MONITORING REPORT
50 MW SIPANSIHAPORAS HYDRO POWER PLANT NORTH SUMATRA

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Contact Information:

Project Title	50 MW Sipansihaporas Hydro Power Plant, North Sumatra
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Table of Contents

1 PROJECT DETAILS

1.1 Summary Description of Project

The 50 MW Sipansihaporas Hydro Power Plant, North Sumatra (hereinafter refer to project activity) is a new run-of-river type hydro power plant. Total installed capacity of the project is 50 MW, comprised of a 33 MW and 17 MW turbines. Stringing a circuit of the existing 150 kV single circuit transmission lines, which is being operated from Sibolga substations, connects the project to the grid. The length of the new lines from each power station to the substation is 7.8 km and 0.9 km respectively.

The project is owned and developed by PT. PLN (Persero), a state-owned electricity company. The project supplies electricity to the connected Sumatra grid.

The Sipansihaporas Hydroelectric project was registered as VCS project with Project ID 486. Further background on this project can be found in the Voluntary Carbon Standard Project Description (VCS PD).

Prior to the implementation of the project activity there is no existing power generation at the project location, electricity in grid is generated mainly from fossil fuel sources and is solely distributed to consumers via the electricity grid.

According to the registered VCS-PD, the project emission of the project activity is measured from diesel fuel quantity in diesel genset operational data logbook. PP has proposed 'Deviation on Monitoring Plan' to change the $FC_{i,y}$ parameter source of data from measured to calculate (detail on section 2.2 'Project Description Deviations' and section 3.3.3. ad II 'Total diesel oil consumption, from the operational of DG Set').

The emissions reduction of the project for crediting period 01 April 2009 – 31 March 2010 is 120,184 t CO_2.

Vintage Year	Emissions Reduction			Unit
	SIPAN 1 (33 MW capacity)	**SIPAN 2 (17 MW capacity)**	**TOTAL MU 1 + 2**	
1 April 2009 – 31 December 2009	34,118	41,331	**75,451**	tCO_2e

1 January 2010 – 31 March 2010	21,860	22,872	**44,733**	tCO_2e
Total (individual unit)	**55,978**	**64,203**	**120,184**	tCO_2e

1.2 Sectoral Scope and Project Type

Sectoral scope : 01. Energy industries (renewable - /non-renewable sources)

Project Type : I. Renewable energy project

Project Category : Grid connected electricity generation from renewable sources

1.3 Project Proponent

PT. PLN (Persero) – the project owner of '50 MW Sipansihaporas Hydro Power Plant, North Sumatra'

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South Pole Carbon Asset Management Ltd., - the VER Consultant and Buyer of project activity

Address	: Technoparkstr.1 8005 Zurich, Switzerland
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Represented by	: Mr. Renat Heuberger
Email	: registration@southpolecarbon.com

1.4 Other Entities Involved in the Project

Not applicable

1.5 Project Start Date

As per the VCS policy announcement from the 10 September 2008, the project start date is the date on which the project activity began reducing or removing GHG emissions.

Following are the two units' commissioning date:

- Sipansihaporas Hydro Power Plant Unit 1: 14 December 2004 (commissioning certificate)
- Sipansihaporas Hydro Power Plant Unit 2: 21 October 2002 (commissioning certificate)

Thus, the project start date is when project activity starts reducing emissions is 21 October 2002, as the earliest project start date of two units at Sipansihaporas Hydro Power Plant.

1.6 Project Crediting Period

- HEPP Project starting date : 21 October 2002
- VCS Crediting period start date : 01 April 2006
- VCS crediting period : 10 years (01-Apr-2006 until 31-Mar-2016)

1.7 Project Location

The project area of the Sipansihaporas Hydropower Plant is situated in North Sumatra Province at about 344 km south of Medan city as the capital city of North Sumatra province and 12 km east of Sibolga as the capital city of Tapanuli Tengah district. The principal structures of the Sipansihaporas project such as the main dam and waterway are situated in the downstream of the confluence of the three tributaries upstream of the Sipansihaporas River, which are Sarumanggita river, Natolbak river and Bargot river. The water flows from Sipansihaporas River with total catchment area of 196 km^2 for power station no. 1, and 210 km^2 for power station no. 2, with a yearly average flow of 28,5 m^3/sec.

The exact location to Sipansihaporas Hydropower Plant :

Power Station	North Latitude	East Longitude
Sipansihaporas #1 power station	1.74058 N	98.86711 E
Sipansihaporas #2 power station	1.72882 N	98.84018 E

The location of the project site is shown in the following maps:

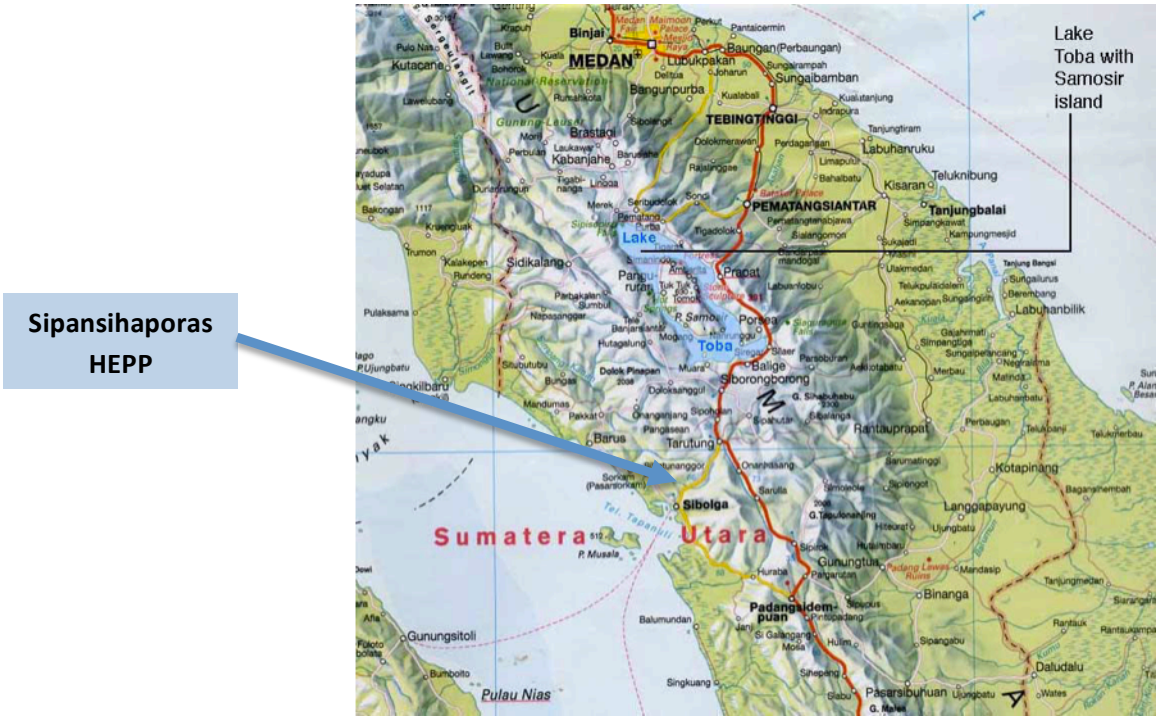

Figure 1 - Location of Sipansihaporas Hydroelectric Power Plant

1.8 Title and Reference of Methodology

Approved consolidated baseline methodology ACM0002 - Consolidated baseline methodology for grid-connected electricity generation from renewable sources, Version 10 (EB 47 annex 7).

Sectoral scope 01 - Energy Industries (renewable-/non-renewable sources).

2 IMPLEMENTATION STATUS

2.1 Implementation Status of the Project Activity

- From the validated VCS PD Version 3, dated 06 November 2009, it is known that with installed capacity of 50 MW, the power plant has the potential to generate power about 214,800 MWh per year, estimated. During this monitoring period, the project activity has generated power of 162,086 MWh with details as below:

1. 01 April – 31 December 2009 : 101,757 MWh
2. 01 January – 31 March 2010 : 60,329 MWh

- In the emission reduction calculation, the net quantity of electricity supplied to the grid by the project activity during this monitoring period is less than its value recorded in Joint Meter Recording (JMR/ Monthly Electricity Transfer Protocol Report). The lower values of the net quantity of electricity supplied to the grid is determined conservatively by applying the maximum permissible error of the instrument to the measured values as per paragraph 4(a) of Annex 60, EB 52[1] due to incomplete information on the Calibration Certificates in 2005.

2.2 Project Description Deviations

The project developer has requested Deviation of Monitoring Plan for several parameters with details below:

A. Deviation to parameter $EG_{PJ,y}$

As per validated VCS PD, PP must monitor parameter $EG_{PJ,y}$ as described in the baseline methodology of ACM0002 – Consolidated methodology for grid-connected electricity generation from renewable sources (Version 10, 28th May 2009, EB 47).

Subject	Original Monitoring Plan as per validated VCS PD	Deviation of the Monitoring Plan
QA/QC procedures to be applied:	The QA/QC will be conducted through cross-checking with sales electricity receipts. Meters will be calibrated on yearly basis according to the national standard or other documents. Data measured by meters will be cross-checked by electricity sales receipts. The meter (s) will either: i) be read frequently and jointly by the	The QA/QC will be conducted through cross-checking the kWh meter reading at the generation unit with the Water Tax payment report issued by North Sumatera Province Tax Office (local government). Meters at generation unit will be calibrated once every five-year according to the national regulation (refer to http://www.esdm.go.id/regulasi/permen/cat_view/64-regulasi/70-peraturan-menteri/276-peraturan-menteri-esdm/219-tahun-2008.html) The meter at the Generation Unit (Main meter at the transaction point) will be read regularly and jointly by the person in charge

[1] EB 52 Annex 60 "Guidelines for assessing compliance with the calibration frequency requirements"

	generation unit and transmission unit, ii) be read by the project proponent (generation unit) and the data will then be double checked with the electricity sales receipts using comparison meter iii) only be read by the grid company (transmission department). Monitoring Frequency: Monitoring is continuous with monthly recording of data.	from Generation unit and Transmission unit. Monitoring Frequency: Monitoring is continuous with monthly recording of data.
Any comment:		

B. Deviation to parameter $FC_{PJ,y}$

As per validated VCS PD, PP must monitor parameter $FC_{PJ,y}$ as described in the latest version of the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" (Version 02, 2nd August 2008, EB 41).

Subject	Original Monitoring Plan as per validated VCS PD	Deviation of the Monitoring Plan
Description of measurement methods and procedures to be applied:	Fuel consumption will be recorded monthly, specifically for each fuel (currently only diesel consumption is available). Fuel consumption will be calculated from static graduated level gauges on the fuel injection tanks by using emergency diesel genset, resulted in litres then	Fuel consumption will be recorded monthly, specifically for each fuel (currently only diesel consumption is available). Fuel consumption will be calculated based on diesel oil purchase receipt. If the purchase receipt not

	converted to tonnes using fuel specific density or scientifically proven fuel densities.	available for particular month, the largest purchase amount in any of the latest three months is taken for conservative estimation. Fuel consumption value in litres is converted to tonnage using fuel specific density or scientifically proven fuel densities.

C. Editorial correction on Unit of parameters $FC_{i,j,y}$ and $NCV_{i,y}$ and $COEF_{i,y}$

Summary Table of Deviation for editorial nature :

Subject	Original Monitoring Plan as per validated VCS PD	Deviation of the Monitoring Plan
C.1 (on equation 8)	Unit for FC (litre / year) Unit for COEF (tCO_2 / litre)	Unit for FC (ton / year) Unit for COEF (tCO_2 / ton)
C.2 (on Parameter Table "$NCV_{i,y)}$	Unit for COEF (tCO_2 / litre) Unit for NCV (GJ / kg)	Unit for COEF (tCO_2 / ton) Unit for NCV (TJ / ton)

Explanation for above list of Deviations C.1 and C.2 (Project Emission calculation in the equation) shown below:

Equation 8 : $PE_{FC,j,CO2} = \Sigma FC_{i,j,y} \times COEF_{i,y}$

Equation 9 : $COEF_{i,y} = NCV_{i,y} \times EF_{CO2,i}$

so that : $PE_{FC,j,CO2} = \Sigma FC_{i,j,y} \times NCV_{i,y} \times EF_{CO2,i}$

The unit shown on the table was not fully correct. (Equation 9) parameter $COEF_{i,y}$ comes from $NCV_{i,y}$ times $EF_{CO2,i}$ (0.043 TJ/t.fuel x 74.1 tCO_2/TJ = 3.1863 tCO_2/ton fuel). From that equation, the unit for $COEF_{i,y}$ was supposed to be **tCO_2/ton** fuel.

This parameter unit would then give the correct unit of $PE_{FC,j,CO2}$ in **t.CO_2/year** (after multiplying by $\Sigma FC_{i,j,y}$ with unit of **ton** fuel **/ year**)

2.3 Grouped Project

The specified project is not a part of a grouped project.

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:	Grid Emission Factor of Sumatra
Source of data:	DNA of Indonesia http://pasarkarbon.dnpi.go.id/web/index.php/komnasmpb/read/14/faktor-emisi-jaringan-listrik-sumatera-dan-jamali-2008.html
Value applied:	0.743
Purpose of the data:	The data is used for baseline emission calculation as per 'Tool to calculate the emission factor for an electricity system', Version 01.1 29 July 2008 (EB 35, Annex 12).
Any comment:	The 2008 grid emission factor has been crosschecked with the 2006 value, which was with 0.855 tCO_2/MWh significantly higher and therefore less conservative. Hence, following the tool by using the most current data available at submission to validation and in terms of conservativeness the emission factor of 2008 is the appropriate value to be used in the emission reduction calculation.

Data Unit / Parameter:	**$NCV_{i,y}$**
Data unit:	TJ / ton fuel
Description:	Net calorific value of diesel fuel
Source of data:	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied:	0.043
Purpose of the data:	The data is used for project emission calculations as per approved methodology ACM0002, "Consolidated monitoring for zero-emissions grid-connected electricity generation from renewable sources", Version 10
Any comment:	

Data Unit / Parameter:	**P_i**
Data unit:	kg/m^3

Description:	Density of diesel fuel
Source of data:	Pertamina diesel fuel specification[26]
Value applied:	0.815 kg/liter = 815 kg/m^3
Purpose of the data:	The data is used for project emission calculations as per approved methodology ACM0002, "Consolidated monitoring for zero-emissions grid-connected electricity generation from renewable sources", Version 10
Any comment:	

Data Unit / Parameter:	**$EF_{CO2,i,y}$**
Data unit:	tCO_2/TJ
Description:	Weighted average CO_2 emission factor of diesel fuel in year 'y'
Source of data:	IPCC default value is used (Source: 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Workbook volume 2 chapter 1 Table 1.4).
Value applied:	74.1
Purpose of the data:	The data is used for project emission calculations as per 'Tool to calculate project or leakage CO2 emissions from fossil fuel combustion' (version 02)
Any comment:	

3.2 Data and Parameters Monitored

Data Unit / Parameter:	**$EG_{PJ,y}$**
Data unit:	kWh
Description:	Net electricity supplied to the grid by the project activity during the year y
Source of data:	kWh meter at project activity site (switchyard) The electricity generation's data used for monitoring is the monthly electricity generation report delivered to grid signed by both parties of generation department and transmission department (Joint Meter

[26] http://www.pertamina.com/index.php?option=com_content&task=view&id=3262&Itemid=697

	Reading).
Description of measurement methods and procedures to be applied:	Electricity supplied to the grid will be measured by a watt-hour meter (connected to a digital control system and recorded continuously), which can measure export and import electricity data separately. Net electricity delivered to the grid would be the difference of export and import electricity. The Electricity Transfer Protocol Report form will be the basis for calculation of the emission reductions. The joint meter reading taken at the transaction point is witnessed by the presence of P3B officials as transmission department and the PP representative as generation department. The accuracy class of main and back up meter is 0.2
Frequency of monitoring/recording:	The measurement of electricity supplied to the grid will be conducted by joint meter reading taken at the transaction point on a regular basis (monthly), where monthly data is recorded and continuous total electricity measurement will be available. The measurement results will be summarized in regular production reports.
Value monitored:	162,410,650
Monitoring equipment:	Type: Digital Watt-hour meter type ACTARIS SL7000 (Main Meter) Accuracy class: 0.2 Serial Number: 36027177 (MU 1) 36027137 (MU 2)
QA/QC procedures to be applied:	The QA/QC will be conducted through crosschecking the main meter reading report (Monthly Electricity Protocol Report) at the transaction point with the Water Tax report/receipt. The main meters at the transaction point will be read frequently and jointly by the person in charge from PLN Sipansihaporas HEPP Generation Unit and PLN Transmission Unit. Meters at the transaction point will be calibrated once every five-year according to the national regulation[2]. The date of 1st calibration: 28 July 2005 The date of 2nd calibration: 10 April 2010
Calculation method:	Net electricity supplied to grid is calculated as the difference between EG_{export} and EG_{import} ($=EG_{export} - EG_{import}$).
Any comment:	n.a

[2] the Ministry of Energy and Mineral Resource's regulation number 37 year 2008 dated November 27, 2008 on the Grid Code Sumatra Electricity Power System, the calibration of kWh meter must be done every 5 (five) years, as stated in the Metering Code section, MC 4.1.1 (Test after metering code commissioning, page 138), http://www.esdm.go.id/regulasi/permen/cat_view/64-regulasi/70-peraturan-menteri/276-peraturan-menteri-esdm/219-tahun-2008.html

Data Unit / Parameter:	$FC_{i,y}$
Data unit:	Ton
Description:	Amount of diesel fuel used in the hydropower plant operation during the year y.
Source of data:	Calculated – Project Owner – diesel fuel purchase receipt
Description of measurement methods and procedures to be applied:	Fuel consumption is calculated from the monthly diesel oil purchase report of the diesel generators. The average annual amount of diesel oil purchase is taken and applied for every months in the reported monitoring period, then converted to ton using fuel specific density or scientifically proven fuel densities.
Frequency of monitoring/recording:	Fuel consumption will be recorded monthly, specifically for each fuel (currently only diesel consumption is available).
Value monitored:	1.14 ton (1,400 liter)
Monitoring equipment:	-
QA/QC procedures to be applied:	No equipment is use to measure the actual diesel oil consumption. The operator of Sipansihaporas Generation Unit will record the diesel oil consumption assumption on the historical card, whenever they operate the DG set. The diesel oil purchase receipt will be crosschecked with this historical card.
Calculation method:	Converted from litre to ton using the density of diesel.
Any comment:	The value applies for fuel consumption calculation the average annual amount taken from the diesel oil purchase receipt (diesel oil was purchase on June, July and August 2009 during this monitoring period). This average value of 116.67 l/month is then applied for the whole crediting months. (116.67 l/month x 12 months). : 116.67 l/month * 12 month/year * 0.815 kg/liter = 1.14 ton/y Fuel consumption will only occur in emergencies when power plant is not operational and the grid is also not available, a confluence of events which is expected to happen very rarely; at other times the plant will run on grid electricity. DG set usage is only for critical instrument/control system during turbine trip and shutdown.

3.3 Description of the Monitoring Plan

This section details the steps taken to monitor on a regular basis the GHG emissions reductions from the Sipansihaporas Hydroelectric Power Plant Project in Indonesia in accordance with ACM0002 version 10.

The Monitoring Plan for this project has been developed to ensure that the project collects and archives complete data from the very start.

3.3.1 Monitoring period

The monitoring period covers 01 April 2009 to 31 March 2010 (both days included)

Period prior to 01 April 2009 was not covered under this Monitoring Period, for the older vintage VCU demand was considered being less attractive.

3.3.2 Monitoring organization

The monitoring team has been established and integrated within the existing organization structure of Sipansihaporas hydropower plant prior to the start of the verification[3]. Clear roles and responsibilities are assigned to all staff involved in the VCS project and the prospect of nominating a VCS Manager have been considered. The VCS Manager has the overall responsibility for the monitoring system on this project.

All other VCS monitoring staff will have clearly defined roles and responsibilities. The VCS manager will manage the process of training new staff; ensure trained staff performs the monitoring duties as necessary; and ensure that where trained monitoring staff is absent, the integrity of the monitoring system is maintained by other trained staff.

A formal set of monitoring procedures is established prior to the start of the verification. These procedures will detail the organization, control, and the steps required for certain key monitoringsystem features, including:

a) VCS staff training

b) VCS data and record keeping arrangements

c) Data collection

d) VCS data quality control and quality assurance

e) Equipment maintenance

[3] the PLN Pandan Sector Office manages the Sipansihaporas HEPP Generation Unit. During the crediting period of 01 April 2009 – 31 March 2010 no specific VCS monitoring team has been established. Therefore, the existing organization structure of Sipansihaporas HEPP Generation Unit was assigned by PLN Pandan Sector Office to monitor the VCS project.

Subsequently, the PLN Pandan Sector has formed the VCS Monitoring Team (for both Sipansihaporas and Lau Renun VCS Project) through the 'Keputusan Manajer PT PLN (Persero) Sektor Pembangkitan Pandan Nomor : 067.K/MSPDN/2012' letter (or Management Decision Letter of PT PLN (Persero) Pandan Generation Sector Office No : 067.K/MSPDN/2012).

f) Equipment calibration

g) Equipment failure

The procedures will be agreed and signed off by PT PLN (Persero) and South Pole Carbon Asset Management Ltd. Any changes to procedures will need to be agreed by both parties. The VCS manager will be responsible for ensuring that the procedures are followed on site and for continuously improving the procedures to ensure a reliable monitoring system is established.[4]

3.3.3 Monitoring equipment and installation

Considering that the emission factor is calculated *ex-ante* and according to the Monitoring Methodology ACM0002 version 10, the only data to be monitored is electricity supplied to the grid by the project (detailed in section 3.2). The primary instruments include:

Metering of Electricity Supplied to the Grid

The main electricity meter for establishing the net electricity delivered to the grid (detailed in section 3.2) is installed at the Sipansihaporas power plant. This electricity meter will be the main meter (revenue meter), measuring the quantity of electricity supplied (net electricity delivered) to the grid that will be paid by the PLN. Net electricity delivered to the grid would be the difference of electricity export and import. As this meter provides the main VCS measurement, it will be the key part of the verification process. The main meter is located at the Sipansihaporas power station. The main electricity meter reading record (Joint Meter Reading) then recorded on the Monthly Transfer Electricity Protocol Record (METPR).

The main electricity meter read together by representatives from PT PLN (Persero) Generation Division (PT PLN (Persero) Generation Unit Sipansihaporas HEPP) and PT PLN (Persero) Load Dispatcher and Transmission Division (PT PLN (Persero) Sibolga Sub-Station). Since both parties are under the same Head Company (PT PLN (Persero)), no other check meter (comparison meter) installed at the transaction point.

Electricity meters should meet the relevant local standards at the time of installation and will be calibrated by the manufacturer before installation. The meters will be installed by the project according to the Indonesian standard “Standard Electricity Meter Equipment”. Records of the meter (type, make, model, and calibration documentation) will be retained in the quality control system on-site.

[4] The Pandan Sector has implemented the key monitoring system as mentioned above by having the PLN monitoring system on their management system.
As part of the PLN management system requirement, Sipansihaporas HEPP has develop some SOPs as follow:

- SOP tp read the Electricity Meter
- SOP to calibrate the Test and Measurement equipment.
- SOP to develop an Electricity Transfer Monthly Protocol Report (BAP)
- SOP for Electricity Transfer
- SOP for Emergency Response
- SOP for Line Charging

All those SOPs are in-line with the need for VCS project at Sipansihaporas HEPP. Therefore, no need to develop a new SOP for VCS Project. Sipansihaporas VCS Team would continue to follow the SOP during the monitoring period. Newly developed SOP for VCS Monitoring would make available after the activation of the VCS Monitoring team.

All equipment will be calibrated by the manufacturer according to relevant local standards at the time of installation and maintained in accordance with the manufacturer's recommendations to ensure accuracy of measurements. Records of the meter (type, make, model, calibration, and maintenance documentation) will be retained as part of the VCS monitoring system.

Main Meter Quality Control

The project developer owns the meter and is responsible for its maintenance and calibration, as stated in the SOPs agreed upon with the PLN. PLN and its representative are entitled to be present during any test, inspection, maintenance, and replacement of any part of the metering system, which will be performed by the meter manufacturer on request of the project developer.

The project developer specifies the QC (flow-chart) procedure for calibration of test and measurement equipment (SOP to calibrate the Test and Measurement equipment) to ensure the measurement accuracy of values shown by the instrument / measuring device and test or a measurement system (one of the instrument mentioned on this SOP is the electricity meter). The calibration can be done internally or externally depend on the type of measuring equipment and resource capability. The electricity meter located at the Sipansihaporas HEPP project site is calibrated by the external party.

The Power Plant Operator would periodically check if all tools and equipment work in a good condition as per the SOP[5]. In the event of any broken security seal in the metering system; or when the system fails to register, or if the measurement result is found upon testing to vary more than the allowable error from the standard meter used in the test, then an adjustment shall be made correcting all measurements of energy made by the metering system, as described in the SOP.

No check meter (comparison meter) installed at the transaction point. In case of failure of the main meter, production meter and own consumption meter (hereinafter refer as cross-check meters) located at generation site of each power generation unit will be read to measure the quantity of electricity exported from the project. The difference between electricity produced and consumed on-site shall be valid for claiming carbon credits. In the special case of total failure of all meters no credits will be claimed during such period.

The operator of Sipansihaporas HEPP will read the main meter and cross-check meters continuously and if the difference between the respective main meter and cross-check meters exceeds the maximum error for such meters then all meters shall be tested in turn. The main meter shall be used as transfer data and provide a letter of agreement.

During testing, if all meters are found to be working beyond the permissible limits of error, then the electricity delivered for the previous billing month shall be corrected to account for this error. The meters shall be calibrated and data will be calculated manually.

[5] http://kepustakaan-presiden.pnri.go.id/uploaded_files/pdf/government_regulation/normal/UU_2_1981_soeharto.pdf

During calibrations interval[6], if the main meter is found to be within the permissible limits of errors, and the cross-check meters are found to be beyond the permissible limits of errors, the main meter shall be used for electricity delivered.

In case, during the annual tests, the main meter is found to be beyond the permissible limit of error but cross-check meters are found to be within the permissible limit of error, then cross-check meters reading shall be used for electricity delivered.

In case, during annual tests, both, the main meter and the cross-check meters are found to be beyond the permissible limit of error, then the meters shall be replaced with spare set of calibrated meters. Moreover, the electricity delivered for this period (from the date of last calibration) shall be corrected for the maximum error in meters.

There was no metering devices breakdown or malfunction during the following monitoring period (01 April 2009 – 31 March 2010). All the meters listed above have performed well. However, any plant shut down or any other malfunctions are recorded in the logbook. In case of failure of the main meter, will use the production meter and the plant own consumption meter (which were also located at generation site of each power generation unit) as cross-check meters, measuring the quantity of electricity exported from the project. The difference between electricity produced and consumed on-site shall be valid for claiming carbon credits. In the special case of total failure of all meters no credits will be claimed during such period.

Data recording procedure

The procedures for collecting the electricity meter data is outlined in the Standard Operating Procedure as explained below.

The procedures for collecting the electricity meter data will be outlined in the Standard Operating Procedure signed between the project owner and the Grid Operator (both are under PLN)[7]. All relevant data will be archived electronically and backed up regularly. Uncertainty will be considered to achieve conservative results. Moreover, it will be kept for the full crediting period, plus two years after the end of the crediting period or the last issuance of VCUs for this project activity (whichever occurs later). The Monitoring Plan would develop to ensure that the project has robust data collection, processing, and archiving procedures.

[6] According to the national regulation, namely the Ministry of Energy and Mineral Resource's regulation number 37 year 2008 dated November 27, 2008[6] on the Grid Code Sumatra Electricity Power System, the calibration of kWh meter must be done every 5 (five) years (instead of yearly basis as described in the PDD). This is stated in the Metering Code section, MC 4.1.1 (Test after metering code commissioning, page 138)

[7] Sipansihaporas HEPP is following the "Prosedur Pembuatan BA Pengiriman Energi Listrik PLTA Sipansihaporas" or the 'Procedure to develop Sipansihaporas HEPP Monthly Electricity Protocol Report' as the detail procedure for Electricity Transfer to the Sumatera Grid. This procedure is a further development refer to the General Operational Procedure for PLN generation unit located in the North and South Sumatera, titled "Prosedur tetap transfer tenaga listrik antara PT PLN (Persero) Pembangkitan Sumbagut, PT PLN (Persero) Pembangkitan Sumbagsel dengan PT PLN (Persero) P3B Sumatera"

Procedure for Joint Meter Reading (JMR) as per 'Procedure to develop Monthly Electricity Protocol Report' in general view:

- Joint meter reading by operator from Generation Unit (Unit Pembangkitan / UP) and Transmission Service Unit (Unit Pelayanan Transmisi / UPT P3B) conducted on the first date of each month at 10 A.M

- Operating and maintenance supervisor (O & M supervisor) responsible for recording the amount of EG imported and exported by Generation unit as the result from kWh meter downloading.

- Operating and maintenance supervisor responsible for constructing the electricity generating protocol report, which includes calculation of net electricity delivered to PLN transmission unit. This report has to be reported and signed by Unit Manager, which will then be further reported to the Sector Manager. VCS manager will have the copy of such report and be notified as well.

- O & M supervisor with other authorized staff from Generation unit will extract the data by downloading via computer from the kWh electronic meter and then record it in the form of Monthly Electricity Protocol (MEP), which shall be signed by both Generating unit (PLN Sipansihaporas Generation Unit) and PT. PLN P3B (Tragi Sibolga / Sibolga Sub-station). The joint meter reading taken at the transaction point is witnessed by the presence of P3B officials as transmission department and the PP representative as generation department.

- The MEP will be then rechecked by authorized person from PT. P3B (UPT Pematang Siantar / Pematang Siantar Transmission Unit) and PT PLN Generation Sector Office (Pandan Sector Office).

After all such information is rechecked and agreed by all related parties, the MEP will be signed by all authorized parties from Generation unit and Transmission unit. The report will thus be sent to PLN Medan as headquarter for all power plant units in North Sumatra.

All relevant data will be archived electronically and backed up regularly. Uncertainty will be considered to achieve conservative results. Moreover, it will be kept for the full crediting period, plus two years after the end of the crediting period or the last issuance of VCUs for this project activity (whichever occurs later). The Monitoring Plan has been developed to ensure that the project has robust data collection, processing, and archiving procedures.

Main Electricity Meter specification:

Serial Number	Type	Factory	Class	Location
MAIN METER (SIPAN 1)				
36027177	SL 7000 (Digital)	Actaris	0.2s	Main electricity meter 1 (SIPAN 1) → to monitor electricity supply from turbine SIPAN 1
MAIN METER (SIPAN 2)				

36027137	SL 7000 (Digital)	Actaris	0.2s	Main electricity meter 2 (SIPAN 2) → to monitor electricity supply from turbine SIPAN 2
PRODUCTION METER (Generator 1)				
47246	F3A-K22UB (Analog)	FE	-	Production electricity meter 1 → to monitor electricity generation from turbine SIPAN 1
PRODUCTION METER (Generator 2)				
41673	F3A-K22UB (Analog)	FE	-	Production electricity meter 2 → to monitor electricity generation from turbine SIPAN 2
OWN CONSUMPTION METER (PS 1)				
36000599	SL 7000 (Digital)	Actaris	0.5s	Own Consumption meter 1 (PS 1) → to monitor electricity own consumption at the SIPAN 1 power plant unit.
OWN CONSUMPTION METER (PS 2)				
36013142	SL 7000 (Digital)	Actaris	0.5s	Own Consumption meter 2 (PS 2) → to monitor electricity own consumption at the SIPAN 2 power plant unit.

Picture of the main meter is shown below:

Figure 3 - Picture of main meter and production meter

Total diesel oil consumption, from the operational of DG Set

The Project Emission resulted from the consumption of diesel oil for the operational of Emergency Diesel Generator Set (Emergency DG Set). No equipment available on the project activity site to measure the actual diesel oil consumption ($FC_{i,y}$ monitoring parameter). Hence, Fuel consumption will be calculated based on diesel oil purchase receipt.

If the purchase receipt not available for particular month, the average diesel oil purchase amount is taken for conservative estimation. For conservative approach, we use the average purchase amount of 116.67 litres for each and every month in this monitoring period. The calculation is shown on section 4.2.2.

3.3.4 VCS data collection and record keeping arrangements

Every month the Operation Supervisor from Renun Generation Unit (member of VCS Team) and Transmission Sub-station read the meter together and record the data on their journal. Based on this reading, a monthly electricity generation report was signed by both the generation department (Sipansihaporas HEPP Generation Unit) and the transmission department (Tragi Sidikalang).

At the end of each month the monitoring data needs to be filed electronically. The electronic files need to have CD back-up and/or print-out. The project developer needs to keep electricity sale and purchase invoices. All written documentation such as maps, drawings, the EIA and the Feasibility study, should be stored for the crediting period and two years afterwards, and be made available to the verifier so that the reliability of the information may be checked.

4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

4.1.1 Formula used for baseline emissions calculation

The formula used for determination of the baseline emissions are described in section 4.3 of the registered VCS PD Ver. 3 dated 10th November 2009.

Baseline emissions are calculated as follows:

$BE_y = EG_{PJ,y} \times EF_{grid,CM,y}$ (1)

Parameter	Description	Unit	Value	Source
BE_y	Baseline emission during the period April'09 – March '10	tCO_2/year	120,188	Equation (1)
$EG_{PJ,y}$	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the project activity in April'09 – March '10	MWh/yr	162,086	Monthly Electricity Protocol Report (adjusted with 0.2% conservative deduction)
$EF_{grid,CM,y}$	Combined margin CO_2 emission factor for grid connected power generation in year y	tCO_2/MWh	0.743	Indonesian DNA published grid emission factor for Sumatra.

4.1.2. Baseline emissions calculation

Vintage Year	EG Facility (MWh) SIPAN 1		EG Facility (MWh) SIPAN 2		BE_y (tCO_2e)		
	Actual monitored value	Conservative deducted 0.2% accuracy class	Actual monitored value	Conservative deducted 0.2% accuracy class	SIPAN 1	SIPAN 2	Total BE_y
1 April - 31 December 2009	46,107	46,015	55,854	55,743	34,121	41,334	75,454
1 January - 31 March 2010	29,541	29,482	30,909	30,847	21,861	22,873	44,734
TOTAL	75,648	75,496	86,763	86,589	55,982	64,207	**120,188**

The calculation for Baseline Emissions was based on MWh data from the main meter. As explained on the section 2.1, 'Implementation Status of the Project Activity', conservatively we apply deduction of 0.2 % according to the main meter's accuracy class due to incomplete information on the calibration certificate issued in 2005.

4.2 Project Emissions

4.2.1 Formula used for project emissions calculation

The formula used for determination of the baseline emissions are described in section 4.3 of registered VCS PD Ver. 3 dated 10th November 2009.

Project emissions are calculated as follows:

$$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y} \quad (2)$$

Parameter	Description	Unit	Value	Source
PE_y	Project emission in year y	tCO_2e/yr	Calculated	Equation (2)
$PE_{FF,y}$	Project emissions from fossil fuel consumption in year y	tCO_2/yr	Calculated	"Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion"
$PE_{GP,y}$	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year y	tCO_2/yr	0	*Not applicable.* Project activity is not a geothermal powerplant.
$PE_{HP,y}$	Project emissions from water reservoirs	tCO_2/yr	0	*Not applicable.* Sipansihaporas HEPP is a run-off river hydro powerplant.

$PE_{FF,y} = PE_{FC,j,CO2}$,

$PE_{FC,j,CO2} = \Sigma FC_{i,j,y} \times COEF_{i,y}$ (3)

Parameter	Description	Unit	Value	Source
$PE_{FC,j,CO2}$	CO_2 emissions from fossil fuel combustion in process j during year y	tCO_2/y	**4.00** *Note :* 3.00 (for year 2009) 1.00 (for year 2010)	Equation (3) % PEy to BEy = **0.0033%**
$FC_{i,j,y}$	Quantity of fuel type I combusted in process j during the year y	ton/y	**1.14** *Note :* 0.86 (for year 2009) 0.29 (for year 2010)	Measured in litre than converted into ton

$COEF_{i,y}$	CO_2 emission coefficient of fossil fuel type i in year y	tCO_2/ton	3.1863	Equation (4)
i	Fuel types combusted in process j during year y	-	i= Diesel oil	Sipansihaporas HEPP

$COEF_{i,y}$ is calculated using option B. Option B calculates $COEF_{i,y}$ based on net calorific value and CO_2 emission factor of fuel type i, as follows:

$$COEF_{i,y} = NCV_{i,y} \times EF_{CO2,i} \quad (4)$$

Parameter	Description	Unit	Value	Source
$COEF_{i,y}$	CO_2 emission coefficient of fossil fuel type i in year y	tCO_2 / ton fuel	3.1863	Equation (4)
$NCV_{i,y}$	Weighted average net calorific value of fuel type i in year	TJ/ton fuel	Diesel Fuel: 0.043	IPCC 2006 default for diesel oil
$EF_{CO2,i}$	Weighted average CO_2 emission factor of fuel type i in year y	tCO_2/TJ	Diesel Fuel: 74.1	IPCC 2006 default for diesel oil
i	Fuel types combusted in process j during year y	-	i=Diesel oil	Sipansihaporas HEPP

4.2.2 Project emissions from the consumption of fossil fuels

Year	Fuel Consumption (ton)	PEy (tCO2/year)	% PEy to BEy
2009 (Apr – Dec)	0.86	3.00	0.0040%
2010 (Jan – Mar)	0.29	1.00	0.0022%

4.3 Leakage

No leakage emissions are considered. The main emissions potentially giving rise to leakage in the context of electric sector projects are emissions arising due to activities such as power plant construction and upstream emissions from fossil fuel use (e.g. extraction, processing, transport). These emissions sources are neglected.

$$LE_y = 0$$

4.4 Summary of GHG Emission Reductions and Removals

4.4.1 Formula used for emission reductions calculation

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y \quad (5)$$

Parameter	Description	Unit	Value	Source
BEy	Baseline emissions in the period *y*	tCO_2e	Calculated	Equation (1)
PEy	Project emissions in the period *y*	tCO_2e	Calculated	Equation (2)
ERy	Project emission in the period y	tCO_2e	Calculated	Equation (3)

4.4.2 Emission reduction calculation

Vintage Year	Unit	Corrected BE_y with deduction of 0.2%			PE_y	Corrected ER with deduction of 0.2%		
		SIPAN 1 (33 MW capacity)	SIPAN 2 (17 MW capacity)	TOTAL		SIPAN 1 (33 MW capacity)	SIPAN 2 (17 MW capacity)	TOTAL
1 April - 31 December 2009	tCO2e	34,121	41,334	75,454	3.00	34,118	41,331	**75,451**
1 January - 31 March 2010	tCO2e	21,861	22,873	44,734	1.00	21,860	22,872	**44,733**
TOTAL	**tCO2e**	**55,982**	**64,207**		**4.00**	**55,978**	**64,203**	

5 ADDITIONAL INFORMATION

A. **Electricity Supply Sipansihaporas HEPP**

ELECTRICITY SUPPLY SIPANSIHAPORAS HEPP
01 APRIL 2009 - 31 MARCH 2010

YEAR	MONTH	UNIT	SIPAN 1	SIPAN 2	IMPORT SIPAN 1	IMPORT SIPAN 2	NET SUPPLY SIPAN 1	NET SUPPLY SIPAN 2	TOTAL SUPPLY
2009	JAN								
2009	FEB								
2009	MAR								
2009	APR	kWh	1,624,460	3,585,800	99,210	16,250	1,525,250	3,569,550	5,094,800
2009	MAY	kWh	1,156,400	2,715,790	168,580	22,760	987,820	2,693,030	3,680,850
2009	JUN	kWh	3,536,340	3,936,540	32,140	49,200	3,504,200	3,887,340	7,391,540
2009	JUL	kWh	4,089,700	4,575,820	164,610	21,520	3,925,090	4,554,300	8,479,390
2009	AUG	kWh	7,268,830	8,055,440	151,730	4,210	7,117,100	8,051,230	15,168,330
2009	SEP	kWh	6,717,930	7,850,120	282,120	10	6,435,810	7,850,110	14,285,920
2009	OCT	kWh	6,548,300	7,516,380	250,160	60	6,298,140	7,516,320	13,814,460
2009	NOV	kWh	7,423,630	7,284,220	196,350	2,530	7,227,280	7,281,690	14,508,970
2009	DEC	kWh	9,280,160	10,452,000	193,990	1,210	9,086,170	10,450,790	19,536,960
2010	JAN	kWh	8,656,170	9,170,980	44,150	24,190	8,612,020	9,146,790	17,758,810
2010	FEB	kWh	10,606,740	10,872,960	7,350	14,550	10,599,390	10,858,410	21,457,800
2010	MAR	kWh	10,346,710	10,923,640	17,340	20,190	10,329,370	10,903,450	21,232,820

B. **Turbine Operational Hours**

Operational Hour Data Recapitulation for 50 MW Sipansihaporas HEPP

YEAR	MONTH	DAY	UNIT	GEN 1	GEN 2	TOTAL	%	Average Operation Hour per day for Gen 1	Average Operation Hour per day for Gen 2
2009	APR	30	hr/month	-	366.50	366.5	25.10%	-	12.22
2009	MAY	31	hr/month	-	283.73	283.73	19.43%	-	9.15
2009	JUN	30	hr/month	184.10	214.12	398.22	27.28%	6.14	7.14
2009	JUL	31	hr/month	214.13	216.14	430.27	29.47%	6.91	6.97
2009	AUG	31	hr/month	351.70	337.05	688.75	47.17%	11.35	10.87
2009	SEP	30	hr/month	341.77	348.72	690.49	47.29%	11.39	11.62
2009	OCT	31	hr/month	418.80	342.65	761.45	52.15%	13.51	11.05
2009	NOV	30	hr/month	432.15	242.31	674.46	46.20%	14.41	8.08
2009	DEC	31	hr/month	458.28	439.47	897.75	61.49%	14.78	14.18
2010	JAN	31	hr/month	410.32	417.96	828.28	56.73%	13.68	13.93
2010	FEB	28	hr/month	485.05	483.30	968.35	66.33%	15.65	15.59
2010	MAR	31	hr/month	476.02	504.57	980.59	67.16%	15.87	16.82
Total Operation Hour for period Apr'09 - Mar'10				3,772.32	4,196.52	7,968.84	45.48%		

MAXIMUM MONTHLY OPERATIONAL HOURS FROM TWO TURBINES

1,460 hr/month