MONITORING REPORT FORM (F-CDM-MR)
Version 02.0

MONITORING REPORT

Title of the project activity	Nam Ngan Hydropower Project
Reference number of the project activity	3858
Version number of the monitoring report	1.0
Completion date of the monitoring report	03/08/2012
Registration date of the project activity	13/12/2010
Monitoring period number and duration of this monitoring period	The second Monitoring period - 01/09/2011-31/07/2012 (Included both days)
Project participant(s)	1. Nam Mu Hydropower Joint Stock Company - the project owner of Nam Ngan Hydropower Project 2. Energy and Environment Consultancy Joint Stock Company - the CDM Consultant for the project 3. swb Erzeugung GmbH & Co. KG - the CER Buyer
Host Party(ies)	Viet Nam
Sectoral scope(s) and applied methodology(ies)	Sectoral Scope: 01, EB 54 Applied methodology (ies): AMS-ID "Grid connected renewable electricity generation - Version 16
Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD	26,912 tCO_2 (For 335 days)
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period	24,977 tCO_2

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

The Nam Ngan Hydropower Project is located on the Nam Ngan stream Viet Lam and Quang Ngan communes, Vi Xuyen district in Ha Giang province of Viet Nam. The installed capacity and estimated annual gross power generation of Nam Ngan Hydropower Project is 13.5 MW and 58,030 MWh, respectively.

The project activity consists of 2 units of turbine and generators each with a capacity of 6.75 MW. The rated voltage exporting from main transformers is 110 kV and connected to Vietnam national grid.The net electricity generated from this project (annual estimated volume is 57,450 MWh) is supplied to the national grid.

The second verification period of the project is dated from 01/09/2011 to 31/07/2012 included both days.

The construction of Nam Ngan hydropower plant started in December of 2006 and it was 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
December 2006	Start of construction
13/6/2009	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)

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_2 emission reduction of 205,254 tCO_2 over the first crediting period of 7 years. In the second monitoring period, Nam Ngan project has achieved emission reduction of 24,977 tCO_2e.

A.2. Location of project activity

The Nam Ngan Hydropower project is located on the Nam Ngan stream in Viet Lam and Quang Ngan communes, Vi Xuyen district in Ha Giang province of Viet Nam.

The geographic coordination of the dam and the power house of the project is as below:

Project	Nam Ngan	
	Northern latitude	Eastern longitudes
Dam	$22^0$36’17’’	$104^0$54’10’’
Power house	$22^0$36’25’’	$104^0$54’45’’

The site of the project is showed in Figure 1.

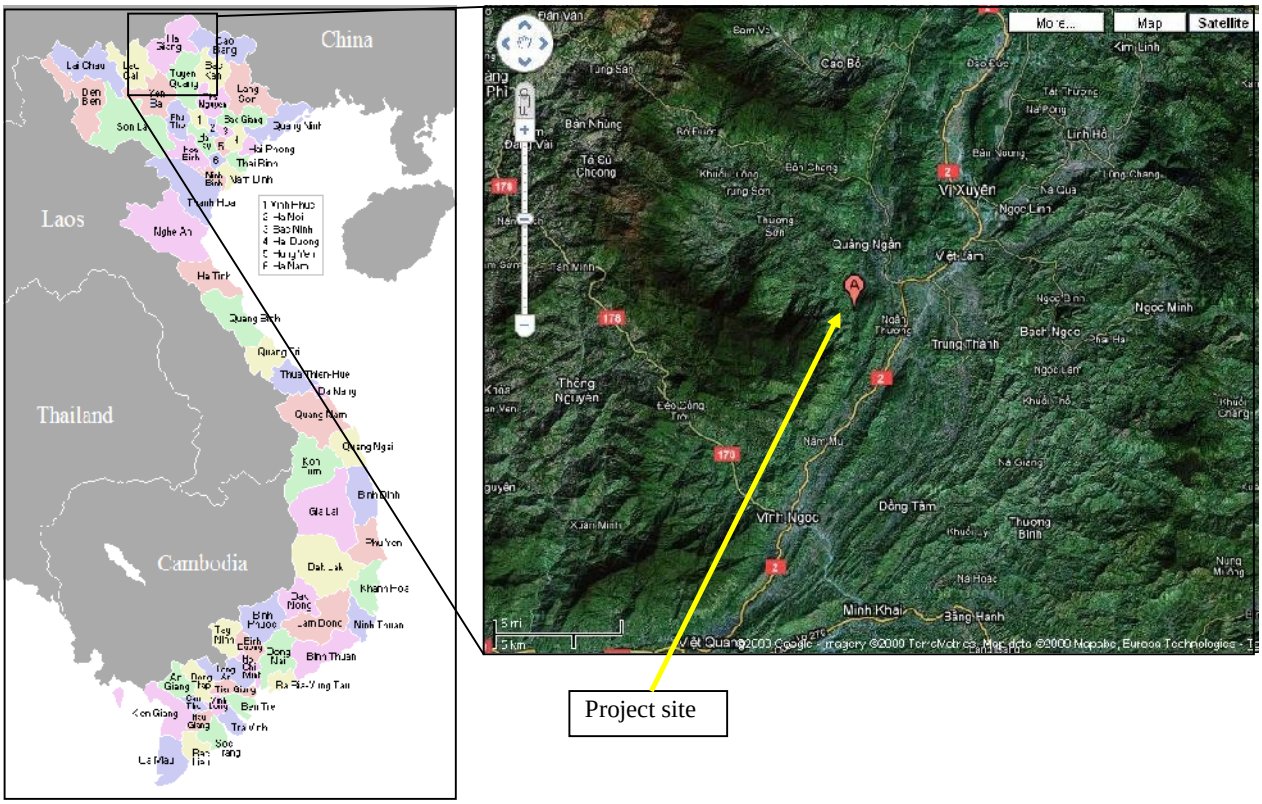

Figure 1. Project site on the map

A.3. Parties and project participant(s)

Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Viet Nam (host)	Nam Mu Hydropower Joint Stock Company	No
Viet Nam (host)	Energy and Environment Consultancy Joint Stock Company	No
Germany	swb Erzeugung GmbH & Co. KG	No

A.4. Reference of applied methodology

(a) Applied methodology:

- AMS- I.D. " Grid connected renewable electricity generation" - Version 16.

(b) Related tools:

- Version 02 of the "Tool to calculate the emission factor for an electricity system"
- Version 05.2 of the "Tool for the demonstration and assessment of additionality"

A.5. Crediting period of project activity

Type of crediting period: Renewable.
The start date of crediting period: 13/12/2010
The second monitoring period: 01/09/2011 - 31/07/2012.

SECTION B. Implementation of project activity

B.1. Description of implemented registered 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 hydro 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.

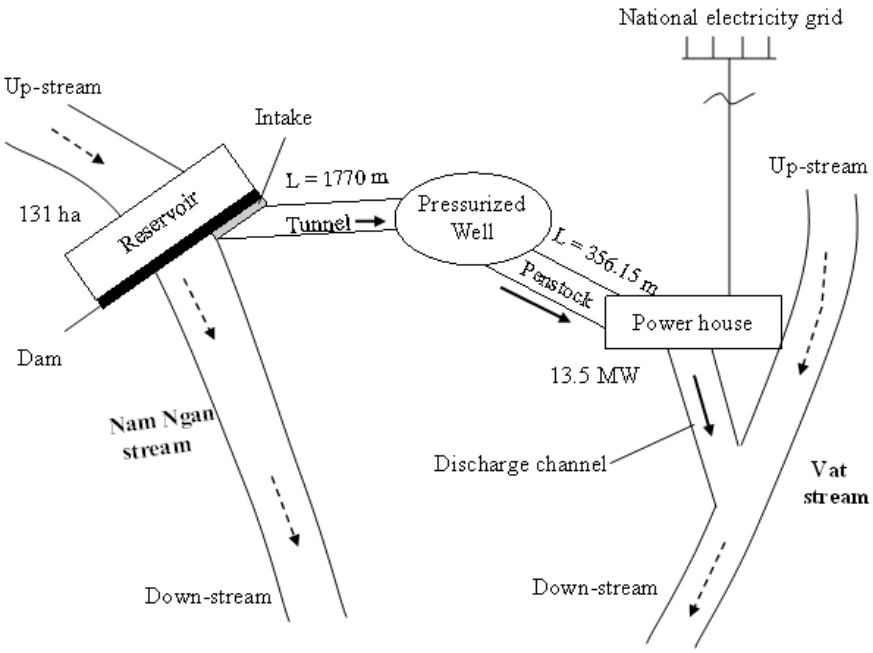

Figure 2: Project lay-out

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 Lingling 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^3/s	6.64	
• Capacity	kW	6,995	
• Speed	rpm	1,000	
2. Generator			Symbol: SFW6750 – 6/1780, Manufacturer: Hunan Lingling 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,		97.5%	

Cosφ = 0.8			

B.2. Post registration changes
B.2.1. Temporary deviations from registered monitoring plan or applied methodology

Not applicable.

B.2.2. Corrections

Not applicable.

B.2.3. Permanent changes from registered monitoring plan or applied methodology

Not applicable.

B.2.4. Changes to project design of registered project activity

Not applicable.

B.2.5. Changes to start date of crediting period

Not applicable.

B.2.6. Types of 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:

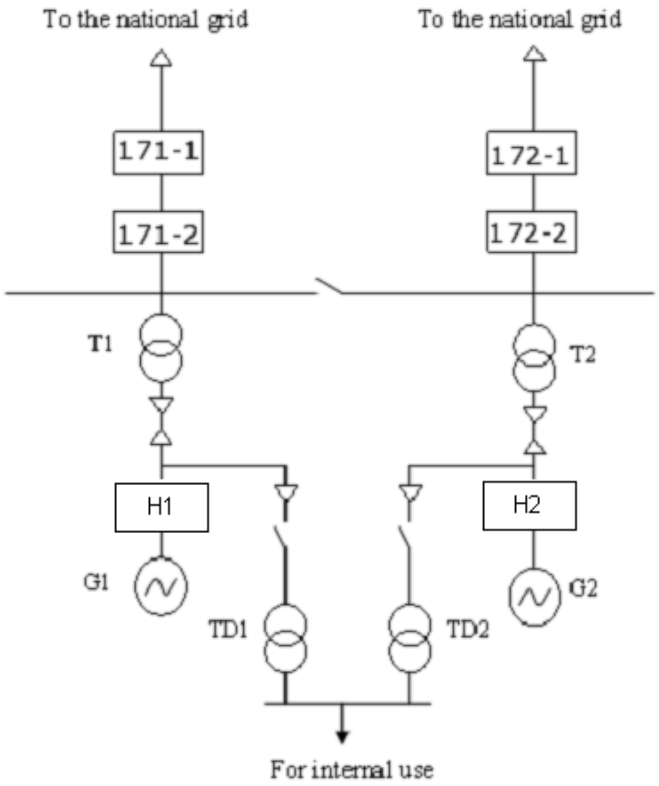

Figure 3: Meter diagram of Nam Ngan Project

Where:

The details of power meters are as below:

- T1 and T2: The transformers
- G1 and G2: The generators
- 171-1, 171-2, 172-1, 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: Parameters of power meters

Power meter	Manufacture	Position	Function	Record frequency	Calibration party and frequency
The main power	Landis & Gyr	In Nam Ngan	Amount of electricity	The end of	Third Party,

meter. Serial number 96009794 (171-1)		hydropower plant	exported to the national grid and consumed by Nam Ngan Hydropower Plant	every month	At least once every 2 years
The backup power meter. Serial number 96009793 (171-2)					
The main power meter. Serial number 96009795 (172-1)					
The backup power main. Serial number 96009796 (172-2)					
The generator power meter H1	Zhuhai Guoce (China)		Amount of electricity produced by the Generator No.1 of Nam Ngan Hydropower		
The generator power meter H2			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 any interference by Northern Electrical Testing Company of North 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.

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 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.

2. 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:

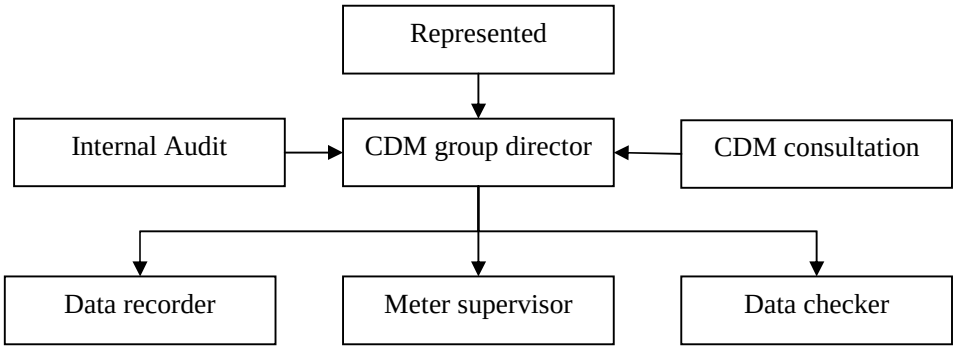

Figure 4: Structure of monitoring group.

The details of members in CDM group are as follow:

Table 4: Group members and their responsibilities:

Function[1]	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	Vuong Hai Nguyen	Deputy Manager of Nam Ngan Power plant	Check the monitoring procedure.
Data recorder	Pham Duc Hanh	Staff member	Collecting and recording data every month.
Data recorder	Dinh Trong Cuong	Staff member	Collecting and recording data every month.
Data recorder	Dinh Van Bang	Staff member	Collecting and recording data every month.
Data recorder	Dam Van Son	Staff member	Collecting and recording data every month.

[1] Group members will be adjusted based on the actual adjustment of Nam Mu Joint Stock Company

Meter supervisor	Nguyen Manh Ha	Shift leader	Checking power meter periodically according to relevant regulation.
Meter supervisor	Vu Quoc Huy	Shift leader	Checking power meter periodically according to relevant regulation.
Data checker	Vuong Hai Nguyen	Shift leader	Double check the collected data measured by power meter.
Data checker	Nguyen Danh Thoi	Shift leader	Double check the collected data measured by power meter.
Monitoring consultant	Nguyen Quang Phuong	Energy and Environment Consultancy JSC	Providing monitoring group director training and technical support about monitoring plan.

3. Calibration of metering equipment

- ❖ 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 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***

Power meters of operating period (01/09/2011-31/07/2012)

- ✓ 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 (a division of EVN which has authority for calibration of all electrical measurement equipment). During this monitoring period (01/09/2011-31/07/2012), the power meters system is in good state and no failure occurrences reported.
- ✓ Detailed information of each power meters can be found in below table:

Table 5: Technical details of main and backup power meters (171-1 and 172-1)

Technical Details	**Main meter (171-1)**	**Backup meter (171-2)**	**Main meter (172-1)**	**Backup meter (172-2)**
Serial No.	96009794	96009793	96009795	96009796
Certificate number	A6-11-100	A6-11-101	A6-11-102	A6-11-103
Model	ZMD 402 CT			
Type	3x57.7/100 ÷ 240/415V & 3 x 1(2) A			

	(Two-way and 3-phase power meter)
Accuracy level	0.2s
Operating period	01/09/2011 – 31/07/2012
Status during the operating period	Good
Manufacturer	Landis & Gyr (Switzerland)
Date of current calibration	14/07/2012
Expected date for the next calibration	05/2013
Calibration entity	Northern Electrical Testing Company of North Power Corporation
Calibration frequency	At least once every 2 years

- ***History of output generator meters – TEG of Nam Ngan hydropower***
  - ✓ The Nam Ngan hydropower plant has been started to operate since 13 June 2009. The output generator meters – Zhuhai Guoce with accuracy level 0.5s were installed and operated since then. The power meters have been calibrated by Electrical Testing Centre of Power Company 1 (The old name of Northern Electrical Testing Company of North Power Corporation) (a division of EVN which is accredited as an entity for calibration all electrical measurement equipment). During the operating period, the power meters system has been in good state with no reported problems.
  - ✓ Detailed information of each power meter can be found in the below table:

Table 6: Technical details of the 2 output generator meters (H1 &H2)

Technical Details	**Generator 1 (H1)**	**Generator 2 (H2)**
Serial No.	0801886	0801885
Certificate number	A6-11-104	A6-11-105
Model	DSSD25	
Type	3x100V & 3 x 1.5(6) A	
Accuracy	0.5s	
Operating period	13/12/2010 – 31/08/2011	
Status during the operating period	Good	
Manufacturer	Zhuhai Guoce (China)	
Date of last calibration	28/05/2011	
Expected date for the next calibration	05/2013	
Calibration entity	Northern Electrical Testing Company of North Power Corporation	
Calibration frequency	At least once every 2 years	

4. Data recording and archiving procedures

- 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 power plant will send a copy to VNEEC for secondary backup.
- All of the data should be kept for 2 years after the crediting period.

5. 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 with check the result in both main and backup power meters.

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.

6. 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 shall be provided. 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 personnel 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
- ✓ Personnel training VNEEC has cooperated with Nam Ngan HPP to establish CDM group which has full responsibility for CDM monitoring as well as data management. The short training course has started in June 2009, and it has provided Nam Ngan staffs all necessary information to monitor plant. Furthermore, Nam Ngan HPP has an internal meeting for exchanging experience and improving quality of CDM monitoring.
- ✓ History of CDM internal training in Nam Ngan hydropower project during the second monitoring period:
  - On 20/09/2010, CDM group leader (Nam Ngan Deputy Director) has conducted the internal meeting for CDM monitoring, and the purpose of internal meeting is to improve the quality of monitoring and operating. There were 35 participants who including group leader, internal audit, shift leader, monitoring and operating staffs.

8. Internal Audit

This is an internal process to confirm that the scheduled or requested Nam Ngan HPP's monitoring process is operated in proper manner to confirm to CDM monitoring. .

Regular Audit

Deputy Director shall be responsible for ensuring that internal audits are conducted at least once a year to ensure observance of the standards set forth.

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.

Occasional Audit

Occasional audit will be conducted when the Director feels a necessity for same.

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. So in the second verification period, the chairman of Nam Mu Hydropower JSC conducted management review on 15/01/2012. 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 or at renewal of crediting period

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
Purpose of data	The data are used for project emission calculation
Additional comment	For calculation of EF_{OM} or EF_{BM}

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

Data/Parameter	$EF_{CO2,i,y}$
Unit	tCO_2/GJ
Description	CO_2 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
Purpose of data	The data are used for project emission calculation
Additional comment	For calculation of EF_{OM} or EF_{BM}

Data/Parameter	$EG_{m,y}$
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
Purpose of data	The data are used for baseline emission calculation
Additional comment	For calculation of EF_{OM} or EF_{BM}

Data/Parameter	Cap_{BL}
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
Purpose of data	The data are used for Project emission calculations
Additional comment	

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 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
Purpose of data	The data are used for project emission calculation
Additional comment	

Data/Parameter	**EF_{res}**
Unit	kg CO_2e/MWh
Description	Default emission factor for emissions from reservoirs
Source of data	Default value as per EB23
Value(s) applied	90 kgCO_2e/MWh.
Purpose of data	The data are used for project emission calculation
Additional comment	For calculation of project emission (PE)

D.2. Data and parameters monitored

Data/Parameter	**$EG_{y, export}$**
Unit	MWh/yr
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 $EG_{y, export}$ does not include the electricity generated by the proposed project used for internal consumption and losses.
Value(s) of monitored parameter	49,051.138 MWh.
Monitoring equipment	- Main meter 171-1 & Backup meter 171-2 - Main meter 172-1 & Backup meter 172-2
Measuring/Reading/ Recording frequency	Continuously measured and monthly recorded
Calculation method (if applicable)	Direct measurement.
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 at least once every 2 year.
Purpose of data	Project emission
Additional comment	Calculating $EG_{BL,y}$

Data/Parameter	**$EG_{y, import}$**
Unit	MWh/yr
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
Value(s) of monitored parameter	114.166 MWh.
Monitoring equipment	- Main meter 171-1 & Backup meter 171-2 - Main meter 172-1 & Backup meter 172-2
Measuring/Reading/ Recording frequency	Continuously measurement and monthly recording
Calculation method (if applicable)	Direct measurement
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 every 2 year.
Purpose of data	Project emission.
Additional comment	Calculating $EG_{BL,y}$

Data/Parameter	**$EG_{BL, y}$**
Unit	MWh/yr
Description	Net electricity supplied to the national grid by the proposed hydropower plant
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.
Value(s) of monitored parameter	48,936.972 MWh.
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	Calculating project emission reduction
Additional comment	

Data/Parameter	Reservoir
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	1,245,000 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	Project emission.
Additional comment	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	Calculating the project emission
Additional comment	

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	50,522.672 MWh.
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	Project emission
Additional comment	Use for calculating $PE_{HP,y}$

D.3. Implementation of sampling plan

Not applicable.

SECTION E. Calculation of emission reductions or GHG removals by sinks
E.1. Calculation of baseline emissions or baseline net GHG removals by sinks

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

$$BE_y = EG_{BL,y} \cdot EF_{CO2,grid,y}$$

Where:

BE_y	Baseline emissions in the monitoring period (tCO2e)
$EG_{BL,y}$	Net electricity supplied by the Nam Ngan hydropower plant to the grid during the monitoring period (MWh);
$EF_{CO2,grid,,y}$	Emission factor of the grid (tCO_2/MWh) (0.5104 tCO_2/MWh, as calculated ex-ante in the registered PDD and will be fixed during the first crediting period).

In the second monitoring period (01/09/2011 - 31/07/2012), this project supplied to the grid a total net electricity of 48,936.972 MWh.

The baseline emission (BE_y) can be calculated as follow:

$$BE_y = EG_{BL,y} \cdot EF_{CO_2,grid,y} = (48,936.972 - 0) \times 0.5104 = 24,977\,tCO_2e$$

E.2. Calculation of project emissions or actual net GHG removals by sinks

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 2012	124.5

The power density project plant is derived as follows:

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}} = \frac{13.5 \times 10^6 - 0}{124.5 \times 10^4 - 0} = 10.84 W / m^2$$

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

E.3. Calculation of leakage

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. Summary of calculation of emission reductions or net anthropogenic GHG removals by sinks

This section includes the formula of calculating the emission reductions in monitoring period:

Time Period	**Baseline emissions or baseline net GHG removals by sinks (tCO_2e)**	**Project emissions or actual net GHG removals by sinks (tCO_{2e})**	**Leakage (tCO_2e)**	**Emission reductions or net anthropogenic GHG removals by sinks (tCO_2e)**
Total	24,977	0	0	24,977

E.5. Comparison of actual emission reductions or net anthropogenic GHG removals by sinks with estimates in registered PDD

This monitoring period, the estimated emission reduction in registered PDD is 26,912 tCO_2. The actual emission reduction is 24,977 tCO_2, or equivalent to 92.81% of estimated emission reduction.

Item	Values estimated in ex-ante calculation of registered PDD	Actual values achieved during this monitoring period
Emission reductions or GHG removals by sinks (tCO_2e)	26,912	24,977

E.6. Remarks on difference from estimated value in registered PDD

Not applicable.

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