

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

According to the results of measuring reservoir area which was measured by the third party, the reservoir area is 38.4 ha.

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

$$PD_{2011} = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}} = \frac{32 \times 10^6 - 0}{38.4 \times 10^4 - 0} = 83.33 \text{ W} / m^2$$

As the power densities of the project plant are greater than $10 \text{ W}/m^2$, thus the project emission is zero:

$$PE_y = 0.$$

E.3. Calculation of leakage emissions

According to ACM0002 Version 20.0, this emission is neglected.

E.4. Calculation of emission reductions or net anthropogenic removals

	Baseline GHG emissions or baseline net GHG removals (t CO ₂ e)	Project GHG emissions or actual net GHG removals (t CO ₂ e)	Leakage GHG emissions (t CO ₂ e)	GHG emission reductions or net anthropogenic GHG removals (t CO ₂ e)			
				Before 01/01/2013	From 01/01/2013 until 31/12/2020	From 01/01/2021	Total amount
Total	343,811	0	0	N/A	343,811	N/A	343,811

E.5. Comparison of emission reductions or net anthropogenic removals achieved with estimates in the registered PDD

Amount achieved during this monitoring period (t CO ₂ e)	Amount estimated ex ante for this monitoring period in the PDD (t CO ₂ e)
343,811	391,302

E.5.1. Explanation of calculation of “amount estimated ex ante for this monitoring period in the PDD”

According to the renewed PDD, annual amount estimated ex-ante of emission reductions (365 days) is 121,244 tCO₂e. This monitoring period covers from 11/10/2017 to 31/12/2020 (first and last days included) – 1,178 days. Therefore, the amount estimated ex ante for this monitoring period in the PDD is calculated as follows: $121,244 / 365 * 1,178 = 391,302$ tCO₂e.

E.6. Remarks on increase in achieved emission reductions

The actual emission reductions achieved in this monitoring period (11/10/2017 - 31/12/2020) is 343,811 tCO₂e while the estimated ex-ante is 391,302 tCO₂e. It is thus 88% of the ex-ante estimation in renewed PDD. Therefore, no justification is requested.

E.7. Remarks on scale of small-scale project activity

Not applicable.

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Document information

<i>Version</i>	<i>Date</i>	<i>Description</i>
09.0	8 October 2021	Revision to: <ul style="list-style-type: none"> • Ensure consistency with version 03.0 of the “CDM project standard for project activities” (CDM-EB93-A04-STAN).
08.0	6 April 2021	Revision to: <ul style="list-style-type: none"> • Reflect the “Clarification: Regulatory requirements under temporary measures for post-2020 cases” (CDM-EB109-A01-CLAR).
07.0	31 May 2019	Revision to: <ul style="list-style-type: none"> • Ensure consistency with version 02.0 of the “CDM project standard for project activities” (CDM-EB93-A04-STAN); • Add a section on remarks on the observance of the scale limit of small-scale project activity during the crediting period; • Add "changes specific to afforestation or reforestation project activity" as a possible post-registration changes; • Clarify the reporting of net anthropogenic GHG removals for A/R project activities between two commitment periods; • Make editorial improvements.
06.0	7 June 2017	Revision to: <ul style="list-style-type: none"> • Ensure consistency with version 01.0 of the “CDM project standard for project activities” (CDM-EB93-A04-STAN); • Make editorial improvements.
05.1	4 May 2015	Editorial revision to correct version numbering.
05.0	1 April 2015	Revisions to: <ul style="list-style-type: none"> • Include provisions related to delayed submission of a monitoring plan; • Provisions related to the Host Party; • Remove reference to programme of activities; • Overall editorial improvement.
04.0	25 June 2014	Revisions to: <ul style="list-style-type: none"> • Include the Attachment: Instructions for filling out the monitoring report form (these instructions supersede the "Guideline: Completing the monitoring report form" (Version 04.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for completing the CDM-MR-FORM in A.6 and Appendix 1; • Change the reference number from <i>F-CDM-MR</i> to <i>CDM-MR-FORM</i>; • Editorial improvement.
03.2	5 November 2013	Editorial revision to correct table in page 1.

<i>Version</i>	<i>Date</i>	<i>Description</i>
03.1	2 January 2013	Editorial revision to correct table in section E.5.
03.0	3 December 2012	Revision required to introduce a provision on reporting actual emission reductions or net GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB 70, Annex 11).
02.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01.0	28 May 2010	EB 54, Annex 34. Initial adoption.
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