Monitoring Report

210 MW Musi Hydro Power Plant,

Bengkulu

(VCS Database Project ID 487)

Monitoring period – 01/04/2009 to 31/03/2010 (both days included)

Monitoring report No.4
Date and version no. – 23/08/2011, version 4

Net Emission Reduction : 568,898 tCO_2e

ER vintage for year 2009 : 421,938 tCO2e
ER vintage for year 2010 : 146,960 tCO2e

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1. Project Background

Musi Hydroelectric Power Plant is a new run-of-river type hydro power plant. Total installed capacity of the project is 210 MW, consisting of three (3) x 70 MW turbines. The project is owned and developed by PT. Perusahaan Listrik Negara (PT.PLN), a state-owned electricity company. The project supplies electricity to the connected Sumatra grid.
The Musi Hydroelectric project was registered as VCS project[1]. Further background on this project can be found in the Voluntary Carbon Standard Project Description (VCS PD).
Parties involved are Indonesia (Host Country) and Switzerland (Other Parties).

The Musi Hydroelectric Power Plant is located in Bengkulu Province, Indonesia, at the latitude and longitude of 03° 37' 6.59" S, 102 º 27' 25.87" E, about 30 km northeast of Bengkulu City or about 2.5 hours car drive.

2. Project Implementation and sustainable development

2.1 Implementation status

The Project has been completed and commisioned since 19 July 2006. The power plant has been generating a total of 765,677 MWh_e, during this 4th monitoring period from 01 April 2009 to 31 March 2010. The project classified as 'large scale grid connected renewable electricity generation' because it has installed capacity 210 MW and connected to the grid. The calculated emission reductions achieved by the project activity within this period is 568,898 tCO_2e. The emission reduction is divided into ER vintage for year 2009 and 2010.
The emission reduction credits are calculated and reported in more details in Section 4 of this monitoring report. These credits are to be verified and claimed as Voluntary Carbon Units (VCUs).

2.2 Operation of the project

Overall the power plant has been successfully managed and operated by a team of competent personnel. Its performance has been satisfactorily and in line with the design. The design has not changed compared to the PD.

2.3 Sustainable development

The project has strongly contributed on the sustainable development at social, economic, environmental and technological aspects as explained below:

Social well-being:
- The project contributes to the development of the region by increasing community development and corporate social responsibility of PT. PLN (Persero)
- During the construction and operation, there are various kinds of work, which generate employment on regular and permanent basis.

Economic well-being:
- The project activity generates employment in the local area which is a developing region.
- The generated electricity is fed into regional grids through the local grid, thereby improving the grid frequency and availability of electricity to local consumers (villagers and sub-urban inhabitants). Due to

[1] https://vcsprojectdatabase1.apx.com/mymodule/ProjectDoc/EditProjectDoc.asp?id1=487

increased grid reliability, new opportunities for industries and economic activities arise along with prospects for local employment and overall development.
- The project activity leads to diversification of the national energy supply, which is dominated by conventional fuel based generation units.
- The project activity contributes to the economic sustainability around the plant sites, which is encouraging economic power decentralization.

Environmental well-being:
- The project utilizes hydropower to generate electricity, which otherwise would have been generated through alternative fuel- (most likely fossil fuel-) based power plants. This contributes to a reduction in specific emissions (emissions of pollutant/unit of energy generated), including GHG emissions.
- As hydroelectric power projects do not produce end-products in the form of solid waste (ash,etc.), they do not have to cope with the problem of solid waste disposal encountered by most other sources of power.
- Being a renewable energy source, hydro energy is used to generate electricity that contributes to resource conservation.

Technological well-being:
- The project supports high quality equipments transfer from other regions and even other countries, and contributes to capacity building of the labor force through training and practical work.
- The project promotes local products developed in the region, when replacement of spare parts is necessary, and supports renewable technology development especially for hydroelectric power technology.

2.4 Actual emission reductions

The fourth monitoring period is from 01 April 2009 to 31 March 2010. During the period, the actual emission reduction is 568,898 ton CO_2. Detailed calculations of the emissions can be found in section 4 of this monitoring report.

3. Compliance with the monitoring methodology

The project personnel and management has conducted the monitoring activities by following the monitoring plan presented in the PD and in accordance with the following approved methodology and tool:

Applied methodology

ACM0002 – Consolidated baseline methodology for grid connected electricity generation from renewable sources (Version 10, EB 47)

Applied tool

"Tool for demonstration and assessment of additionality" (version 05.2)
"Tool to calculate the emission factor for an electricity system" (version 02)
"Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" (version 02)

3.1 Monitoring period

The 4th monitoring period covers 01 April 2009 to 31 March 2010 (both days included)

3.2 Monitoring equipment and installation

Given 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.

Metering of Electricity Supplied to the Grid

Musi HEPP is consists of three (3) x 70 MW turbines. The main electricity meter of each power generation unit for establishing the electricity delivered to the grid is installed at the transaction point of Musi Power Plant and PLN grid (150 kV Transmission line). This electricity meter will be the main meter (revenue meter) that measures the quantity of electricity supplied to the grid that will be paid by the PLN. As this meter provides the main VCS measurement, it will play a key role in the verification process.

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 or designated national body on request of the project developer.

To ensure maximum data availability and to introduce data quality controls, three crosscheck meters are installed in addition to the revenue meter for each power generation unit. Those meters are located at the Musi power station, measuring electricity production from the project and own consumption.

Electricity meters have met the relevant local standards at the time of installation. Before the installation of the meters, they calibrated by the manufacturer on July 28, 2005 (at Balai Pengelolaan Laboratorium Kemetrologian[2]). The meters installed by the project developer according to the manufacturer's standard (ACTARIS). Records of the meter (type, make, model and calibration documentation) is shown in the Table 1 below.

3.3 Monitoring parameters

The parameters monitored applied for the determination of the emission reductions is described in detail in section 3.3 of the VCS PD Version 3.1, 23 August 2011. Several changes have made to complete the monitoring of the project with details described in the 'Deviation of the monitoring plan of 210 MW Musi Hydro Power Plant, Bengkulu'. The deviation proposal will only affect this current monitoring period (01 April 2009 – 31 March 2010). For the next monitoring period, the procedures will remain the same as indicated in the registered VCS PD Version 3, 09 November 2009.

The simplified diagram of all measurement devices installed and their relative position is presented in Figure 1 below. Primary instruments are shown with numbers. The primary instruments include:

- Total net electricity transferred, as measured by three electricity meters with code name VA TECH#1, VA TECH#2, VA TECH#3 located at the transaction point (150 kV transmission line) as main data.
- Total diesel oil consumption for 3 emergency diesel generators located at MCH, Intake and Re-regulating Dam)

[2] Indonesian Calibration Office

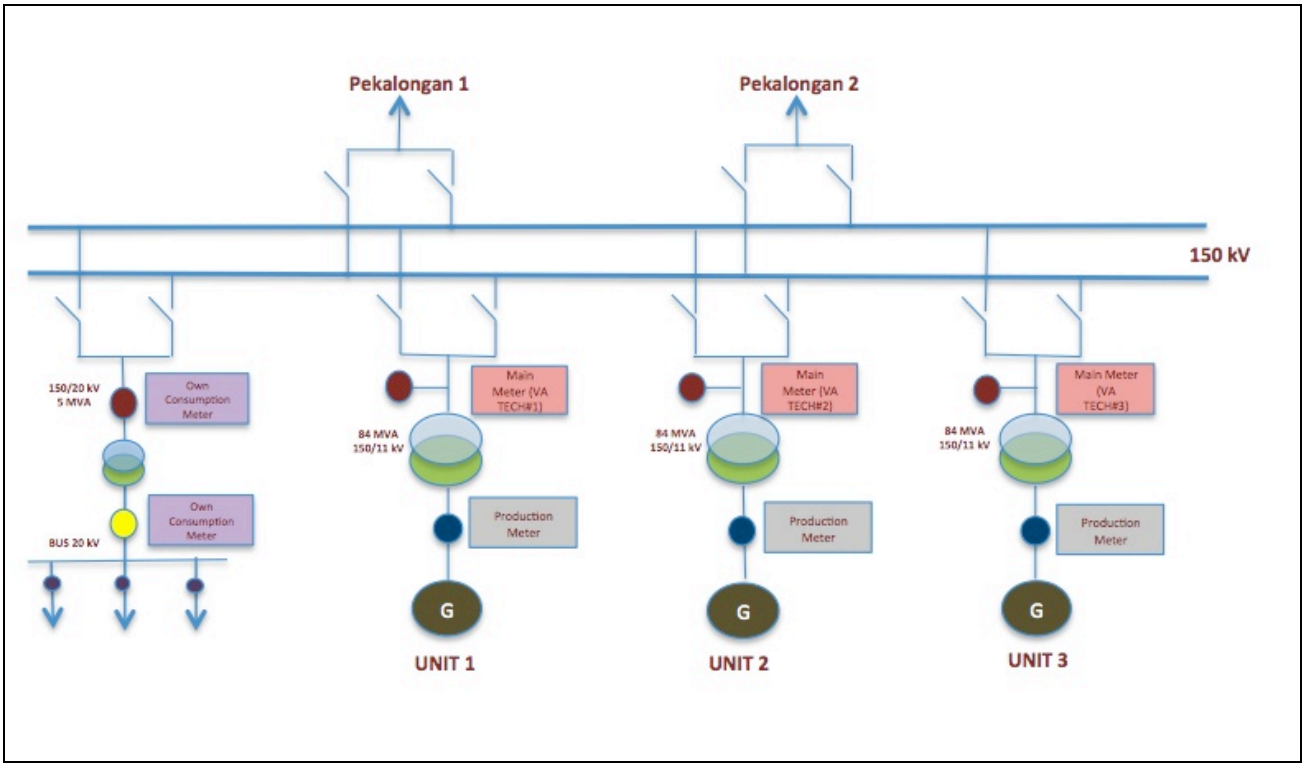

Figure 1 Project's Simplified Schematic Diagram, including relative position of its metering devices

Table 1 below summarizes parameters that are monitored against requirement in the PDD. Readings from all instruments listed in this table are logged on the basis as mandated by the PD.

Table 1. Key monitored parameters, its relevant instrument, and estimated values in the PD.

PD Ref	Output of measurements	Unit	Source of Data as required in section 3.3 of PD	Instruments Installed Instrument's Accuracy
EG_y (VCS PD Point 3.3 page 25)	Electricity supplied by the project activity to the grid	kWh	**kWh meter at project activity site (switchyard)** The electricity generation's data used for monitoring is the monthly electricity generation/protocol report "Berita Acara tentang Penyerahan dan Penerimaan kWh Penyaluran" delivered to grid. This monthly report was signed by both parties of generation department and transmission department (as Joint Meter Reading). These readings are taken from main meter located in main control house, which acts as the transaction point. These readings are also stored in a computer based on SCADA system. Hence there are no possibilities of manual errors to be occurred during the transposition between data sets.	**Main Meter:** Digital Watt-hour meter type ACTARIS SL7000, Class 0.2 **Serial Number :** Meter from Generation Unit 1 (VA TECH#1) : 36027156 Meter from Generation Unit 2 (VA TECH#2) : 36027159 Meter from Generation Unit 3 : 36027158 **Check Meter (at each Power Generation Unit) :** Digital Watt-hour meter type ACTARIS SL7000, Class 0.2 **Serial Number :** Meter at Generation Unit 1 : 36049453 Meter at Generation Unit 2 : 36050371 Meter at Generation Unit 3 : 36049455 **Calibration Interval:** Meters will be calibrated once every five years according to

				national regulation[3].
				QA/QC procedures to be applied: The QA/QC will be conducted through crosschecking the kWh meter reading at the transaction point with the Water Tax payment receipt issued by Bengkulu Province Tax Office (local government).
$FC_{i,y}$ (VCS PD Point 3.3 page 26)	Amount of diesel fuel used in the hydropower plant operation	ton	Calculated - Project Owner - Maximum running hours of the diesel generators in monthly basis	Fuel consumption will be recorded monthly, specifically for each fuel (currently only diesel consumption is available). Fuel consumption is calculated from the maximum running hours of the diesel generators in monthly basis, converted to litres using the fuel consumption default from engine manufacturer datasheet on 100% load. Then, liters shall be converted to tonnes using fuel specific density or scientifically proven fuel densities.
				QA/QC procedures to be applied: Not required as most conservative figures are considered
				Any comment: 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. Emergency diesel genset is only for critical instrument/control system during turbine trip and shutdown.

Table 3. Fix ex-ante parameters, its relevant instrument, and estimated values in the PD.

PD Ref	Output of measurements	Unit	Source of Data as required in section 3.3 of PD
$EF_{grid,CM,y}$	Grid emission factor of Sumatra	tCO_2/MWh	DNA of Indonesia http://pasarkarbon.dnpi.go.id/web/index.php/komnasmpb/read/14/emission-factors-for-sumatera-and-jamali-grid-2008.html CDM_Grid_Sumatera_JAMALI_2008. EF value for Grid Sumatera 0.743
$NCV_{i,y}$	Net caloric value of diesel fuel	TJ/ton	2006 IPCC Guidelines for National Greenhouse Gas Inventories: Workbook volume 2 chapter 1 Table 1.2: IPCC default value: 0.043
P_i	Density of diesel fuel	kg/m^3	Pertamina diesel fuel specification[4] Value used: 815

[3] The Ministry of Mineral and Energy Resource's regulation Number 37 year 2008

[4] Pertamina Solar Characteristic

$EF_{CO2,i,y}$	Weight average CO_2 emission factor of diesel fuel in year'y'	tCO_2/TJ	IPCC default values is used (Source: 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Workbook volume 2 chapter 1 Table 1.4) IPCC default values: 74.1

Metering the net electricity supplied to the grid by the project activity during the year y

Musi HEPP is following the "Prosedur Pembuatan BA Pengiriman Energi Listrik PLTA Musi" or the 'Procedure to develop Musi 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 title, "Prosedur tetap transfer tenaga listrik antara PT PLN (Persero) Pembangkitan Sumbagut, PT PLN (Persero) Pembangkitan Sumbagsel dengan PT PLN (Persero) P3B Sumatera"

By this SOP the data could be retrieve from procedural as follow:
1. Automatic Meter Reading (AMR)
2. Local Download (LD)
3. Remote Reading (RR)
4. Stand meter reading (Musi HEPP follows this procedure)

Stand meter reading

- Joint meter reading by operator from Generation Unit (Unit Pembangkitan/UP) and Transmission Service Unit (Unit Pelayanan Trasmisi/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 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 attract 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 Musi Generation Unit) and PT. PLN (transmission unit). 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 transmission unit for Bengkulu sector.

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 'PT PLN (Persero) Wilayah Sumatera Selatan, Jambi dan Bengkulu' as headquarter for all power plant units in South Sumatra.

Main meter failure – use of check meter data

If the main electricity meter is found to be faulty during its reading, data from the production and own consumption meter will be used in its place. In this circumstance, the electricity exported to the grid should be calculated as follows:

a) The data from the production and own consumption meter will be used for the period of the main meter failure, with a minor adjustment to allow for transmission losses.
b) The electricity used and measured for own consumption should be deducted from the produced electricity measured. The difference will be equal to the net electricity produced.

Check meter failure

A failing cross-check meter will be repaired or replaced by an accredited equipment testing organization appointed by PLN. Maintenance records and any calibration documents will be retained by the project and ensured by the operation and maintenance supervisor that the calibration documents comply with calibration requirements. In case of a check meter failure simultaneously to a main meter failure no electricity produced can be measured and therefore no credits can be claimed.

Possible fault with either meter
During the process of checking the electricity data from the meters, a difference may be established that is considerably larger than the historic difference (allowing for transmission losses). In this unlikely event, it could be either electricity meter at fault. The data recording procedures for this circumstance will be specified in a separate procedure.

3.4 Monitoring management and operational system

PLN Sector Bengkulu (covering several powerplant units, including Musi) performed general internal audit on management system as listed below:

-ISO 9001 (Management Quality System) is valid from 25 August 2008 until 24 August 2011,

-ISO 14001 (Environmental Management System) is valid from 25 August 2008 until 24 August 2011.

-OHSAS (Certificate on Emergency Preparedness and Response Procedure in place) is valid from 20 February 2009 until 20 February 2012.

For Musi HEPP the audit activities are listed below:

a. Quality Management System Documentation,
b. Quality Standard, Document Control,
c. Recording control,
d. Generator Operation,
e. Generator Maintenance,
f. Generator Failure Control,
g. Precaution and Repair

The internal audit conducted on June 28 – 29, 2010. The audit location is in Bengkulu Sector Office and Musi HEPP unit location, focusing on the implementation of Integrated Management System. The internal audit is conducted annually and performed by Musi audit team.

The external audit usually conducted for the ISO certificate renewal process. However, no ISO certificates need to be renewed for this 4th monitoring period.

As per the audit focus explained above, the audit process was not related to the VCS project monitoring activity which to monitor the electricity supplied from Musi HEPP to the Sumatra Grid.

The internal audit will start included the electricity supply procedure as a subject on the Internal Audit agenda for the next monitoring period (start after the 4th Musi HEPP Monitoring Report finalization date).

The monitoring team has been established and integrated within the existing organization structure of the Musi hydropower plant prior to the start of the verification. Clear roles and responsibilities are assigned to all staff involved in the VCS project. The VCS Manager has the overall responsibility for the monitoring system on this project.

VCS team has been required to do several key monitoring system 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
f. Equipment calibration
g. Equipment failure

South Pole has organized one time Monitoring training as introduction for all VCS team at the project site location. During the monitoring period, VCS team is responsible to collect, record and data keeping and quality control for all VCS data needed. Details about the monitoring management including roles and responsibilities of related personnel, QA/QC of parameters monitored and procedures for accounting for missing key parameters and other details can be found in the SOP Monitoring Plan.

The Musi Unit Office provides Standard Operation Procedures (SOP) for equipment maintenance, calibration and failure as describe below:

1. SOP to calibrate the Test and Measurement equipments.
2. SOP to develop an Electricity Transfer Monthly Protocol Report
3. SOP for Electricity Transfer
Musi HEPP VCS team will continue to follow those SOP during the monitoring period.

VCS data collection and record keeping arrangements
As explained on the 1st paragraph of section 3.2, the only data to be monitored is electricity supplied to the grid by the project. Every month the Operation Supervisor from Musi 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, they develop a monthly electricity generation report signed by both parties of generation department and transmission department. These readings are also stored in a computer based on SCADA system located at the Bengkulu Sector office. Hence there are no possibilities of manual errors to be occurred during the transposition between data sets.

3.5 Accuracy of monitoring equipments

The accuracy of the monitoring results are in conformity with calibration requirements, recording frequency and quality assurance and quality control procedure stated in the monitoring plan.

3.5.1 Calibration of monitoring equipments

The following is the calibration status of the monitoring equipment during this period:

Meter Tag Number	Parameter measured	Serial Number	Duration of calibration mentioned in the PD	Latest calibration date	By	Next calibration date
VA TECH#1	Net electricity generation supplied to the Grid from Generation Unit 1	36027156 ACTARIS Class 0.2	Once every 5-year according to the national regulation[5].	28 July, 2005	External calibration (Balai Pengelolaan Laboratorium Kemetrologian)	Latest July 2010
VA TECH#2	Net electricity generation supplied to the Grid from Generation Unit 2	36027159 ACTARIS Class 0.2	Every 5-year according to the national regulation	28 July, 2005	External calibration (Balai Pengelolaan Laboratorium Kemetrologian)	Latest July 2010
VA TECH#3	Net electricity generation supplied to the Grid from Generation Unit 3	36027158 ACTARIS Class 0.2	Every 5-year according to the national regulation	28 July, 2005	External calibration (Balai Pengelolaan Laboratorium Kemetrologian)	Latest July 2010

[5] 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

PLN Sector Bengkulu has performed new calibration round in July 28, 2010 for all electricity meters and the certificates were issued in August 4, 2010.

3.5.2 Monitoring equipment malfunctions

There was no metering devices breakdown or malfunction during the following monitoring period. 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 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.

4. Emission Reduction calculations

The formulas used for calculation are in accordance with the approved methodology ACM0002 – Consolidated baseline methodology for grid connected electricity generation from renewable sources (Version 10, EB 47).

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 Project Document v.3.1 dated 23 August 2011.

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 y	tCO_2/year	568,898	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 year y	MWh/yr	765,677	Electricity Transfer Protocol Report
$EF_{grid,CM,y}$	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

Year	Vintage Month	EG facility (MWh)				Total	BEy
		Unit 1	Unit 2	Unit 3	PS		
2009	1 - 30 April	18,586	19,173	18,175	-294.174	55,640	41,340
2009	1 - 31 May	26,452	26,744	27,093	-339.069	79,950	59,403
2009	1 - 30 June	20,918	17,225	19,501	-306.95	57,336	42,601
2009	1 - 31 July	18,743	14,961	14,220	-306.933	47,617	35,380
2009	1 - 31 August	22,381	13,962	16,011	-305.962	52,048	38,672
2009	1 - 30 September	20,790	22,188	15,864	-298.672	58,544	43,498
2009	1 - 31 October	29,906	26,587	30,362	-646.329	86,209	64,053
2009	1 - 30 November	24,157	20,554	22,096	-332.69	66,474	49,390
2009	1 - 31 December	22,515	20,694	21,190	-334.096	64,065	47,600
2010	1 - 31 January	24,157	23,911	22,791	-333.893	70,526	52,401
2010	1 - 28 February	23,283	20,026	21,277	-311.196	64,275	47,756
2010	1 - 31 March	20,932	19,591	22,810	-340.86	62,992	46,803
Total 2009		**204,448**	**182,089**	**184,513**	**(3,165)**	**567,884**	**421,938**
Total 2010		**68,372**	**63,528**	**66,879**	**(986)**	**197,793**	**146,960**
Total 2009 - 2010		**272,820**	**245,617**	**251,391**	**(4,151)**	**765,677**	**568,898**

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 Project Document v.3.1 dated 23 August 2011.

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	Project activity is not a geothermal powerplant.
$PE_{HP,y}$	Project emissions from water reservoirs	tCO_2/yr	0	Musi HEPP is a run-off river hydro powerplant.

Project emissions from the consumption of fossil fuels

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

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

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	4'795.34 (Calculated)	Equation 3) % PEy to Bey = 0.8429% Note: because Project Emission (PE) is less than 1%, here PE is neglected (value considered to be zero)
$FC_{i,j,y}$	Quantity of fuel type i combusted in process j during the year y	ton/y	1'504.99 (Calculated)	Musi HEPP (maximum running hours of the diesel generator data)
$COEF_{i,y}$	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	Musi 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	3.1863	Equation 4)
$NCV_{i,y}$	Weighted average net calorific value of fuel type i in year	TJ/t	Diesel Fuel: 0.043 TJ/ton	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	Musi HEPP

Leakage

According to the methodology, leakage from related emission sources do not need to be considered, thus leakage is zero.

$$L_y = 0$$

4.2.2 Project emissions calculation

Conversion Factor:

Density diesel fuel = 0.815 kg/litre = 0.000815 ton/litre.

Date		Month	Year	Diesel Fuel (ton)	PEy	% Pey to BEy
From	To					
1	30	Apr	2009	123.70	394.14	
1	31	May	2009	127.82	407.28	
1	30	Jun	2009	123.70	394.14	
1	31	Jul	2009	127.82	407.28	
1	31	Aug	2009	127.82	407.28	
1	30	Sep	2009	123.70	394.14	
1	31	Oct	2009	127.82	407.28	
1	30	Nov	2009	123.70	394.14	
1	31	Dec	2009	127.82	407.28	
1	31	Jan	2010	127.82	407.28	
1	28	Feb	2010	115.45	367.86	
1	31	Mar	2010	127.82	407.28	
Total 2009				**1,133.89**	**3,612.92**	**0.8563%**
Total 2010				**371.09**	**1,182.41**	**0.8046%**
TOTAL 2009-2010				**1,504.99**	**4,795.34**	**0.8429%**

Vintage Year		Fuel consumption (ton)	PEy
1 April 2009	- 31 March 2010	1,504.99	4,795.34
% PEy to BEy			0.8429%

Since total PE $_{FC,j,CO2}$ accounts for **less than 1%** of the baseline emissions, and in accordance with ACM0002 version 10, the project emission can be neglected. Therefore $\mathbf{PE_y = 0}$.

4.3 Emission Reductions

4.3.1 Formula used for emission reductions calculation

Emission reductions are calculated as follows:

$ER_y = BE_y - PE_y$ (3)

Parameter	Description	Unit	Value	Source
ER_y	Project emission in the period y	tCO_2e	Calculated	Equation (3)
BE_y	Baseline emissions in the period *y*	tCO_2e	Calculated	Equation (1)
PE_y	Project emissions in the period *y*	tCO_2e	Calculated	Equation (2)

4.3.2 Emission Reduction calculation

Subject	2009	2010	Total	Unit
BEy	421,938	146,960	568,898	ton CO_2
PE_y	0	0	0	ton CO_2
ER_y	421,938	146,960	568,898	ton CO_2

5. Environmental Performance

Since the Project commencement, one set of environmental assessment report for the local environmental agency had been developed in March 2006, which covers the monitoring period of March to September 2006. The subsequent environmental performance test was carried out for the monitoring report submission. Table below show the conclusion of the environmental assessment report as summarized in Chapter III of the report[6].

Parameter monitored	Conclusion
Water Quality	The main parameters for water quality are water temperature, TSS, TDS, water pH, BOD and COD. The purpose of this water quality monitoring is to find out if the Waste Water Treatment System design has efficiently implemented or still need some modifications. The laboratory test showed that the Simpang Aur -Lemau River water quality is still below the standard in accordance with Government Regulation No. 81/2001 on Water Quality Control. Musi HEPP also has a program to clean off the water plant (*Eichornia crassipes*) that reduce water quality and disturbed the water intake process. The water plant will be processed to be made into an organic fertilizer.
"Bukit Daun" Protected Forest damage	The project is partially located in a protected area, namely "Bukit Daun Protected Forest". An underground powerhouse was chosen to minimize impact on the forest. Musi HEPP had carried out reforestation on several areas. Reforestation aimed at the land boundary between the lands of villagers with land owned by PLN. Reforestation also aimed to revitalize land both upstream and downstream of Musi HEPP.

6. Conclusion

From 01 April 2009 to 31 March 2010, the project activity has performed satisfactorily and achieved a total emission reduction of 568,898 tCO_2, which has been calculated according to the approved methodology set out in the VCS PD version 3.1, 23 August 2011. The monitoring of required parameters is in accordance with the approved monitoring methodology as described in the VCS PD.

The company management also believes that its VCS Team has taken all reasonable efforts to maintain credibility of data through proper administration and supervision. To evaluate the monitoring report for each monitoring period, the VCS Team (PT PLN (Persero) Generation Sector Bengkulu) held a management review once for every monitoring period at end of the monitoring period. Since this is the first verification process ever conducted on Musi HEPP, the management review took place on May 20, 2010 or after the Verification site visit. The meeting discussed some points such as calibration certificate, kWh meter recording and many more (complete management review result has been submitted to DOE).

[6] Please refer to submitted document "UKL UPL 2006 Sem I.doc"

Appendix 1 Complete Emission Reduction Xcel Sheet calculation

Vintage Year	BEy	PEy	ER
1 April 2009 - 31 December 2009	421,938	-	421,938
1 January 2010 - 31 March 2010	146,960		146,960
Total (1 Apr'09 - 31 Mar'10)	568,898	-	568,898

Note : this PE value is smaller than 1% of BE (568,898), therefore PE is neglected

Baseline emission calculation

Electricity Generation

Electricity Generation (kWh)

						2009	2010
						Electricity generated	Electricity generated
Source	Electricity supply to the Grid from each turbine as per Monthly Electricity Report					Monthly electricity report (based on net amount)	Monthly electricity report
Bulan	Unit 1	Unit 2	Unit 3	PS (Own Consumption)	Total	Total	Total
Apr'09	18,585,809	19,173,022	18,175,172	(294,174)	55,639,829	55,639,829	
May'09	26,451,940	26,744,226	27,093,185	(339,069)	79,950,282	79,950,282	
Jun'09	20,917,939	17,224,800	19,500,671	(306,950)	57,336,460	57,336,460	
Jul'09	18,742,934	14,961,355	14,219,790	(306,933)	47,617,146	47,617,146	
Aug'09	22,380,705	13,962,105	16,011,208	(305,962)	52,048,056	52,048,056	
Sep'09	20,790,211	22,188,333	15,864,451	(298,672)	58,544,323	58,544,323	
Oct'09	29,906,276	26,587,210	30,361,693	(646,329)	86,208,850	86,208,850	
Nov'09	24,156,572	20,553,850	22,096,472	(332,690)	66,474,204	66,474,204	
Dec'09	22,515,354	20,693,924	21,189,909	(334,096)	64,065,091	64,065,091	
Jan'10	24,157,204	23,911,247	22,791,378	(333,893)	70,525,936		70,525,936
Feb'10	23,282,985	20,025,798	21,277,459	(311,196)	64,275,046		64,275,046
Mar'10	20,932,051	19,591,078	22,809,881	(340,860)	62,992,150		62,992,150
Total 2009	**204,447,740**	**182,088,825**	**184,512,551**	**(3,164,875)**	**567,884,241**		567,884,241
Total 2010	**68,372,240**	**63,528,123**	**66,878,718**	**(985,949)**	**197,793,132**		197,793,132
Total Electricity generated (Apr'09-Mar'10)	**272,819,980**	**245,616,948**	**251,391,269**	**(4,150,824)**	**765,677,373**		**765,677,373**

Year	Vintage Month	EG facility (MWh)				Total	BEy
		Unit 1	Unit 2	Unit 3	PS		
2009	1 - 30 April	18,586	19,173	18,175	-294.174	55,640	41,340
2009	1 - 31 May	26,452	26,744	27,093	-339.069	79,950	59,403
2009	1 - 30 June	20,918	17,225	19,501	-306.95	57,336	42,601
2009	1 - 31 July	18,743	14,961	14,220	-306.933	47,617	35,380
2009	1 - 31 August	22,381	13,962	16,011	-305.962	52,048	38,672
2009	1 - 30 September	20,790	22,188	15,864	-298.672	58,544	43,498
2009	1 - 31 October	29,906	26,587	30,362	-646.329	86,209	64,053
2009	1 - 30 November	24,157	20,554	22,096	-332.69	66,474	49,390
2009	1 - 31 December	22,515	20,694	21,190	-334.096	64,065	47,600
2010	1 - 31 January	24,157	23,911	22,791	-333.893	70,526	52,401
2010	1 - 28 February	23,283	20,026	21,277	-311.196	64,275	47,756
2010	1 - 31 March	20,932	19,591	22,810	-340.86	62,992	46,803
Total 2009		**204,448**	**182,089**	**184,513**	**(3,165)**	**567,884**	**421,938**
Total 2010		**68,372**	**63,528**	**66,879**	**(986)**	**197,793**	**146,960**
Total 2009 - 2010		**272,820**	**245,617**	**251,391**	**(4,151)**	**765,677**	**568,898**

Project Emission calculation

ACM 0002 Version 10

Date: 1 July 2009

Author: NW

Project Name: Musi Hydro Power Plant

Project Emission from consumption of fossil fuels, $PE_{CO2,fossil\ fuel,y}$

$$PE_{FC,i,y} = \sum_i FC_{i,j,y} \times COEF_{i,y} \quad (1)$$

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

EF fossil fuel	tCO_2/t Diesel	3.1863
Fuel density	kg/m3	815

Year	Date		Month	Fuel consumption (t)	PEy (t CO_2/yr)	%Pey to BEy
	From	To				
2009	1	31	April	123.70	394.14	
2009	1	30	May	127.82	407.28	
2009	1	31	June	123.70	394.14	
2009	1	30	July	127.82	407.28	
2009	1	31	August	127.82	407.28	
2009	1	31	September	123.70	394.14	
2009	1	28	October	127.82	407.28	
2009	1	31	November	123.70	394.14	
2009	1	30	December	127.82	407.28	
2010	1	31	January	127.82	407.28	
2010	1	28	February	115.45	367.86	
2010	1	31	March	127.82	407.28	
Total 2009				**1,133.89**	**3,612.92**	**0.8563%**
Total 2010				**371.09**	**1,182.41**	**0.8046%**
Total 2009 - 2010				**1,504.99**	**4,795.34**	**0.8429%**

Note :

Because Project Emission (PE) is less than 1%, so PE is neglected

Appendix 2 Standard Operating Procedures

List of submitted Standard Operating Procedures

SOP Number	Title	Content
SOP Electricity Transfer Protocol Report procedural	SOP Prosedur pembuatan Berita Acara pengiriman energi listrik PLTA Musi	Description of procedure, responsible persons involved and their responsibilities to ensure the data recording, transfer protocol report document completion and document reporting to PT. PLN Pembangkitan Sumbagsel
SOP Calibration Process PT-SKBL-MUSI-06	Prosedur Kalibrasi	The description of procedure, calibration flow chart, calibration form template and responsible persons involved and their responsibilities.
SOP Line Charging Implementation at Musi HEPP	SOP Quality Control	Working instruction in case of *black out*
SOP on Electricity Energy Transfer	a.Prosedur Tetap Transfer Tenaga Listrik antara PT.PLN Pembangkitan Sumbagut, PT. PLN Pembangkitan Sumbagsel dengan PT. PLN (P3B) Sumatera. b.Prosedur pembuatan BA (Berita Acara) Pengiriman Energi Listrik PLTA Musi	SOP for electricity transfer to the Sumatera Grid (General procedure) Procedure to develop Musi HEPP Monthly Electricity Protocol Report (Detail procedure)