

MONITORING REPORT DAK PSI 3 AND 4 HYDROPOWER PROJECT

Document Prepared By Kyoto Energy Pte Ltd

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1 PROJECT DETAILS

1.1 Summary Description of Project

The proposed project activity aims to construct and operate a run-of-river hydropower project with 2 cascades; namely Dak Psi 3 and Dak Psi 4. As it is run-of-river project, the proposed project design offers a particularly sensitive solution to growing energy demands when compared to an accumulation or a pumped storage project. The operation of the project will offset the combustion of thousands of tonnes of fossil fuels, which would have been used to generate electricity for the Viet Nam electricity grid in the baseline scenario. Indeed, the need for projects such as Dak Psi 3 and 4 is clearly illustrated by the fact that the contribution of hydropower and renewables to the overall supply of electricity in Viet Nam is shrinking and not growing. Currently, due to shortfalls in the amount of electricity available, Viet Nam imports electricity from China, where the grid emission factor is much higher than that of Viet Nam¹. The project will generate power to offset the combustion of thousands of tonnes of fossil fuels and, in doing so, will help preserve non-renewable resources by promoting the exploitation and use of renewable resources and technologies. Therefore, the proposed project activity is primarily implemented for power generation, and not with the purpose to create GHG emissions and their subsequent reduction, removal or destruction.

The total capacity of the project is 45MW, including 2 cascades, the first one of 15MW (Dak Psi 3) and the second of 30MW (Dak Psi 4). At present, both cascades Dak Psi 4 and Dak Psi 3 have come into operation and their first commercial operation dates were on 09/10/2010 and 29/08/2012 respectively.

The project presented herein was registered as a CDM project number 4891 on 06/11/2011, hence the VCS monitoring period is proposed from 09/10/2010 to 05/11/2011. Only Dak Psi 4 was under operation during the proposed VCS monitoring period since, as described above, Dak Psi 3 was still under construction.

The timeline of events of the project activity is presented in the table below:

Event	Date	Monitoring period
Commercial operation of Dak Psi 4	09/10/2010	VCS monitoring period
CDM registration date	06/11/2011	CDM monitoring period
Commercial operation of Dak Psi 3	29/08/2012	

The project activity generated a total of **79,544 tCO₂e** emission reductions during the monitoring period.

¹ Please refer to the List of Grid Emission Factor used in the CDM registered project activities, published by the Institute for Global Environmental Strategies (IGES):

<http://enviroscope.iges.or.jp/modules/envirolib/view.php?docid=2136> (accessed on September 2012).

1.2 Sectoral Scope and Project Type

Sectoral scope: 1. Energy industries (renewable - / non-renewable sources)

Project Type: Renewable Energy Projects

The proposed project activity is not a grouped project.

1.3 Project Proponent

Dak Psi Hydropower Investment and Development Joint Stock Company

(The Project Owner and responsible for the implementation of the proposed project activity)

Address: No. 762C, Pham Van Dong street, Pleiku city, Gia Lai province, Vietnam

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Represented by: Ms. Mau Thi Thanh Xuyen

1.4 Other Entities Involved in the Project

Kyoto Energy Pte Ltd

(VCS Consultant to Dak Psi 3 and 4 Hydropower Project)

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1.5 Project Start Date

According to VCS Standard, the project start date is the date on which the project began generating GHG emission reductions or removals. Hence for the project, start date is considered as the date of Commercial Operation Date (COD) of the first unit on 09/10/2010.

1.6 Project Crediting Period

The project's crediting period is of 10 years and renewable twice. However, as the project is already registered under CDM project, the last date of the VCS crediting period would end at the end of the 21 years of the CDM crediting period. Further, the PP confirms that for monitoring periods of this project which fall under both VCS and CDM crediting period, only one of the schemes will be used to claim emission reductions so as to avoid double counting. A written confirmation of the same is provided by the PP to the DOE in this regard.

The current crediting period under VCS starts on 09/10/2010 and lasts 10 years.

1.7 Project Location

- (a) Host Party(ies): Socialist Republic of Viet Nam
- (b) Region/ State/ Province, etc.: Kon Tum Province,
- (c) City/ Town/ Community, etc.: Dak Ha and Tu Mo Rong Districts
- (d) Physical/ Geographical location: GPS coordinates: 14°46'30"N ; 107°59'50"E

Figure .1 shows the location of the project:

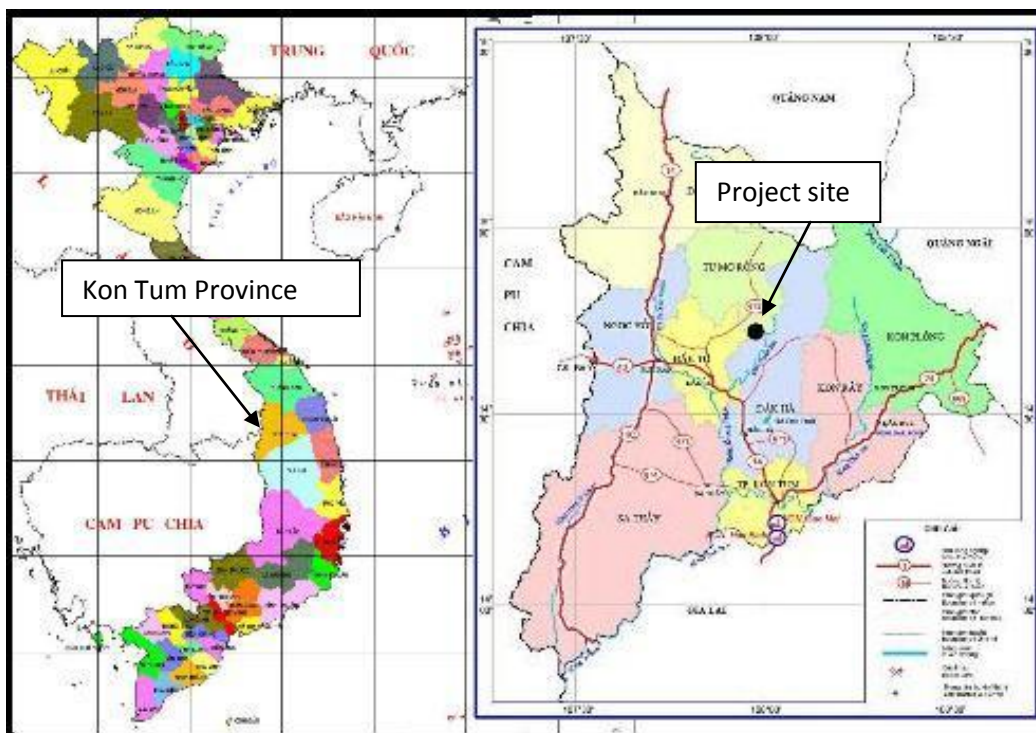


Figure 1. Project location

1.8 Title and Reference of Methodology

Selected methodology

ACM0002. “Consolidated baseline methodology for Grid Connected Electricity Generation from Renewable Sources”, version 12.1.0, EB 58 (hereafter referred as the “selected methodology”).

2 IMPLEMENTATION STATUS

2.1 Implementation Status of the Project Activity

(a) Description of the installed technology(ies), technical process and equipment utilized:

The project is a run-of-river hydropower plant with a small run-of-river reservoir and consists of two weirs and spillway dams, two penstocks, two powerhouses (containing 3 turbines and 3 generators for each cascade). The electricity generated by the project is delivered to the Viet Nam national grid via a new 110 kV transmission line.

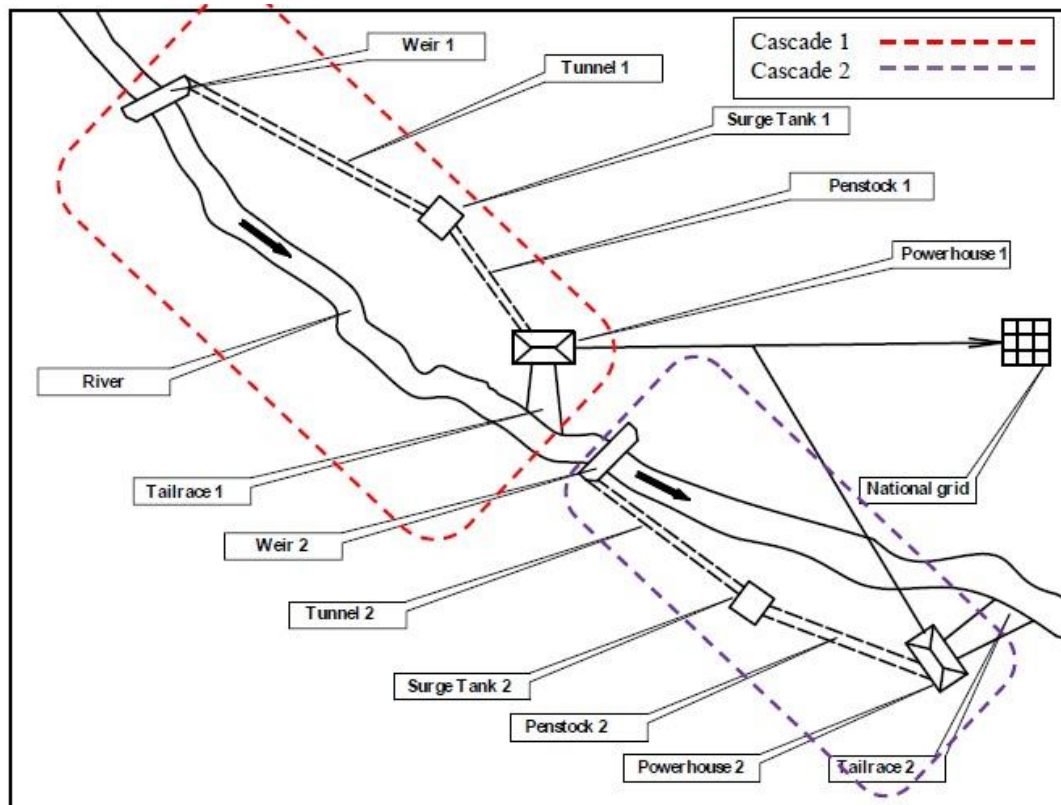


Figure 2: A schematic representation of the project activity

The table below provides the key technological characteristics of the installed turbine generator sets in the project activity.

Table 1. The main technologies used in the project.

Dak Psi 3 cascade		Value
TURBINE	Model	Francis Turbine- horizontal axis
	Quantity	3
	Capacity	5.208 MW
	Rate speed	500 rpm
	Runaway speed	946 rpm
	Efficiency	88.62%
GENERATOR	Model	3 phase synchronization with horizontal axis
	Quantity	3
	Capacity	5 MW
	Rated speed	500 rpm
	Runaway speed	946 rpm
	Cosφ	0.8
	Efficiency	96.00%

Dak Psi 4 cascade		Value
TURBINE	Model	Francis Turbine, horizontal axis
	Quantity	3
	Capacity	10.3093 MW
	Rated Speed	500 rpm
	Runway Speed	1234 rpm
	Efficiency	91%
GENERATOR	Model	3 phase synchronization with horizontal axis
	Quantity	3
	Capacity	10 MW

	Rated speed	500 rpm
	Runaway speed	1234 rpm
	Cosφ	0.8
	Efficiency	97%

It is important to note there is a slight difference in technical specifications of the Dak Psi 4 cascade when compared with the CDM registered PDD. The rated speed as mentioned in the CDM registered PDD of Dak Psi 4 turbine generator set is 600 rpm. Whereas the actually installed turbine generator set has a rated speed of 500 rpm. It is to be noted however, that there is no change in the capacities of the turbine generator set as mentioned in the PDD. As there is no change in the total capacity of the project activity, this small change in the rated speed of the turbine generator set has no impact on the applicability of the methodology or additionality of the project activity.

The changes happened at the time of installation of the turbine generator set during October 2010. The PP called tender for the procurement of the electro-mechanical equipment in February 2008. In the tender document the PP specified turbine – generator sets as per the feasibility Study (FS) prepared for the project activity for the Dak Psi 4 cascade. The FS among other technical details specifies the rated speed of the Dak Psi 4 cascade as 600 rpm. The selected supplier offered a turbine generator set matching the capacity stated the FS and which could deliver the output specified in the FS, but with a rated speed of 500 rpm instead of 600 rpm as mentioned in the FS and requested in the tender document.

(b) Implementation and actual operation of the project activity

1. The total installed capacity of the project is 45MW. However, during the monitoring period, only Dak Psi 4 cascade (30MW) operated. The Dak Psi 3 cascade's (15MW) first COD was 29/08/2012.
2. The first commercial operation date of Dak Psi 4 was 09/10/2010.

(c) Special events, situations

1. During the monitoring period, the project has been operating normally.
2. No event or situation that could impact the applicability of the selected methodology occurred during the monitoring period.

2.2 Project Description Deviations

No deviation from the Monitoring Plan.

2.3 Grouped Project

Not applicable.

3 DATA AND PARAMETERS

3.1 Data and Parameters Available at Validation

Data Unit / Parameter:	EF_{grid,CM,y}
Data unit:	tCO ₂ /MWh
Description:	Combined margin CO ₂ emission factor for grid connected power generation
Source of data:	As per the “Tool to calculate the emission factor for an electricity system” and Combined Margin defined in issued “Study, Definition of Viet Nam Grid Emission Factor, 2009” by the Department of Meteorology, Hydrology and Climate and issued by DNA
Value applied:	0.5764
Purpose of the data:	Calculation of the baseline emissions
Any comment:	-

Data Unit / Parameter:	EF_{Res}
Data unit:	kgCO _{2e} /MWh
Description:	Default emission factor for emissions from reservoirs
Source of data:	Decision by EB23
Value applied:	90
Purpose of the data:	Calculation of the project emissions
Any comment:	-

Data Unit / Parameter:	Cap_{BL}
Data unit:	W
Description:	Installed capacity of the hydro power plant before the implementation of the project activity. For new hydro power plants, this value is zero
Source of data:	Project site
Value applied:	0
Purpose of the data:	Calculation of the project emissions
Any comment:	-

Data Unit / Parameter:	A_{BL}
Data unit:	m^2
Description:	Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full. For new reservoirs, this value is zero
Source of data:	Project site
Value applied:	0
Purpose of the data:	Calculation of the project emissions
Any comment:	-

3.2 Data and Parameters Monitored

Data Unit / Parameter:	$EG_{\text{facility},y} = EG_{PJ,y}$
Data unit:	MWh/yr
Description:	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y
Source of data:	Project activity site: MM, BM1 and BM2 in case of the MM failure (see section 3.3)
Description of measurement methods and procedures to be applied:	Bidirectional meters were installed at the powerhouse to measure the amount of electricity exported to and imported from the national grid. Please refer to section 3.3 for further detail.
Frequency of monitoring/recording:	Continuous measuring Monthly reading Monthly recording
Value monitored:	138,003
Monitoring equipment:	Please see Section 5
QA/QC procedures to be applied:	Cross check measurement results with records for sold electricity. For the calibration frequency and date of the monitoring equipment, please refer to the Section 5.
Calculation method:	Not applicable
Any comment:	-

Data Unit / Parameter:	Cap _{PJ}
Data unit:	W
Description:	Installed capacity of the hydro power plant after the implementation of the project activity
Source of data:	Nameplates on generators at project site
Description of measurement methods and procedures to be applied:	The equipment specification is shown on the nameplate issued by the supplier
Frequency of monitoring/recording:	Yearly
Value monitored:	30,000,000
Monitoring equipment:	Not applicable
QA/QC procedures to be applied:	Not applicable
Calculation method:	Not applicable
Any comment:	-

Data Unit / Parameter:	A _{PJ}
Data 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.
Source of data:	Water level gauge at project site & area-level chart
Description of measurement methods and procedures to be applied:	The area is corresponding to the maximum water level recorded during the monitoring period.
Frequency of monitoring/recording:	Yearly measuring, reading and recording of the reservoir area
Value monitored:	306,715
Monitoring equipment:	Water level gauge on the side of the reservoir
QA/QC procedures to be applied:	Value cross check with official documentation
Calculation method:	Area calculated based on water level measurements and the area- level chart
Any comment:	-

3.3 Description of the Monitoring Plan

3.3.1. Description of the monitoring plan.

The system is composed of three energy meters (1 main and 2 backups) belonging to the grid operator EVN and used as the source of data for the calculation of emission reductions. The location of each instrument is indicated schematically in the monitoring diagram shown in Fig.3 :

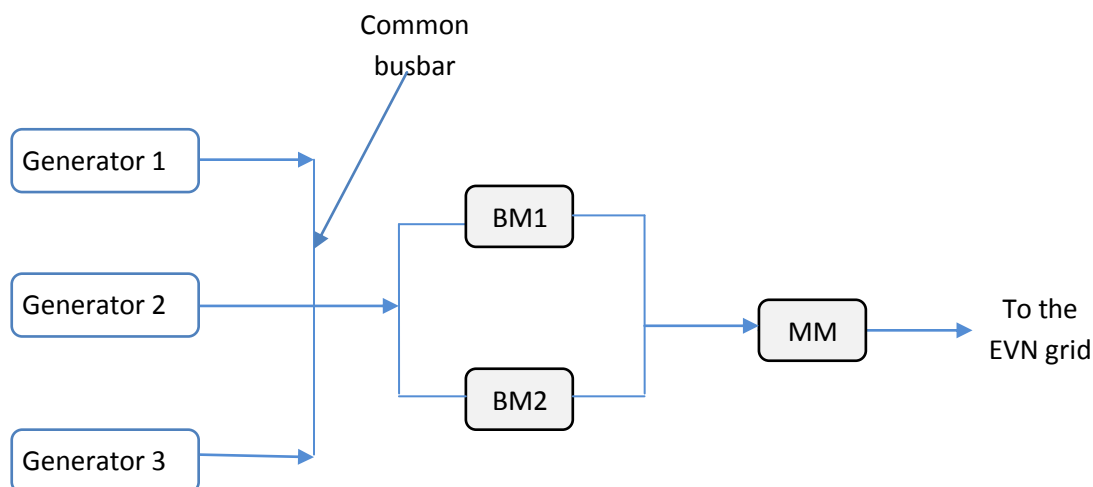


Figure 3: Schematic representation of the meters location on the electric circuit for Dak Psi 4 cascade

- MM is the main meter. It measures the electricity generation while taking into account both export and import from the national grid. The MM is the source of data for the EVN receipts.
- BM1 and BM2 are the backup meters. They are used to compare with the records from the main meter, and used as record source in case the main meter fails (see section 3.3.4).

3.3.2. Organizational structure, responsibilities and competencies.

The organizational structure, responsibilities and competencies are composed of the following staff:

Table 1: CDM Monitoring Team Details

Report to:	Position	Names
Dak Psi Hydropower Investment and Development Joint Stock Company	Project Director	Vu Hong Tuyen
	Assistant manager/ Supervisor	Doan Vinh Quang
	Operator/ Head of Shift	Trinh Van Dung
	Operator	Ha Huy Tien
	Operator	Mai Van Duy
	Operator	Do Manh Tien
	Operator	Nguyen Van Dien
	Operator	Kieu Cao Ba
	Operator	Tran Huy Doan
	Operator	Nguyen Van Thuc
	Operator	Tran Quoc Sinh
	Operator/ Head of Shift	Nguyen Thanh Tien
Kyoto Energy Pte Ltd	CDM Consultant/ Project manager	David Louis Shaw

Table 2: Allocation of monitoring responsibilities

#	Tasks description (and frequency)	Operator	Supervisor	Project director	CDM consultant
Monitoring activity					
1	Recording of monitored data	✓			
Quality Assurance & Quality Control					
2	Verification of data monitored (consistency and completeness)		✓		
3	Ensuring adequate training of staff		✓		
4	Ensuring adequate maintenance		✓		
	Ensuring calibration of monitoring instruments		✓		
5	Data archiving: ensuring adequate storage of data monitored (integrity and backup): 2 years after the end of the crediting period.			✓	
6	Identification of non-conformance and corrective/preventive actions and monitoring plan improvement.		✓		
7	Emergency procedures		✓		
8	External audit				✓
Calculation of GHG emission reductions and reporting					
9	Processing of data and calculation of emission reductions			✓	✓
10	Monitoring report: management review of monitoring report (internal audit)			✓	

3.3.3. Description of methods for generating, recording, storing, aggregating, collating and reporting data on monitored parameters

The log files are kept for a minimum of 2 years after the end of the last crediting period by using paper documents and electronic files.

The log files are stored on various media (CD-ROM and hard disks) at several locations (plant, headquarters and CDM consultant server).

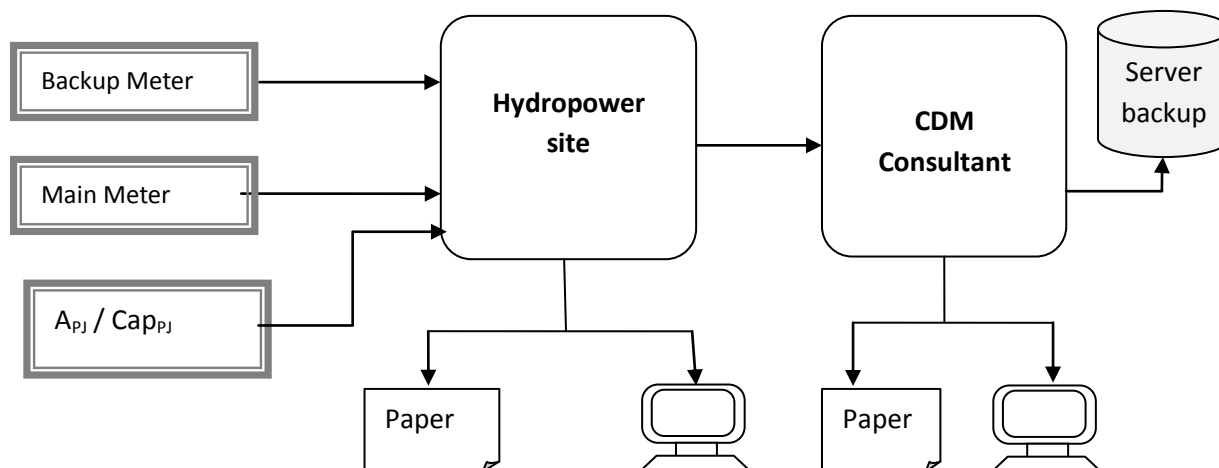


Figure 4: Monitoring data flow chart

The daily internal record procedure is as follows: everyday at midnight the operator on duty takes a reading of the three main meters and inputs these values into the Excel logfile on the site computer.

The preparation of the EVN receipt is as follows: At the beginning of every month, representatives of Dak Psi Investment and Development Joint Stock Company and of Central Power Company (EVN-CPC) come to the site. The meters keep in their memory the values recorded at the end of the last day of previous month, so that they can take a joint reading and prepare the receipt together. Readings are taken for both main and backup meters. The sale receipt prepared at the site serves as basis for the payment.

3.3.4. Internal auditing and non-conformities

Internal auditing:

- **Data treatment and verification:**

A verification of the data recorded was performed by:

- The spot check of field instruments by staff; and
- The comparison between the main meter and backup meter.

- **Maintenance and calibration of monitoring instrument:**

Calibration takes place to ensure that the monitoring equipment is correctly installed and functioning properly. The instrument manifest is available in Section 5.

Calibrations for the main and backup meters are performed by Central Electrical Testing Company which is a subsidiary of EVN. The calibration frequency of the energy meters are one year.

Non-conformities:

Non conformities are internally defined as any incidents affecting the project or its monitoring (e.g.: calibration delay, data loss, instrument malfunction, change in project implementation, etc.) They feature various severities and some of them may lead to data reconstruction (emergency procedure), request for deviation from the monitoring plan (see section 2.2), whereas some others may not require any particular corrective measures (e.g. temporary grid outage).

In the event that the metering system suffers any failure, damage or unexpected problems, or if any errors in the main metering systems are detected during calibration, the electricity exported is measured as follows:

- Using the results of the backup system;
- Should the backup system also suffer a breakdown, the electricity exported is proposed by reconstructing data by means of trend analysis (taking a conservative approach).

4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

The Baseline emissions are calculated as follows:

$BE_y = EG_{PJ,y} * EF_{grid,CM,y}$				(1)
Where:	Description	Units	Value	
BE_y	Baseline Emissions in year y	tCO ₂	79,544	
$EG_{PJ,y}$	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity during the monitoring period	MWh	138,003	
$EF_{grid,CM,y}$	Combined margin CO2 emission factor for the grid connected power generating in year y	tCO ₂ /MWh	0.5764	

Refer to the table in section 4.4 to get details on the monthly emission reductions.

4.2 Project Emissions

According to methodology ACM0002, in order to calculate the power density, the below formula is used:

Power density: $PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}} \quad (2)$			
Where:	Description	Units	ID/value
PD	Power density of the project activity	W/m ²	97.81
Cap_{PJ}	Installed capacity of the hydropower plant after the implementation of the project activity	W	30,000,000
Cap_{BL}	Installed capacity of the hydropower plant before the implementation of the project activity (W). For new hydropower plants, this value is zero	W	0
A_{PJ}	Area of the reservoirs measured in the surface of the water, after the implementation of the project activity, when the reservoirs are full	m ²	306,715
A_{BL}	Area of the reservoirs measured in the surface of the water, before the implementation of the project activity, when the reservoirs are full (m ²). For the new reservoir, this value is zero	m ²	0

As per the registered PDD and the selected methodology, the power density of the project is greater than 10 W/m², hence there are no project emissions due to the implementation of the project activity. It has to be noticed that the highest the power density, the lowest the carbon footprint of the project (smaller reservoir area for a given capacity). Thus the proposed project activity is particularly

Therefore:
$$PE_y = 0 \quad (3)$$

4.3 Leakage

As per the selected methodology and the registered PDD, the project does not need consider leakage.

Therefore:
$$LE_y = 0 \quad (4)$$

4.4 Summary of GHG Emission Reductions and Removals

Below are the detailed amounts of Emission reductions generated by the project over the monitoring period:

Table 4: Monthly emission reductions

Year	Period	Net electricity generation	Project Activity Emissions	Leakage	Grid emission factor	Emission Reductions
		EG	PE	LE	$EF_{grid,CM}$	ERs
		kWh	(tCO _{2e})	(tCO _{2e})	tCO _{2e} /MWh	tCO ₂
		(A)	(B)	(C)	(D)	$(C)=A*D/1000-B-C$
2010	09/10/2010-31/10/2010	6,791,020	0	0	0.5764	3,914
	01/11/2010-30/11/2010	18,178,290	0	0	0.5764	10,478
	01/12/2010-31/12/2010	8,905,080	0	0	0.5764	5,133
2011	01/01/2011-31/01/2011	5,455,987	0	0	0.5764	3,145
	01/02/2011-28/02/2011	3,762,230	0	0	0.5764	2,169
	01/03/2011-31/03/2011	3,714,563	0	0	0.5764	2,141
	01/04/2011-30/04/2011	3,467,494	0	0	0.5764	1,999
	01/05/2011-31/05/2011	6,395,217	0	0	0.5764	3,686
	01/06/2011-30/06/2011	4,580,043	0	0	0.5764	2,640
	01/07/2011-31/07/2011	13,757,969	0	0	0.5764	7,930
	01/08/2011-31/08/2011	18,128,051	0	0	0.5764	10,449
	01/09/2011-30/09/2011	19,914,817	0	0	0.5764	11,479
	01/10/2011-31/10/2011	21,519,352	0	0	0.5764	12,404
	01/11/2011-05/11/2011*	3,432,480	0	0	0.5764	1,978
Total		138,002,593	0	0	0.5764	79,544

* For the last month, daily site records were used in order to account for the exact generation during this

fraction of month.

The totals may not match due to rounding. Please refer to the excel spreadsheet for the detailed calculations.

5 ADDITIONAL INFORMATION

5.1 – Benefit to local community

The proposed project activity is particularly contributing to the improvement of the local community along the three pillars of the sustainable development:

A - Environmental benefits:

The proposed project activity has positive impacts with respect to the environment. It is offsetting fossil fuel use and lowering greenhouse gas emissions while helping the country to cope with the growing demand of energy.

An Environmental Impact Assessment (EIA) has been prepared by an independent third part consultant and has been approved by local authorities. It mainly results in showing that the project is not harmful to the environment since there are no endangered species within the project area and since the land is of poor quality of the ecosystem. Further, any potential negative impacts (such as the noise and the dust during the construction) will be mitigated and monitored as stated in official documents. It has specifically to be highlighted that since the project is located in steep slope, the water of the river used in the plant is not suitable for fish habitat. Hence the project does not impact the aquatic ecosystem which is not the case of most accumulation / storage hydropower plants.

Besides, thanks to its implementation, the project will contribute to raise the awareness on climate change among the local community (through the stakeholder meeting) or at a larger scale through the donation of part of the CER revenue to the Vietnam Environment Protection Fund (for further details, please see the “economic benefits”).

Finally, the power density of the proposed project activity is far above the UNFCCC threshold of 10 W/m² for project emission calculation. This means that the carbon foot print of the project is particularly low for a hydropower project and that the potential damage to the environment is very limited.

B - Social benefits

As per the Environmental Impact Assessment approved, new roads have been constructed and are now connecting remote villages.

Besides, the project is also improving the local economy through local employment during both the construction period (short-term jobs) and the operation (long-term jobs) of the plant. Some of these jobs require high level of expertise which is contributing to the increase of the local standard of living. The local knowledge will also increase due to the transfer of technology.

Finally, it has to be highlighted that this project activity is of small scale and that no residential land is impacted. Thus, no indigenous people have to resettle due to the implementation of the proposed project activity.

C - Economic benefits

In Viet Nam, all the CDM registered projects especially beneficial for the local community. Indeed, as per the Vietnamese Circular No: 58/2008/TTLT-BTC-BTN&MT issued by the Ministry of Natural Resources and Environment and by the Ministry Of Finance, 1.2% of the CER revenue from the implementation of Renewable Energy Sources projects will be given to the Vietnam Environment Protection Fund (VEPF). This money will notably be used for supporting the propagation, disseminate information and improve the public awareness in relation to climate change and CDM.

The economy will also be improved both at a small scale (job creation) and at larger scale since it is satisfying the growing energy demands within the region and the country.

5.2 – Instrument manifest of the electricity meters

Please find below the instrument manifest of the electricity meters of the proposed project activity.

Data / Parameter	Tag	Model, serial number and manufacture	Accuracy class	Calibration frequency	Calibration dates	Calibration Validity	Event during the monitoring period
Main meter	MM	Type: Energy meter Manufacturer: Elster Model: A1700 Serial: 10001847	0.2%	1 years	29/07/2010 15/07/2011	28/07/2011 14/07/2012	None
Backup meter	BM1	Type: Energy meter Manufacturer: Elster Model: A1700 Serial: 10018260	0.5%	1 years	29/07/2010 15/07/2011	28/07/2011 14/07/2012	None
Backup meter	BM2	Type: Energy meter Manufacturer: Elster Model: A1700 Serial: 10018259	0.5%	1 years	29/07/2010 15/07/2011	28/07/2011 14/07/2012	None