



**Monitoring report form for CDM project activity  
(Version 06.0)**

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

**MONITORING REPORT**

<b>Title of the project activity</b>	Nam Ngan Hydropower Project	
<b>UNFCCC reference number of the project activity</b>	3858	
<b>Version number of the PDD applicable to this monitoring report</b>	2.3	
<b>Version number of this monitoring report</b>	01.0	
<b>Completion date of this monitoring report</b>	24/10/2017	
<b>Monitoring period number</b>	4	
<b>Duration of this monitoring period</b>	01/06/2014 – 30/09/2017	
<b>Monitoring report number for this monitoring report</b>	1.0	
<b>Project participants</b>	1. Nam Mu Hydropower Joint Stock Company 2. Swiss Carbon Assets Ltd. 3. Energy and Environment Consultancy Joint Stock Company	
<b>Host Party</b>	Viet Nam	
<b>Sectoral scopes</b>	1: Energy industries (renewable - / non-renewable sources)	
<b>Applied methodologies and standardized baselines</b>	AMS-I.D. ver.16 – Grid connected renewable electricity generation	
<b>Amount of GHG emission reductions or net anthropogenic GHG removals achieved by the project activity in this monitoring period</b>	<b>Amount achieved before 1 January 2013</b>	<b>Amount achieved from 1 January 2013</b>
	N/A	99,455 tCO <sub>2</sub> e
<b>Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the PDD</b>	97,767 (tCO <sub>2</sub> e)	

## SECTION A. Description of project activity

### A.1. General description of project activity

The Nam Ngan Hydropower Project involves the construction of a two-unit hydropower plant, which is located on the Nam Ngan stream between Viet Lam and Quang Ngan communes, Vi Xuyen district in Ha Giang province of Vietnam. The project's installed capacity and estimated annual gross power generation are 13.5 MW and 58,030 MWh, respectively.

The project's purpose is to generate and to supply renewable electricity to the national grid via the Power Purchase Agreement (PPA) signed with the Electricity Corporation of Vietnam (EVN). The rated voltage exporting from main transformers is 110 kV and connected to Vietnam national grid. The estimated annual net electricity generated from this project is 57,450 MWh and supply to the national grid.

The construction of Nam Ngan hydropower plant started in December of 2006 and it completed in June of 2009. On 13/06/2009, the plant started commissioning and supplying electricity to the national grid. Nam Ngan hydropower plant was registered as CDM project on 13/12/2010 with the PDD version 2.3 dated 26/04/2010.

The implementation of the project is listed in Table 1.

**Table 1: The list of key events of Nam Ngan hydropower plant**

Date	Key events
Dec - 2006	Start of construction
13/06/2009	Commissioning date
13/12/2010	Registration and monitoring period start date
13/12/2010 – 31/08/2011	The first monitoring period (Included both days)
01/09/2011 – 31/07/2012	The second monitoring period (Included both days)
01/08/2012 – 31/05/2014	The third monitoring period (Included both days)
01/06/2014 – 30/09/2017	The fourth monitoring period (Included both days)

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 CO<sub>2</sub> emission reduction of 205,254 tCO<sub>2</sub> over the first crediting period of 7 years. In the fourth monitoring period, Nam Ngan Hydropower Project has achieved emission reduction of 99,455 tCO<sub>2</sub>e.

### A.2. Location of project activity

The Nam Ngan Hydropower Project is located on the Nam Ngan stream, Viet Lam and Quang Ngan communes, Vi Xuyen district, Ha Giang province. The Nam Ngan stream is the first branch of the Lo river.

This project has co-ordinates as follows:

	Co-ordinates of the dam <sup>1</sup>	Co-ordinates of the powerhouse <sup>2</sup>
Northern latitude:	22°36'17"	22°36'25"
Eastern longitude:	104°54'10"	104°54'45"

The site of the project is showed in Figure 1.

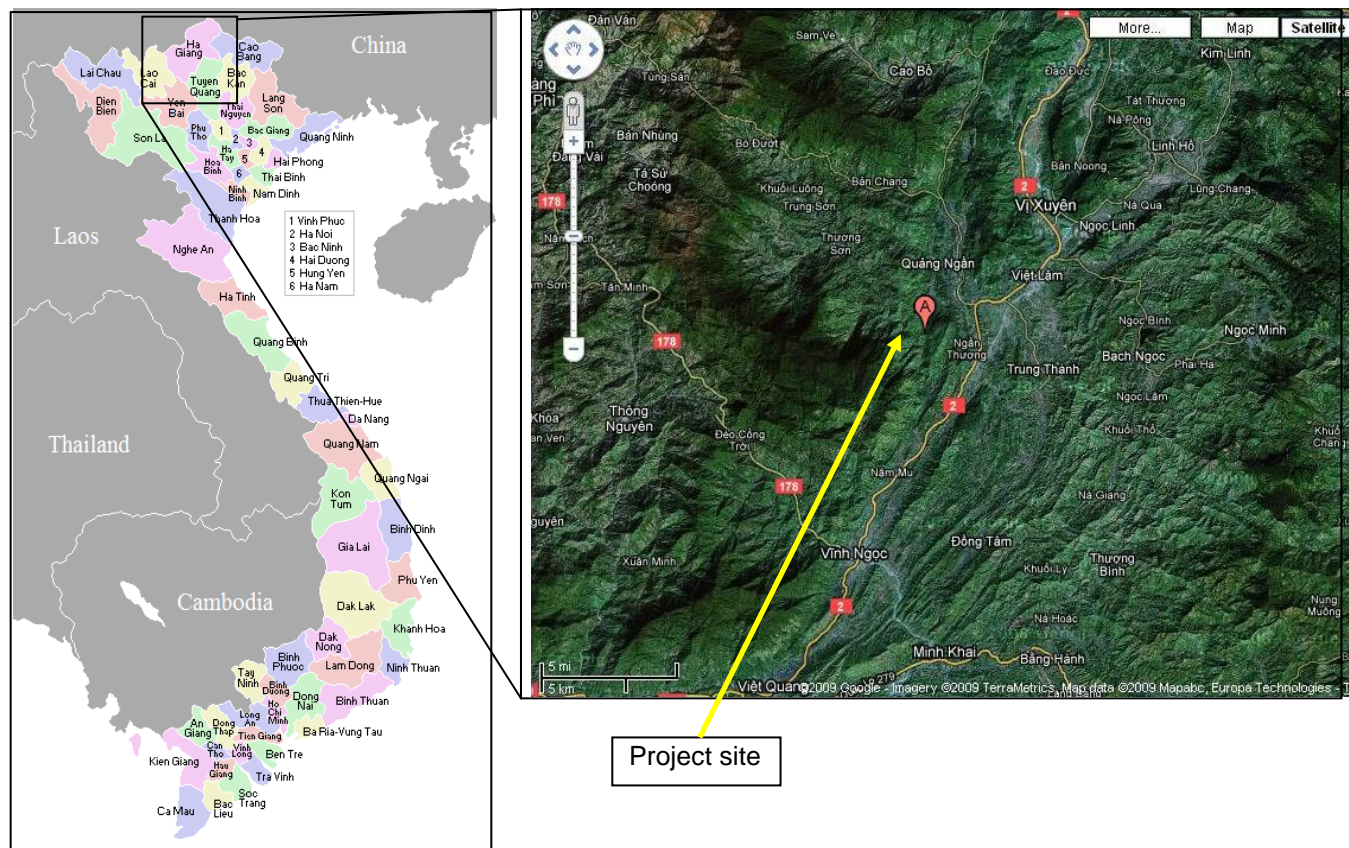


Figure 1. Project site on the map

### 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)	Nam Mu Hydropower Joint Stock Company	No
Viet Nam (host)	Energy and Environment Consultancy Joint Stock Company	No
Switzerland	Swiss Carbon Assets Ltd.	No

### A.4. Reference to applied methodologies and standardized baselines

The applied methodology:

<sup>1</sup> Feasibility Study Report

<sup>2</sup> The coordinate was measure onsite and could be confirmed by the internet map: [http://maps.google.com/maps?f=q&source=s\\_q&hl=en&q=22.606944,+104.912500&vps=3&jsv=198a&sll=22.551245,104.878922&sspn=0.368435,0.529404&ie=UTF8&geocode=FW/DOWAEddNZABg&split=0](http://maps.google.com/maps?f=q&source=s_q&hl=en&q=22.606944,+104.912500&vps=3&jsv=198a&sll=22.551245,104.878922&sspn=0.368435,0.529404&ie=UTF8&geocode=FW/DOWAEddNZABg&split=0)

- Version 16.0 of AMS-I.D: Grid connected renewable electricity generation. UNFCCC CDM website for reference:

[https://cdm.unfccc.int/filestorage/S/J/I/SJI52M6QXGKFNOZABTHDYP789EV3C/EB54\\_repan07\\_AMS-I.D\\_ver16.pdf?t=RGJ8b3Z4enR4fDDvDhRDKsi9-LAWKtjfMtv3](https://cdm.unfccc.int/filestorage/S/J/I/SJI52M6QXGKFNOZABTHDYP789EV3C/EB54_repan07_AMS-I.D_ver16.pdf?t=RGJ8b3Z4enR4fDDvDhRDKsi9-LAWKtjfMtv3)

#### **The applied tools:**

- Version 02.0 of the “Tool to calculate emission factor for an electricity system”. UNFCCC CDM website for reference:

[https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v2.pdf/history\\_view](https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v2.pdf/history_view)

- Version 05.2 of the “Tool for the demonstration and assessment of additionality”. UNFCCC CDM website for reference:

[https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v5.2.pdf/history\\_view](https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v5.2.pdf/history_view)

#### **A.5. Crediting period type and duration**

Type of crediting period: Renewable

The start date of crediting period: 13/12/2010 (registration date of Nam Ngan Hydropower Project)

Crediting period: 13/12/2010 – 12/12/2017

Monitoring period: 01/06/2014 – 30/09/2017 (both days included)

### **SECTION B. Implementation of project activity**

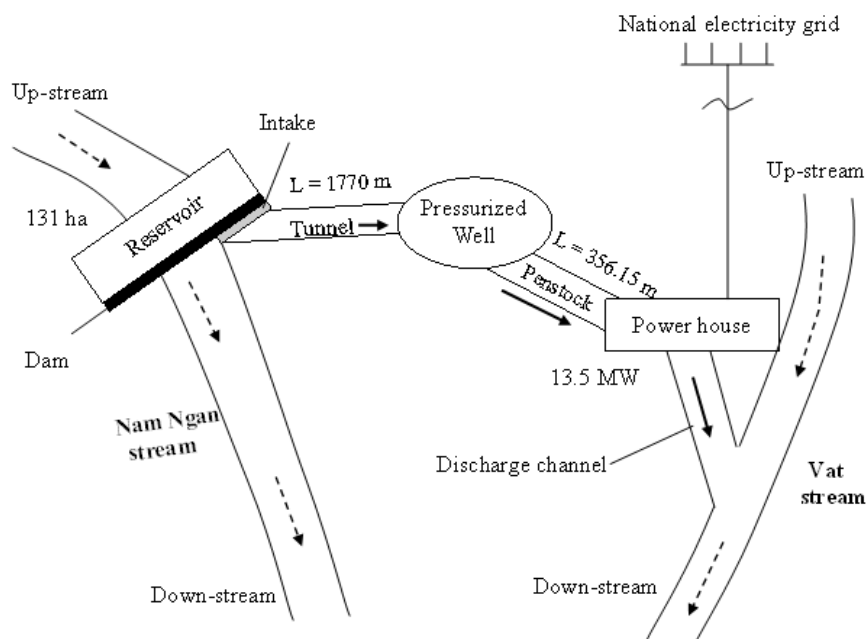
#### **B.1. Description of implemented project activity**

Nam Ngan hydropower plant has been operating since 13/06/2009 and has been registered as CDM project by UNFCCC on 13/12/2010.

#### ***Technology employed by the project activity***

The project involves the construction of a hydropower plant and installation of new hydro turbines and alternators 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 Ngan Hydropower Project are shown in Table 2.

**Table 2: Main technical parameters of the proposed project activity**

Main parameters	Units	Values	Manufacturer
1. Turbine			Symbol: HLA 743 – WJ – 81, Manufacturer: Hunan Ling Ling Hengyuan Generating Equipment Co Ltd., China
• Type		Francis with horizontal shaft	
• Diameter of runner	m	1	
• Rated net head	m	116.7	
• Number of turbine	set	02	
• Turbine discharge	m <sup>3</sup> /s	6.64	
• Capacity	kW	6,995	
• Speed	rpm	1,000	
2. Generator			Symbol: SFW6750 – 6/1780, Manufacturer: Hunan Ling Ling Hengyuan Generating Equipment Co Ltd., China
• Type		synchronous, 3 phases, horizontal axis	
• Number	set	2	
• Rated voltage	kV	6.3	
• Rated capacity	kW	6750	
• Efficiency at 100% load, Cosφ = 0.8		97.27%	

**B.2. Post-registration changes**

**B.2.1. Temporary deviations from the registered monitoring plan, applied methodologies or standardized baselines**

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

**B.2.5. Permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other applied standards or tools**

Not applicable

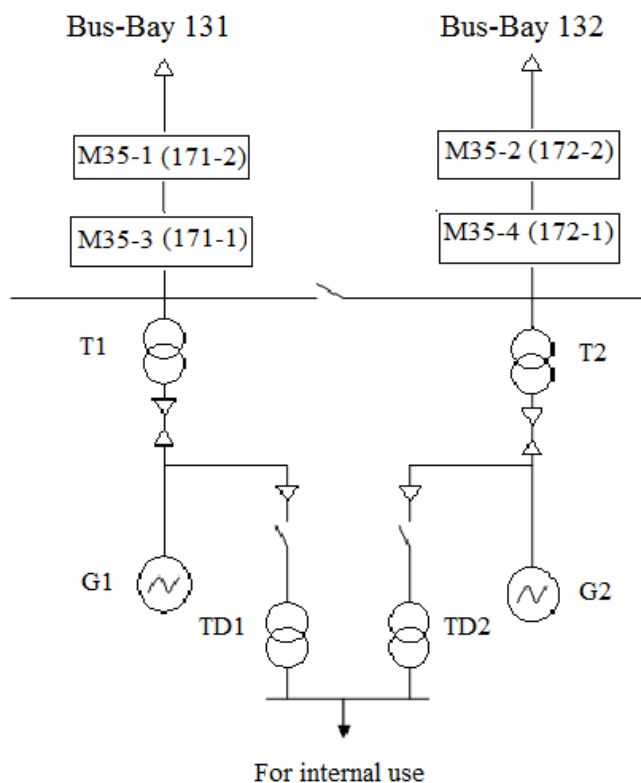
**B.2.6. Changes to project design**

Not applicable

**SECTION C. Description of monitoring system**

**C.1. Monitoring equipment**

The following diagram indicates the power meter location:



**Figure 3. Meter diagram of Nam Ngan Hydropower Project**

Where:

- T1 and T2: The transformers
- G1 and G2: The generators
- M35-3(171-1), M35-1(171-2), M35-4(172-1), M35-2(172-2): The power meters
- H1 and H2: Out-put generator meters
- TD1 and TD2: The transformers for internal use

The details of power meters are as follow:

**Table 3. Monitoring equipment**

Power meter	Manufacture	Position	Function	Record frequency	Calibration party and frequency
The main power meter. Serial number 96009794 M35-3(171-1)	Landis & Gyr	In Nam Ngan hydropower plant	Amount of electricity exported to the national grid and consumed by Nam Ngan Hydropower Plant	The end of every month	Third Party, At least once every 2 years
The backup power meter. Serial number 96009793 M35-1(171-2)					
The main power meter. Serial number 96009795 M35-4(172-1)					

The backup power main. Serial number 96009796 M35-2(172-2)					
The generator power meter H1. Serial number 0801886	Zhuhai Guoce (China)		Amount of electricity produced by the Generator No.1 of Nam Ngan Hydropower		
The generator power meter H2. Serial number 0801885			Amount of electricity produced by the Generator No.2 of Nam Ngan Hydropower		

All the power meters of Nam Ngan Hydropower plant have been sealed up to prevent interference by Northern Electrical Testing Company Limited of Northern Power Corporation (Third party).

Monitoring Manual:

The project owner and VNEEC have developed and implemented the monitoring manual. The manual is used by monitoring group for data collection, supervision, verification and recording.

### C.2. Data collection procedures

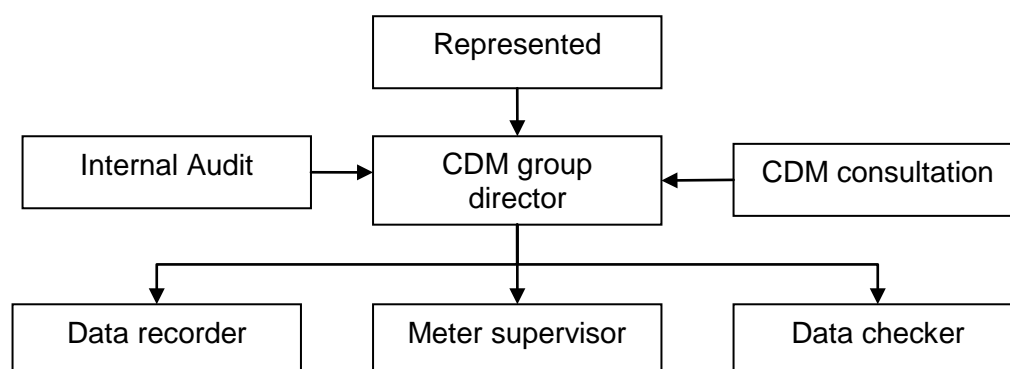
The steps of monitoring the electricity supplied to the grid and the electricity imported from grid and consumed by the proposed project are as follows:

- 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 Ngan 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.

### C.3. Management structure

Project Owner had setup a special CDM group to take charge of data collection, supervision, recording and verification. 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 <sup>3</sup>	Name	Job Title	Responsibility
Representative	Nguyen Viet Ky	Deputy Director of Nam Mu Hydropower JSC	Legal representative of Nam Mu Company
CDM group Manager	Bui Trong Can	Manager of Nam Ngan Power plant	Managing the whole monitoring business of Nam Ngan HPP, guiding and supervising data recording after training by Monitoring consultation.
Internal Auditor	Phung Xuan Hung	Deputy Manager of Nam Ngan Power plant	Check the monitoring procedure.
Data recorder	Nguyen Van Tuyen	Staff member	Collecting and recording data every month.
	Dao Xuan Cuong		
	Vuong Hai Nguyen		
Meter supervisor	Pham Duc Hanh	Shift leader	Checking power meter periodically according to relevant regulation.
	Vu Quoc Huy		
Data checker	Dinh Trong Cuong	Shift leader	Double check the collected data measured by power meter.
	Nguyen Danh Thoi		
CDM consultant	Pham Minh Hang	VNEEC – Project Manager	Providing monitoring group director training and technical support about monitoring plan.
	Pham Thu Huong		
	Nguyen Quang Phuong		

#### C.4. Emergency procedures for the monitoring system

The main and backup power meters will be used in order to record the electricity exported to the grid. These power meters will be calibrated at least once every 2 years. Monthly, the representatives of EVN and the Project Owner will check the result in both main and backup power meters.

<sup>3</sup> Group members will be adjusted based on the actual adjustment of Nam Mu Joint Stock Company

The discrepancy between the main power meter and the backup one will be determined. If the discrepancy is larger than the specific error value allowed, then the EVN and Project Owner will 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 of power meters by qualified party to find the erroneous meter.
- Under normal circumstance, the amount of electricity delivered to the grid measured by main power meter will be adopted, but in case of error with the main power meter, the amount of electricity will be adjusted as follows:
  - Use the value recorded by the backup power meter.
  - If the backup power meters are also found to be erroneous:
    - If the main power meter could record the amount of electricity, the amount of electricity generated by Nam Ngan hydropower plant; shall be based on the value recorded by the main power meter after the justification is agreed by both Project Owner and EVN.
    - If the main power meter could not record the amount of electricity, the Project Owner and EVN will jointly calculate a conservative estimation of power amount supplied to the grid. The assumptions applied to estimate the net electricity supplied to the grid shall be signed by both representatives of the Project Owner and the power company (EVN).
    - In any other cases, if Project Owner and EVN cannot reach an agreement on the conservative method to estimate reading, arbitration should be conducted according to Power Purchase Agreement.

#### Emergency case

Since the starting of Nam Ngan hydropower plant, no emergency case has been reported and the difference between the power meters is in the acceptable range because director of plant has applied the preventive maintenance to ensure the smooth operation of systems.

### **C.5. Quality Assurance and Quality Control**

#### **C.5.1. Training**

- All persons working for CDM group should be trained and the training record should be kept. Through the training, persons will know the necessary knowledge on the installation, examination and maintenance of electricity and machine. It is also ensured that staff is familiar with the equipment operating principle and basic structure; master the cause and solution of commonly reported problem and the basic knowledge on CDM and monitoring requirement.
- During the operating period, Project Owner will hold some training to improve staff's professional level.
- The new staffs are not allowed to operate or maintain the equipment until they master the knowledge and skills required.
- CDM monitoring training contents:
  - Monitoring organization
  - File system
  - Connection point knowledge
  - Monitoring parameters
  - Monitoring method
  - Guidelines against dispute resolution
  - Data management
  - Calibration and maintenance

- Monitoring report
- Internal audit
- Management review

### C.5.2. Data management

- The CDM group appointed by Nam Ngan HPP should keep monitored data in electronic archives at the end of every month. Paper documents should be stored in electronic format and copied by CD.
- Nam Ngan HPP should keep the copy of electricity sales/purchase invoice (the original electricity sales/purchase invoice will be kept by Project Owner).
- In order to help verifiers obtain documents and information related to the emission reduction of the proposed project, Project Owner should offer index of the project documents and monitoring report.
- All the data and information in the form of paper documents will be kept in archives by CDM group, with at least one copy backup for each datum.
- Hard copy documentation will be stored in cabinet for safety. Every month, CDM group leader and internal auditor will check it to ensure that all data is good status.
- Data in electronic spreadsheet will be stored on main hard disk and other type such as CD ROM, memory stick. In addition, the Nam Ngan hydropower plant will send a copy to VNEEC for secondary backup.
- All of the data should be kept for 2 years after the crediting period.

### C.5.3. Calibration and Maintenance

- Project Owner had 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 standards and regulations of the state electric power industry. After inspection and on-site check, power meters must be sealed after examination and identification by both; the Project Owner and EVN. Nam Ngan Hydropower Plant (HPP) and EVN should inspect and seal together, either party cannot remove the seal or modify the power meter when the other party (or its authorized representative) is absent.
- All installed power meters should be tested by measurement inspection institution entrusted by both Project Owner and EVN in the shortest time after the followings happen: Power meter has to calibrate due to component malfunction.

#### ➤ ***History of power meters of Nam Ngan Hydropower Project in the monitoring period (01/06/2014-30/09/2017)***

- ✓ Nam Ngan hydropower plant has started operating since 13/06/2009, from that time power meters of system are Landis & Gyr with accuracy level 0.2s. These power meters are calibrated by Northern Electrical Testing Company Limited (a division of EVN which has authority for calibration of all electrical measurement equipment). During this monitoring period (01/06/2014-30/09/2017), the power meters system is in good state and no failure occurrences reported.
- ✓ Detailed information of each power meters can be found below:

Calibration for Main meter Bus-bay 131:

Item		Main Power meter M35-3 (171-1)		
Serial No.		96009794		
Type		ZMD402CT44.0007 s2		
Accuracy		0.2s		
Manufacturer		Switzerland		
Specification		3x58/100 - 240/415V & 3x1(2)A (Two-way and 3-phase power meter)		
Status in the monitoring period		Good		
The calibration before this monitoring period	Certificate No.	A9-2009-95		
	Date of issue	14/07/2012		
	Calibration entity	Northern Electrical Testing Company Limited		
The calibration in this monitoring period	Verification stamp No.	141196-11A	216627-11A	022834-16A
	Date of issue	24/09/2014	04/08/2015	08/08/2016
	Calibration entity	Northern Electrical Testing Company Limited		
Calibration frequency		1 years		
Expected date for the next frequency		31/07/2018		

Calibration for Backup meter Bus-bay 131

Item		Backup Power meter M35-1 (171-2)		
Serial No.		96009793		
Type		ZMD402CT44.0007 s2		
Accuracy		0.2s		
Manufacturer		Switzerland		
Specification		3x58/100 - 240/415V & 3x1(2)A (Two-way and 3-phase power meter)		
Status in the monitoring period		Good		
The calibration before this monitoring period	Certificate No.	A9-2009-96		
	Date of issue	14/07/2012		
	Calibration entity	Northern Electrical Testing Company Limited		
The calibration in this monitoring period	Verification stamp No.	141197-11A	216622-11A	022835-16A
	Date of issue	24/09/2014	03/08/2015	08/08/2016
	Calibration entity	Northern Electrical Testing Company Limited		
Calibration frequency		1 years		
Expected date for the next frequency		31/07/2018		

Calibration for Main meter Bus-bay 132

Item		Main Power meter M35-4 (172-1)		
Serial No.		96009795		
Type		ZMD402CT44.0007 s2		
Accuracy		0.2s		
Manufacturer		Switzerland		
Specification		3x58/100 - 240/415V & 3x1(2)A (Two-way and 3-phase power meter)		
Status in the monitoring period		Good		
The calibration before this monitoring period	Certificate No.	A9-2009-94		
	Date of issue	14/07/2012		
	Calibration entity	Northern Electrical Testing Company Limited		
The calibration in this monitoring period	Verification stamp No.	141194-11A	216629-11A	022836-16A
	Date of issue	24/09/2014	04/08/2015	08/08/2016
	Calibration entity	Northern Electrical Testing Company Limited		
Calibration frequency		1 years		
Expected date for the next frequency		31/07/2018		

Calibration for Backup meter Bus-bay 132

Item		Backup Power meter M35-2 (172-2)		
Serial No.		96009796		
Type		ZMD402CT44.0007 s2		
Accuracy		0.2s		
Manufacturer		Switzerland		
Specification		3x58/100 - 240/415V & 3x1(2)A (Two-way and 3-phase power meter)		
Status in the monitoring period		Good		
The calibration before this monitoring period	Certificate No.	A9-2009-93		
	Date of issue	14/07/2012		
	Calibration entity	Northern Electrical Testing Company Limited		
The calibration in this monitoring period	Verification stamp No.	141193-11A	216628-11A	022837-16A
	Date of issue	24/09/2014	04/08/2015	08/08/2016
	Calibration entity	Northern Electrical Testing Company Limited		
Calibration frequency		1 years		
Expected date for the next frequency		31/07/2018		

#### C.5.4. Internal audit

According to the internal audit reports, deputy director has conducted internal audit every month, and the result of each month reflect that the quality of operation and monitoring of staffs is improving and they follow the operation guidance of hydropower plant and CDM monitoring manual. All the meetings are recorded and stored.

#### C.5.5. Management Review

Management review or annual summary report of the project shall be made at least once a year for reviewing of monitoring and internal audit. The chairman of Nam Mu Hydropower JSC will conduct management review on January of each year. This management review's purpose is to improve their efficient of quality management.

### SECTION D. Data and parameters

#### D.1. Data and parameters fixed ex ante

Data/Parameter	$FC_{i,m,y}$
Unit	mass or volume unit
Description	Amount of fossil fuel type $i$ consumed by power plant / unit $m$ in year $y$
Source of data	Institute of Energy – EVN, 2007 via a data providing contract
Value(s) applied	Value applied presented in Annex 3 of registered PDD
Choice of data or measurement methods and procedures	
Purpose of data/parameter	The data are used for project emission calculation
Additional comments	For calculation of $EF_{OM}$ or $EF_{BM}$

Data/Parameter	$NCV_{i,y}$
Unit	GJ / mass or volume unit
Description	Net calorific value (energy content) of fossil fuel type $i$ in year $y$
Source of data	Institute of Energy – EVN, 2007 via a data providing contract
Value(s) applied	Value applied presented in Annex 3 of registered PDD
Choice of data or measurement methods and procedures	
Purpose of data/parameter	The data are used for project emission calculation
Additional comments	For calculation of $EF_{OM}$ or $EF_{BM}$

Data/Parameter	$EF_{CO_2,i,y}$
Unit	tCO <sub>2</sub> /GJ
Description	CO <sub>2</sub> emission factor of fossil fuel type $i$ in year $y$
Source of data	Default value of the IPCC 2006 Guidelines
Value(s) applied	Value applied presented in Annex 3 of registered PDD

Choice of data or measurement methods and procedures	
Purpose of data/parameter	The data are used for project emission calculation
Additional comments	For calculation of $EF_{OM}$ or $EF_{BM}$

<b>Data/Parameter</b>	<b><math>EG_{m,y}</math></b>
Unit	MWh
Description	Net electricity generated and delivered to the grid by power plant/unit m in year y
Source of data	Institute of Energy – EVN, 2007 via a data providing contract
Value(s) applied	Value applied presented in Annex 3 of registered PDD
Choice of data or measurement methods and procedures	
Purpose of data/parameter	The data are used for baseline emission calculation
Additional comments	For calculation of $EF_{OM}$ or $EF_{BM}$

<b>Data/Parameter</b>	<b><math>Cap_{BL}</math></b>
Unit	MW
Description	Installed capacity of hydropower plant before the implementation of the project activity.
Source of data	According to EIA report, 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 by zero.
Purpose of data/parameter	The data are used for Project emission calculations
Additional comments	

<b>Data/Parameter</b>	<b><math>A_{BL}</math></b>
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 reservoirs, this value is zero.
Source of data	According to EIA report, 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 builds a new reservoir, so $A_{BL}$ is considered by zero.
Purpose of data/parameter	The data are used for project emission calculation
Additional comments	

<b>Data/Parameter</b>	<b>EF<sub>res</sub></b>
Unit	kg CO <sub>2</sub> e/MWh
Description	Default emission factor for emissions from reservoirs
Source of data	Default value as per EB23
Value(s) applied	90 kgCO <sub>2</sub> e/MWh.
Choice of data or measurement methods and procedures	
Purpose of data/parameter	The data are used for project emission calculation
Additional comments	For calculation of project emission (PE)

## D.2. Data and parameters monitored

<b>Data/Parameter</b>	<b>EG<sub>y, export</sub></b>
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 so EG <sub>y, export</sub> does not include the electricity generated by the proposed project used for internal consumption and losses.



Value(s) of monitored parameter	<table><tr><th>Period</th><th>Electricity exported (MWh)</th><th>Period</th><th>Electricity exported (MWh)</th></tr><tr><td>06/2014</td><td>4,893.041</td><td>02/2016</td><td>1,811.145</td></tr><tr><td>07/2014</td><td>9,042.136</td><td>03/2016</td><td>1,614.286</td></tr><tr><td>08/2014</td><td>9,151.491</td><td>04/2016</td><td>1,734.200</td></tr><tr><td>09/2014</td><td>8,151.200</td><td>05/2016</td><td>3,361.555</td></tr><tr><td>10/2014</td><td>5,638.345</td><td>06/2016</td><td>4,745.736</td></tr><tr><td>11/2014</td><td>5,299.932</td><td>07/2016</td><td>6,974.855</td></tr><tr><td>12/2014</td><td>2,615.100</td><td>08/2016</td><td>8,295.577</td></tr><tr><td>01/2015</td><td>2,181.759</td><td>09/2016</td><td>6,581.136</td></tr><tr><td>02/2015</td><td>1,579.578</td><td>10/2016</td><td>3,851.141</td></tr><tr><td>03/2015</td><td>1,883.282</td><td>11/2016</td><td>4,732.459</td></tr><tr><td>04/2015</td><td>1,601.114</td><td>12/2016</td><td>2,281.391</td></tr><tr><td>05/2015</td><td>2,570.355</td><td>01/2017</td><td>3,128.836</td></tr><tr><td>06/2015</td><td>4,338.113</td><td>02/2017</td><td>1,835.714</td></tr><tr><td>07/2015</td><td>4,599.372</td><td>03/2017</td><td>2,943.059</td></tr><tr><td>08/2015</td><td>9,187.141</td><td>04/2017</td><td>3,233.695</td></tr><tr><td>09/2015</td><td>8,448.527</td><td>05/2017</td><td>3,707.182</td></tr><tr><td>10/2015</td><td>5,734.946</td><td>06/2017</td><td>7,222.627</td></tr><tr><td>11/2015</td><td>5,766.519</td><td>07/2017</td><td>9,712.691</td></tr><tr><td>12/2015</td><td>2,811.018</td><td>08/2017</td><td>9,231.468</td></tr><tr><td>01/2016</td><td>3,462.964</td><td>09/2017</td><td>9,231.468</td></tr><tr><td>Total</td><td colspan="3">195,186.155</td></tr></table>	Period	Electricity exported (MWh)	Period	Electricity exported (MWh)	06/2014	4,893.041	02/2016	1,811.145	07/2014	9,042.136	03/2016	1,614.286	08/2014	9,151.491	04/2016	1,734.200	09/2014	8,151.200	05/2016	3,361.555	10/2014	5,638.345	06/2016	4,745.736	11/2014	5,299.932	07/2016	6,974.855	12/2014	2,615.100	08/2016	8,295.577	01/2015	2,181.759	09/2016	6,581.136	02/2015	1,579.578	10/2016	3,851.141	03/2015	1,883.282	11/2016	4,732.459	04/2015	1,601.114	12/2016	2,281.391	05/2015	2,570.355	01/2017	3,128.836	06/2015	4,338.113	02/2017	1,835.714	07/2015	4,599.372	03/2017	2,943.059	08/2015	9,187.141	04/2017	3,233.695	09/2015	8,448.527	05/2017	3,707.182	10/2015	5,734.946	06/2017	7,222.627	11/2015	5,766.519	07/2017	9,712.691	12/2015	2,811.018	08/2017	9,231.468	01/2016	3,462.964	09/2017	9,231.468	Total	195,186.155		
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Additional comments	Calculating EG <sub>BL,y</sub>																																																																																								

<b>Data/Parameter</b>	<b><math>EG_{y, import}</math></b>
Unit	MWh
Description	Electricity supplied by the grid to the proposed hydropower plant

Measured/calculated/default	Measured																																																																																								
Source of data	Direct measurement at the project connection point																																																																																								
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Additional comments	Calculating $EG_{BL,y}$																																																																																								

Data/Parameter	$EG_{BL,y}$
Unit	MWh

Description	Electricity output produced by the Nam Ngan Hydropower plant and supplied to the national electricity grid																																																																																								
Measured/calculated/default	Calculated																																																																																								
Source of data	Calculating from $EG_{y,import}$ and $EG_{y,export}$ . It indicates the net electricity exported to the grid by the project activity.																																																																																								
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Monitoring equipment																																																																																									
Measuring/reading/recording frequency	Continuously measured and recorded on monthly basis																																																																																								
Calculation method (if applicable)	$EG_{BL,y} = EG_{y,exp} - EG_{y,imp}$																																																																																								
QA/QC procedures	Sales record of electricity to the grid is used to ensure the consistency.																																																																																								
Purpose of data/parameter	Calculating project emission reduction																																																																																								
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	Project site.
Value(s) of monitored parameter	1,256,000 $m^2$
Monitoring equipment	Measured by third party.
Measuring/reading/recording frequency	Yearly
Calculation method (if applicable)	Measured from topographical surveys and maps
QA/QC procedures	The uncertainty level of this data is low.
Purpose of data/parameter	Project emission.
Additional comments	Calculating Project density

Data/Parameter	$Cap_{PJ}$
Unit	W
Description	Installed capacity of the hydro power plant after the implementation of the project activity.
Measured/calculated/default	Not applicable
Source of data	Project site
Value(s) of monitored parameter	13,500,000
Monitoring equipment	Not applicable
Measuring/reading/recording frequency	Yearly
Calculation method (if applicable)	Not applicable
QA/QC procedures	Check with manufacture's nameplate
Purpose of data/parameter	Calculating the project emission
Additional comments	

Data/Parameter	$TEG_y$
Unit	MWh
Description	Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year $y$ .
Measured/calculated/default	Measured
Source of data	Direct measurement at the project site
Value(s) of monitored parameter	207,375.524

Monitoring equipment	Meter H1 & H2
Measuring/reading/recording frequency	Continuously measurement and monthly recording
Calculation method (if applicable)	Not applicable
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 at least once every 2 years.
Purpose of data/parameter	Project emission
Additional comments	Use for calculating $PE_{HP,y}$

### D.3. Implementation of sampling plan

Not applicable. This section is left blank intentionally.

## SECTION E. Calculation of emission reductions or net anthropogenic removals

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

Baseline emissions include only CO<sub>2</sub> emissions from electricity generation by fossil fuel fired power plants that are displaced due to the project activity. It is calculated as follows:

$$BE_y = EG_{BL,y} \times EF_{CO_2,grid,y}$$

Where:

$BE_y$  Baseline emissions in the monitoring period (tCO<sub>2</sub>e)

$EG_{BL,y}$  Net electricity supplied by the Nam Ngan hydropower plant to the grid during the monitoring period (MWh);

$EF_{CO_2,grid,y}$  Emission factor of the grid (tCO<sub>2</sub>/MWh) (0.5104 tCO<sub>2</sub>/MWh, as calculated ex-ante in the registered PDD and will be fixed during the first crediting period).

In the fourth monitoring period (01/06/2014 - 30/09/2017), this project supplied to the grid a total net electricity of 194,859.974 MWh.

The baseline emission ( $BE_y$ ) can be calculated as follows:

$$BE_y = EG_{BL,y} \times EF_{CO_2,grid,y} = 194,859.974 \times 0.5104 = 99,455 \text{ tCO}_2\text{e}$$

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

The project emission includes the emission from a new reservoir. The following formula is applied:

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

$PE_{HP,y}$  is the emissions from the reservoir

**The emissions from the reservoir**

The proposed project activity involves the construction of a new hydropower plant and new reservoir thus  $A_{BL} = 0$  and  $Cap_{BL} = 0$ . The power plant have installed capacity and reservoir area are listed as detailed in table below

**Table 9: Installed capacity and respective reservoir area of hydropower plant**

Hydropower plant	Nam Ngan
Installed capacity (MW)	13.5
Reservoir area (ha) in 2017	125.6

The power density project plant is derived as follows:

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}} = \frac{13.5 \times 10^6 - 0}{1,25.6 \times 10^4 - 0} = 10.75 \text{ W/m}^2$$

As the power density of the project plant is above 10 W/m<sup>2</sup> thus the project emission is zero:  $PE_{HP,y} = 0$

### E.3. Calculation of leakage emissions

Because the energy generating equipment are newly manufactured and not transferred from another activity so leakage is no need to be considered.

$$(L_y = 0)$$

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

	Baseline GHG emissions or baseline net GHG removals (t CO <sub>2</sub> e)	Project GHG emissions or actual net GHG removals (t CO <sub>2</sub> e)	Leakage GHG emissions (t CO <sub>2</sub> e)	GHG emission reductions or net anthropogenic GHG removals (t CO <sub>2</sub> e)		
				Before 01/01/2013	From 01/01/2013	Total amount
<b>Total</b>	99,455	0	0	--	99,455	99,455

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

In this monitoring period, the estimated emission reduction in registered PDD is 97,767 tCO<sub>2</sub>. The actual emission reduction is 99,455 tCO<sub>2</sub>, exceed 1.73% of estimated reduction.

Amount achieved during this monitoring period (t CO <sub>2</sub> e)	Amount estimated ex ante (t CO <sub>2</sub> e)
99,455	97,767

### E.6. Remarks on increase in achieved emission reductions

Not applicable. This section is left blank intentionally.