MONITORING REPORT FORM (CDM-MR) *
Version 01 - in effect as of: 28/09/2010

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* as contained within the document entitled "Guidelines for completing the monitoring report form (CDM-MR)" (EB 54 meeting report, annex 34).

MONITORING REPORT
Version number 1.0 13/06/2011

Hedcor Sibulan 42.5 MW Hydroelectric Power Project
UNFCCC reference number 1620
Monitoring period number 1; 26/02/2010 - 25/04/2011

SECTION A. General description of the project activity

A.1. Brief description of the project activity:

The Hedcor Sibulan 42.5 MW Hydroelectric Power Project ("Project"), undertaken by Hedcor Sibulan Inc. ("HSI") as the project company, is a cascade development of two run-of-river type hydro power plants; namely, an upstream Sibulan Plant A with an installed capacity of 16.5 MW and a downstream Sibulan Plant B with an installed capacity of 26MW.

A.1.1. Purpose of the project activity

The purpose of the Project is to generate carbon neutral electricity harnessing the water of the Sibulan and Baroring Rivers to generated electricity. The energy to be generated is and will be exported to the Mindanao grid. In doing so, the Project will displace fossil fuel-fired power generation of the same grid, contributing to a reduction of greenhouse gases (GHGs).

A.1.2. Installed technology and equipments

The two plants are of the run-of-river type that include an intake weir, short tunnel, surface pipeline, desander, headpond, high pressure surface penstock, surface power plant, substation, switchyard, and transmission line. The plants each house two Pelton turbines and generating units.

Further details are given in Section A.4.

A.1.3. Important dates

Table 1: Relevant dates relating to project implementation and operation

Date	Milestone	Notes
26/06/2007	Start of construction	N/A
27/02/2010	Start of commissioning for Plant B	N/A
11/07/2010	Start of commissioning for Plant A	N/A
29/11/2010 – 6/12/2010 for Plant A (due to flooding as mentioned in Section A.1.3)	Periods of discontinued operation	Operation stopped due to high water volume (flooding event).

Please also refer to Section B.1.

A.1.4. Emission reductions achieved

Emission reductions achieved during this monitoring period was 140,389 tCO_2.

A.2. Project Participants

Project Participants are listed below.

Hedcor Sibulan, Inc. of Republic of the Philippines

A.3. Location of the project activity:

The project site, consisting of the upper and lower project areas, is located approximately 19 kilometers from the south-eastern boundary of Davao City, in the Mindanao Province. The lower project area where Plant B is situated is about a 45-minute drive from the city. The upper project area, where Plant A is situated, is about a 2-hour drive away from the city.

The geographical coordinates for the plants are:

- Plant A: 6-56-25.50N / 125-26-27.17E
- Plant B: 6-57-45.57N / 125-22-17.03E

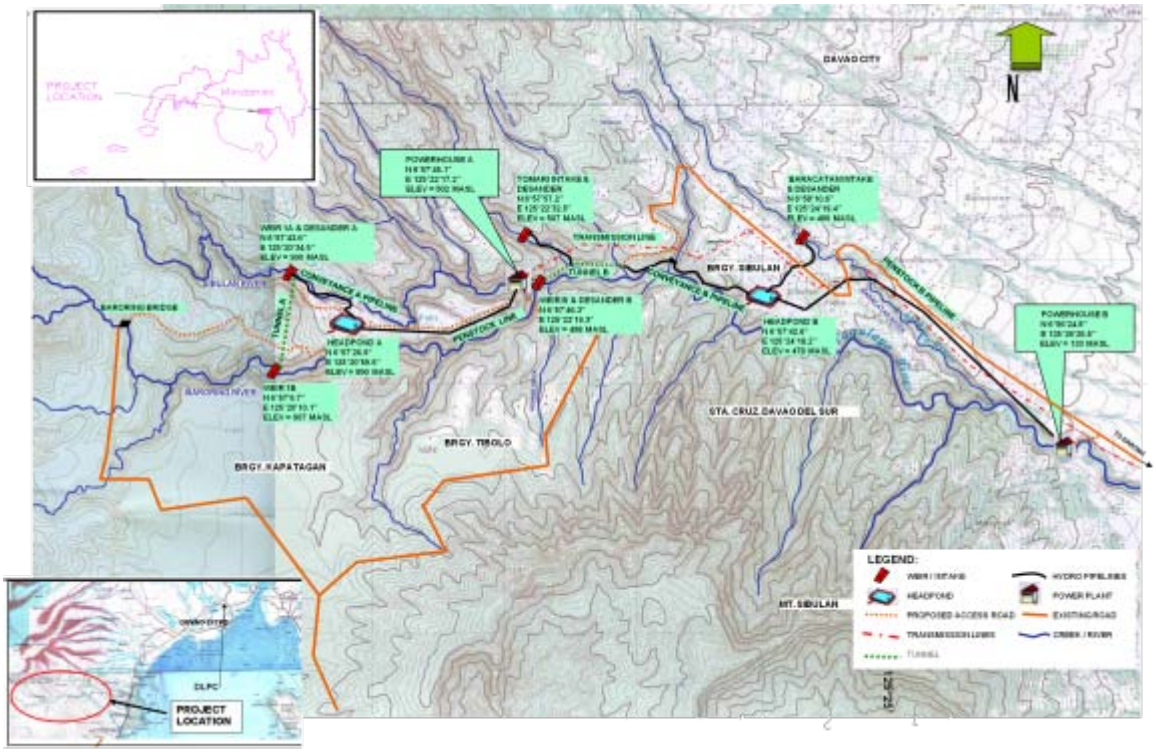

Figure 1: Map indicating Sibulan plant site

A.4. Technical description of the project

As per the registered CDM-PDD, the implemented Project is a cascade development of two power plants – the upstream Sibulan Plant A with an installed capacity of 16.5 MW and the downstream Sibulan Plant B with an installed capacity of 26MW. The plants are of the run-of-river type that include an intake weir, short tunnel, surface pipeline, desander, headpond, high pressure surface penstock, surface power plant, substation, switchyard, and transmission line. The plants each house two mutli-jet pelton type turbines and generating units that create power.

No major dam or reservoir has been constructed. Instead, the plants utilize small, off-river head ponds which will regulate the output daily. The two ponds at Plant A and Plant B together allow for sufficient water storage to cater for the peak demand of the off-taker, Davao Light Power Corporation, Inc. (DLPC).

The Plants are connected to the DLPC system through a 69 KV transmission line to DLPC's ERA Main Substation.

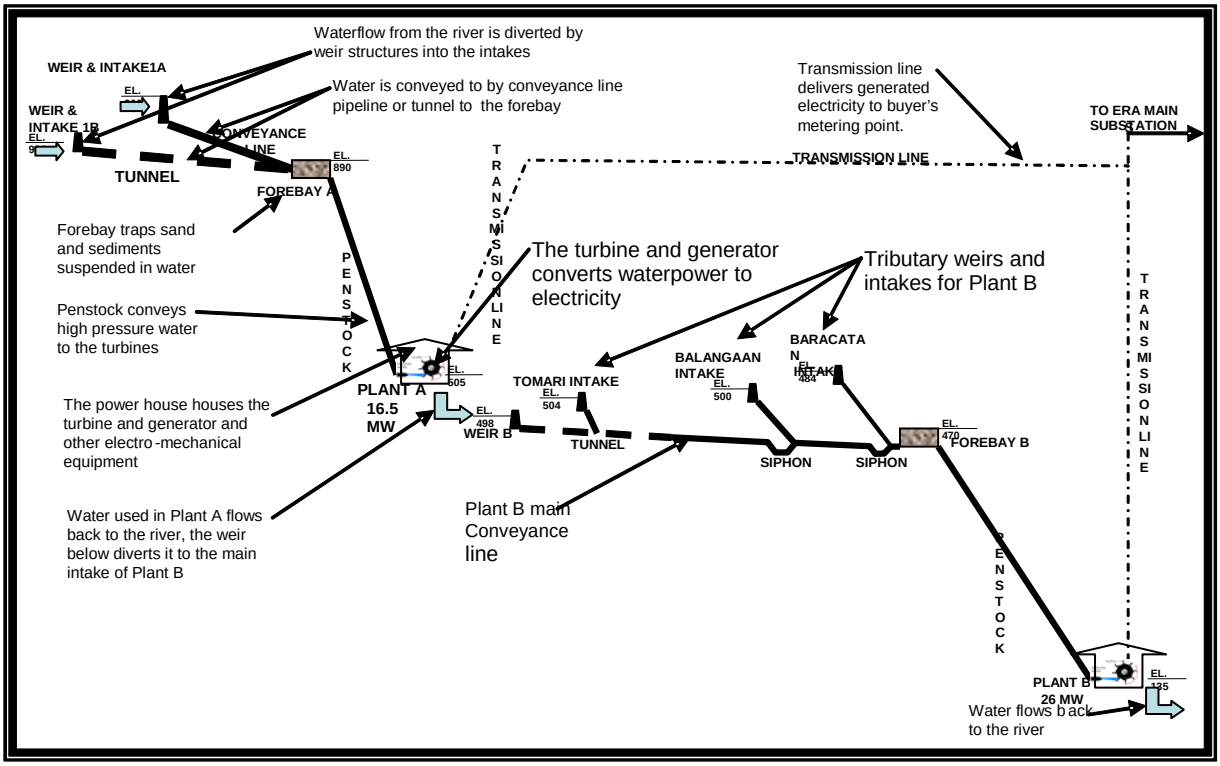

Figure 2: Sibulan Plant Operating Diagram

A.5. Title, reference and version of the baseline and monitoring methodology applied to the project activity:

The approved baseline and monitoring methodology ACM0002 Version 06: *Consolidated baseline methodology for grid-connected electricity generation from renewable sources* ("ACM0002") is applied to the Project.

A.6. Registration date of the project activity:

06/06/2008

A.7. Crediting period of the project activity and related information (start date and choice of crediting period):

Start of crediting period: 26/02/2010
Choice of crediting period: 7 years (renewable)

A.8. Name of responsible person(s)/entity(ies):

The monitoring report was prepared by:

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SECTION B. Implementation of the project activity

B.1. Implementation status of the project activity

Status	Date
Starting date of 26MW Plant B	27/02/2010
Starting date of 16.5MW Plant A	11/07/2010
Overhaul time	N/A
Downtime of equipment	29/11/2010 – 6/12/2010 for Plant A (due to flooding as mentioned in Section A.1.3)
Exchange of equipment	N/A
Any other special events	N/A

No special events or situations occurred during the monitoring period which may impact the applicability of the methodology.

B.2. Revision of the monitoring plan

No revision of the monitoring plan has occurred to date.

B.3. Request for deviation applied to this monitoring period

No deviation has been requested for this monitoring period.

B.4. Notification or request of approval of changes

No approval of changes has been requested for this monitoring period.

SECTION C. Description of the monitoring system

C.1. Monitoring points

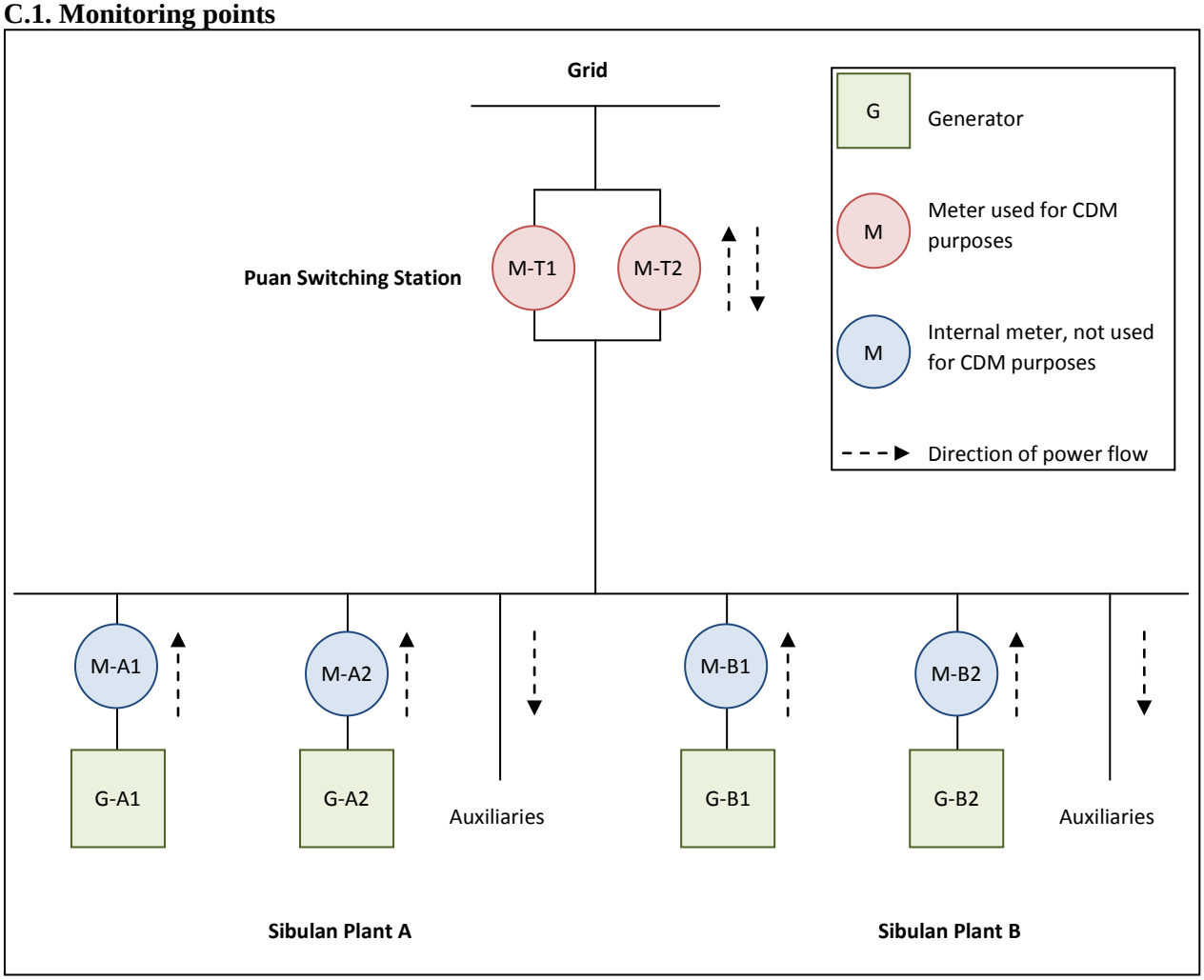

Figure 3: Simplified diagram of monitoring points

C.2. Organizational structure

Consistent with the registered CDM-PDD, an operational and administrative team as outlined below is responsible for monitoring and reporting. The team is composed of a Vice President of Operations, an Operations Manager as well as a group of engineers, operators, technicians and administrative staff.

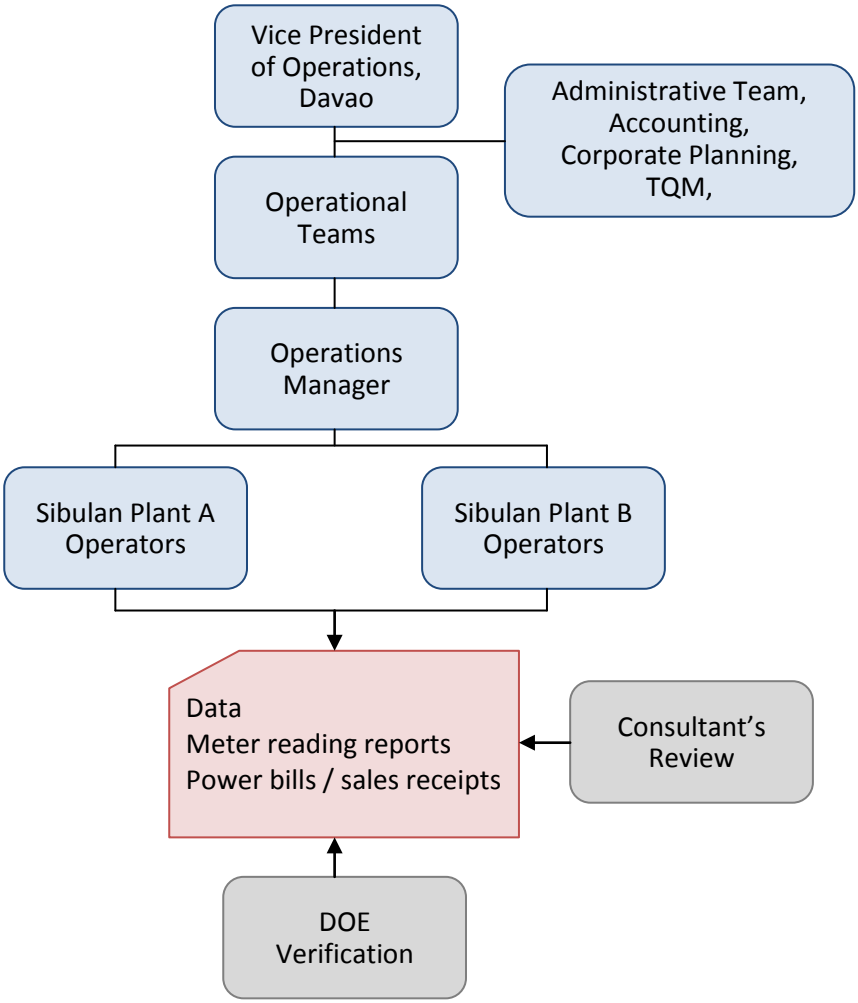

Figure 4: Operational and management structure for monitoring activity

C.3. Data collection procedures

The collection of data is based on the billing reports submitted to the off-taker DLPC, and is undertaken by HSI engineers with the supervision of the Operations Managers. The data is then downloaded by HSI and the National Grid Corporation of the Philippines (NGCP) engineers. NGCP is the default metering services provider. All data are recorded in accordance with the procedures and stored electronically in a systematic, transparent and traceable manner.

The Operational and Administrative Teams will review the data archived and submit a complete set of documentation, which indicates the calculation procedure as well as the ex-post emission reduction estimate to the Corporate Planning Department for internal verification on a monthly basis.

Prior to commissioning, operators were given a series of training on operation and data collection / recording, including visits to other hydro power plants in February 2010.

C.4 Emergency procedures for the monitoring system

The plant has a Standard Operation Procedure that is in line with ISO standards.

SECTION D. Data and parameters

D.1. Data and parameters determined at registration and not monitored during the monitoring period, including default values and factors

Data / Parameter:	**w_{OM}, w_{BM}**	
Data unit:	Fraction	
Description:	Weight of Operating Margin in the Combined Margin, weight of the Build Margin in the Combined Margin	
Source of data used:	ACM0002 Version 06	
Value(s) :	w_{OM}	0.5
	w_{BM}	0.5
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculations	
Additional comment:	N/A	

Data / Parameter:	**CO_2 emission factor**	
Data unit:	$kgCO_2/TJ$	
Description:	CO_2 emission factor of fuels	
Source of data used:	IPCC 2006 Volume 2 Table 2.2	
Value(s) :	Residual fuel oil	77,400
	Gas / diesel oil	74,100
	Coal (anthracite)	98,300
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculations	
Additional comment:	N/A	

Data / Parameter:	**NCV**	
Data unit:	TJ/kt	
Description:	NCV of fuels	
Source of data used:	Philippines Department of Energy	
Value(s) :	Residual fuel oil	43
	Gas / diesel oil	46
	Coal (anthracite)	23
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculations	
Additional comment:	N/A	

Data / Parameter:	**Density**	
Data unit:	kg/l	
Description:	Density of fuels	
Source of data used:	Philippines Department of Energy	
Value(s) :	Residual fuel oil	0.94
	Gas / diesel oil	0.84
	Coal (anthracite)	1
Indicate what the data are used for (Baseline/ Project/	Baseline emission calculations	

Leakage emission calculations)	
Additional comment:	N/A

D.2. Data and parameters monitored

Data / Parameter:	**Surface area at full reservoir level**
Data unit:	m^2
Description:	Surface area of the reservoir / head pond to show the level of project emissions
Measured /Calculated /Default:	Measured
Source of data:	HSI
Value(s) of monitored parameter:	30,300 m^2 (Plant A = 16,200 m^2, Plant B = 14,100 m^2)
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project emission calculations
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N/A
Measuring/ Reading/ Recording frequency:	Once at the start of the project activity
Calculation method (if applicable):	N/A
QA/QC procedures applied:	N/A

Data / Parameter:	**EG_y**
Data unit:	MWh
Description:	Electricity supplied to the grid by the Project
Measured /Calculated /Default:	Measured
Source of data:	HSI through DLPC
Value(s) of monitored parameter:	165,164
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculations
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	
Measuring/ Reading/ Recording frequency:	Monitored continuously, recorded monthly
Calculation method (if applicable):	N/A

Type	Accuracy Class	Serial Number	Calibration Frequency	Date of Last Calibration	Validity
Main (NEXUS 1272)	0.2	2004-411-94930	1 year (per NGCP)	19/04/2011	18/04/ 2012
Backup (Landys +Gyr)	0.2	87573723		N/A (new)	

QA/QC procedures applied:	The measured amount will be double checked against sales receipts. Meters are to be calibrated based on existing procedures that are consistent with ISO standards which have been applied to existing ISO Certified Hedcor, Inc. Plants.

Data / Parameter:	$\mathbf{EF_y}$
Data unit:	tCO_2/MWh
Description:	CO_2 emission factor of the grid
Measured /Calculated /Default:	Calculated
Source of data:	N/A (calculated)
Value(s) of monitored parameter:	0.83
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculations
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N/A
Measuring/ Reading/ Recording frequency:	Annually
Calculation method (if applicable):	$EF_y = w_{OM} \times EF_{OM,y} + w_{BM} \times EF_{BM,y}$, as per Equation 2 of Section E.1.
QA/QC procedures applied:	N/A

Data / Parameter:	$EF_{OM,y}$
Data unit:	tCO_2/MWh
Description:	CO_2 emission factor of set of plants in the Operating Margin
Measured /Calculated /Default:	Calculated
Source of data:	N/A (calculated)
Value(s) of monitored parameter:	0.79
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculations
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N/A
Measuring/ Reading/ Recording frequency:	Annually
Calculation method (if applicable):	$EF_{OM,y} = EF_{OM,simple\_adjusted,y} = (1-\lambda_y) \times \frac{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}}{\sum_j GEN_{j,y}} + \lambda_y \times \frac{\sum_{i,k} F_{i,k,y} \times COEF_{i,k}}{\sum_k GEN_{k,y}}$, as per Equation 3 of Section E.1.1.
QA/QC procedures applied:	N/A

Data / Parameter:	$EF_{BM,y}$
Data unit:	tCO_2/MWh

Description:	CO_2 emission factor of set of plants in the Build Margin
Measured /Calculated /Default:	Calculated
Source of data:	N/A (calculated)
Value(s) of monitored parameter:	0.87
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculations
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N/A
Measuring/ Reading/ Recording frequency:	Annually
Calculation method (if applicable):	$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y} \times COEF_{i,m}}{\sum_{m} GEN_{m,y}}$, as per Equation 3 of Section E.1.2.
QA/QC procedures applied:	N/A

Data / Parameter:	**$F_{i,y}$**
Data unit:	Mass or volume
Description:	Amount of fuel consumed type i consumed by each power source / plant
Measured /Calculated /Default:	Measured
Source of data:	Philippines Department of Energy, CDM Baseline Construction for The Electricity Grids in the Philippines
Value(s) of monitored parameter:	Source: Residual fuel oil — Fuel consumed (kt): 631 Source: Gas / diesel oil — Fuel consumed (kt): 333 Source: Coal (anthracite) — Fuel consumed (kt): 6
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculations
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N/A
Measuring/ Reading/ Recording frequency:	Annually
Calculation method (if applicable):	N/A
QA/QC procedures applied:	N/A

Data / Parameter:	**$COEF_i$**
Data unit:	tCO_2/ t fuel
Description:	CO_2 emission coefficient of each fuel type *i*
Measured /Calculated /Default:	Calculated
Source of data:	IPCC, Baseline Construction for The Electricity Grids in the

	Philippines	
Value(s) of monitored parameter:	Residual fuel oil	3.35
	Gas / diesel oil	3.39
	Coal (anthracite)	2.29
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculations	
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N/A	
Measuring/ Reading/ Recording frequency:	Annually	
Calculation method (if applicable):	N/A	
QA/QC procedures applied:	N/A	

Data / Parameter:	**$GEN_{j/k/n,y}$**	
Data unit:	MWh	
Description:	Electricity generation of each power source / plant *j*, *k* or *n*	
Measured /Calculated /Default:	Measured	
Source of data:	Philippines Department of Energy	
Value(s) of monitored parameter:	$GEN_{j,y}$	3,215,168
	$GEN_{k,y}$	5,020,112
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculations	
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N/A	
Measuring/ Reading/ Recording frequency:	Annually	
Calculation method (if applicable):	N/A	
QA/QC procedures applied:	N/A	

Data / Parameter:	**Plant name (OM)**	
Data unit:	Text	
Description:	Power source / plant for constituting the Operating Margin	
Measured /Calculated /Default:	Measured	
Source of data:	Philippines Department of Energy	
Value(s) of monitored parameter:	Source (*j* or *k*)	Plant type
	j	Coal
	j	Diesel
	j	Residual fuel oil
	k	Geothermal
	k	Hydro
	k	Solar

Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculations
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N/A
Measuring/ Reading/ Recording frequency:	Annually
Calculation method (if applicable):	N/A
QA/QC procedures applied:	N/A

Data / Parameter:	**Plant name (BM)**
Data unit:	Text
Description:	Power source / plant for constituting the Build Margin
Measured /Calculated /Default:	Measured
Source of data:	Philippines Department of Energy
Value(s) of monitored parameter:	Plant name: Plant type Mindanao II (Mt. Apo): Geothermal Bubunawan: Hydro Solar Photovoltaic: Solar PB104: Diesel Mindanao Coal I: Coal Mindanao Coal II: Coal
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculations
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N/A
Measuring/ Reading/ Recording frequency:	Annually
Calculation method (if applicable):	N/A
QA/QC procedures applied:	N/A

Data / Parameter:	**λ_y**
Data unit:	Fraction
Description:	Fraction of time during which low-cost/must-run resources are on the margin
Measured /Calculated /Default:	Measured and calculated
Source of data:	NGCP, Philippines Department of Energy, CDM Baseline Construction for The Electricity Grids in the Philippines
Value(s) of monitored parameter:	0.01
Indicate what the data are used for (Baseline/ Project/	Baseline emission calculations

Leakage emission calculations)	
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N/A
Measuring/ Reading/ Recording frequency:	Annually
Calculation method (if applicable):	As per steps (i) – (iv) in Section E.1.1, which follows ACM0002 Version 06.
QA/QC procedures applied:	N/A

Data / Parameter:	$\mathbf{GEN_{j/k/n,y\_IMPORTS}}$
Data unit:	MWh
Description:	Electricity imports to the project electricity system
Measured /Calculated /Default:	Measured
Source of data:	Philippines Department of Energy
Value(s) of monitored parameter:	0
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculations
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N/A
Measuring/ Reading/ Recording frequency:	Annually
Calculation method (if applicable):	N/A
QA/QC procedures applied:	N/A

Data / Parameter:	$\mathbf{COEF_{i,j,y\_IMPORTS}}$
Data unit:	tCO_2/mass or volume unit
Description:	CO_2 emission coefficient of fuels used in connected electricity system (if imports occur)
Measured /Calculated /Default:	Measured
Source of data:	Philippines Department of Energy
Value(s) of monitored parameter:	N/A (no imports)
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculations
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N/A
Measuring/ Reading/	Annually

Recording frequency:	
Calculation method (if applicable):	N/A
QA/QC procedures applied:	N/A

SECTION E. Emission reductions calculation

E.1. Baseline emissions calculation

Consistent with ACM0002 Version 06 and the registered CDM-PDD, the baseline emissions BE_y are calculated as:

Equation 1

$$BE_y = EG_y \times EF_y$$

where:

EG_y = Electricity supplied to the grid by the Project in year *y* (MWh);

EF_y = Emission factor for grid electricity for year *y* (tCO_2/MWh).

The grid emission factor, EF_y, is calculated as the Combined Margin emission factor, which is the weighted average of the Operating Margin emission factor and the Build Margin emission factor, as follows.

Equation 2

$$EF_y = w_{OM} \times EF_{OM,y} + w_{BM} \times EF_{BM,y}$$

where:

w_{OM} = Weight of Operating Margin in the Combined Margin;

w_{BM} = Weight of Build Margin in the Combined Margin;

$EF_{OM,y}$ = Emission factor of set of plants in the Operating Margin in year *y* (tCO_2/MWh);

$EF_{BM,y}$ = Emission factor of set of plants in the Build Margin in year *y* (tCO_2/MWh).

As per the registered CDM-PDD, both the Operating Margin and Build Margin emission factors are to be monitored and determined *ex post*. The steps and values are delineated in the ensuing sections.

E.1.1. Calculation of the Operating Margin ($EF_{OM,y}$)

For the Operating Margin, consistent with the registered CDM-PDD, the Simple Adjusted OM is applied and is calculated according to the following formula.

Equation 3

$$EF_{OM,y} = EF_{OM,simple\_adjusted,y} = (1 - \lambda_y) \times \frac{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}}{\sum_j GEN_{j,y}} + \lambda_y \times \frac{\sum_{i,k} F_{i,k,y} \times COEF_{i,k}}{\sum_k GEN_{k,y}}$$

where:

λ_y = Fraction of time during which low-cost/must-run resources are on the margin in year *y* (fraction);

$F_{i,j,y}$ = Amount of fuel consumed by relevant power sources *j* in year *y*, where *j* refers to the power sources in the grid excluding low-cost/must-run power plants and including any imports to the grid;

$F_{i,k,y}$ = Amount of fuel consumed by relevant power sources *k* in year *y*, where *k* refers to the low-cost/must-run power sources in the grid;

$COEF_{i,j}$ = CO_2 emission coefficient of fuel *i* used in power sources *j* (tCO_2/mass or volume unit);

$COEF_{i,k}$ = CO_2 emission coefficient of fuel *i* used in power sources *k* (tCO_2/mass or volume unit);

$GEN_{j,y}$ = Electricity supplied to the grid by source *j* (MWh);

$GEN_{k,y}$ = Electricity supplied to the grid by source *k* (MWh).

$EF_{OM,simple\_adjusted,y}$ is calculated based on 2009[1] data, as follows:

Step (i) Plot a Load Duration Curve

The hourly system load data was collected and sorted from highest to lowest MW level. This is then plotted against 8,760 hours in the year, in descending order.

Table 2: Extract of hourly system load for Mindanao grid in 2009[2]

Hour	Date (mm/dd/yyyy)	Time (hh:mm)	System Load (MW)
1	11/09/2009	18:00	1,303.20
2	11/05/2009	18:00	1,294.81
3	11/10/2009	18:00	1,294.40
8708	12/31/2008	3:00	573.59
8709	01/04/2009	5:00	573.00
8710	01/05/2009	4:00	572.90
8,758	01/01/2009	07:00	518.50
8,759	01/01/2009	09:00	514.30
8,760	01/02/2009	03:00	505.90

Based on the above, the load duration curve is plotted.

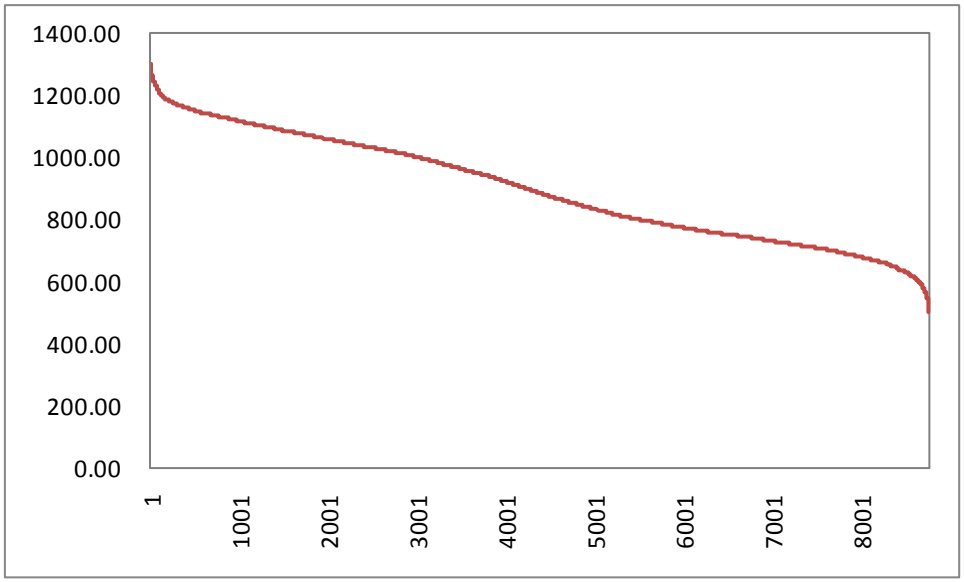

Figure 5: Load duration curve (1) for Mindanao grid in 2009

Step (ii) Organize data by generating sources

The annual generation from low-cost/must-run resources ($\sum_k GEN_{k,y}$) is deduced from the following grid data.

Table 3: Annual power generation for Mindanao grid in 2009[3] [4]

[1] Requested and obtained from National Grid Corporation of the Philippines

[2] Full data set submitted to DOE during verification

[3] Philippines Department of Energy, www.doe.gov.ph

[4] As per AM_CLA_0038, the data from the year previous to generation is used

Plant Type	Annual Power Generation (MWh)
Coal	1,562,753
Oil-based	
Diesel	1,622,575
Oil	29,840
Geothermal	822,926
Hydro	4,195,934
Solar	1,252
Total	8,235,280
Total LCMR	5,020,112

Consistent with ACM0002, hydro and geothermal and solar power sources were deemed to be low-cost/must-run resources. Generation from these plants totalled 5,020,112 MWh.

Step (iii) Fill Load Duration Curve

The average load (in MW) from low-cost/must-run resources in a year is calculated by dividing the total generation from low-cost/must-run resources, determined in Step (ii) as 5,020,112 MWh, by 8,760 hours of the year. This gives an average load of 573 MW.

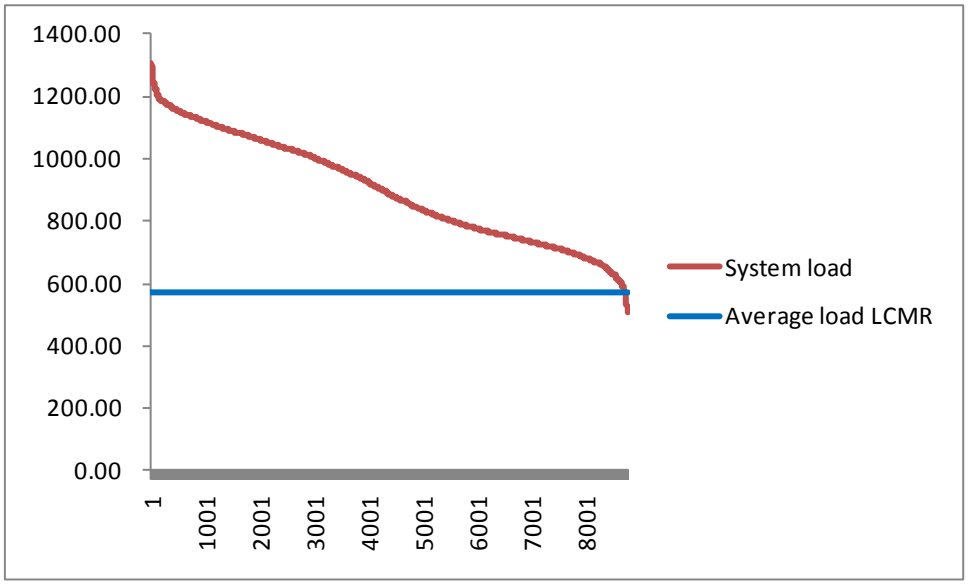

Figure 6: Load duration curve (2) for Mindanao grid in 2009

Step (iv) Determine the number of hours per year for which low-cost/must-run sources are on the margin.

The fraction of time during which low-cost/must-run resources are marginal is the number of hours to the right of the intersection of the two lines in Figure 6. As the lines intersect at the 8,709th hour, the low-cost/must-run resources are considered to be marginal for 51 hours (8,760 hours – 8,709 hours) of the year. This is divided by the total number of hours in the year to obtain λ_y, which is 0.01.

The next step is to calculate the Simple Adjusted OM emission factor using Equation 3. As the power sources *k* – low-cost/must-run plants – consist of hydro, geothermal and solar resources, emission from this source is considered zero. Therefore, Equation 3 can be simplified to the following.

Equation 4

$$EF_{OM,simple\_adjusted,y} = (1 - \lambda_y) \times \frac{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}}{\sum_j GEN_{j,y}}$$

Table 4: 2009 statistics for fossil fuel fired plants in Mindanao grid

Plant Type	Annual Power Generation in 2009 (MWh)	Fuel Consumption (TJ)
Coal	1,562,753	14,673
Oil-based		
Diesel	1,622,575	15,235
Oil	29,840	271
Total	8,235,280	30,179

The above data is used in conjunction with IPCC values as provided in Section D.1, to obtain a weighted average emission factor of 0.79 tCO_2/MWh. Adjusting for λ_y = 0.01 the Simple Adjusted OM emission factor is:

$EF_{OM,simple\_adjusted,y}$ = (1-0.01) x 0.79 tCO_2/MWh
= 0.79 tCO_2/MWh

E.1.2. Calculation of the Build Margin ($EF_{BM,y}$)

The Build Margin is calculated as the generation-weighted average emission factor of a sample of power plants *m*, as follows.

Equation 5

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y} \times COEF_{i,m}}{\sum_{m} GEN_{m,y}}$$

where

$F_{i,m,y}$ = Amount of fuel consumed by sample group *m* in year *y*, where sample group *m* consists of either the five power plants that have been built most recently, or the power plant capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently;

$COEF_{i,m}$ = CO_2 emission coefficient of fuel *i* used in sample group *m* (tCO_2/mass or volume unit);

$GEN_{m,y}$ = Electricity supplied to the grid by sample group *m* (MWh).

As can be seen in Table 5, the five newest plants represent 20% of the total grid power generation.

Table 5: Build Margin power plants[5]

Plant Name	Year Commissioned	Power Generation in 2009[6] (MWh)	Fuel Consumption (TJ)
Bubunawan Hydro	2001	61,320	0
Solar Photovoltaic	2004	8,760	0
PB104	2005	0	0
Mindanao Coal I	2006	1,562,753	14,425
Mindanao Coal II	2006		
Sibulan Hydro (the Project)	2010	N/A	N/A
Total Generation		1,632,833	
% Total Grid Generation		20%	

The CO_2 emission factor for the Build Margin is calculated in the same manner as the Operating Margin. The Build Margin is therefore 0.87 tCO_2 / MWh.

E.1.3. Calculate the baseline emission factor (EF_y)

[5] Philippines Department of Energy

[6] No publicly available generation data for "Bubunawan Hydro", "Solar Photovoltaic" and "PB104" plants. For conservatism assumed maximum load for the first two renewable plants, and zero load for PB104 diesel plant.

The baseline emission factor is calculated as the Combined Margin, which is the weighted average of the Operating Margin and Build Margin emission factors, as given in Equation 2. Default weightings of 50% each, as given in Section D.1, are used.

The simple average of 0.79 tCO_2/MWh and 0.87 tCO_2/MWh is 0.83 tCO_2/MWh. The baseline emission factor is therefore 0.83 tCO_2 / MWh.

E.1.4. Calculate baseline emissions (BE_y)

The baseline emission is calculated by multiplying the electricity supplied by the Project to the grid with the baseline grid emission factor, as per Equation 1.

Since the Sibulan plants supplied 165,164MWh of electricity during this monitoring period, the total baseline emissions is 137,086 tCO_2

E.2. Project emissions calculation

According to ACM0002, project emissions may arise for hydro power projects with new reservoirs. The Project is run-of-the-river type that does not require a reservoir. It only has small head ponds for the purpose of regulating daily output. The size of these head ponds are such that no project emissions need to be accounted for, as shown in the following table.

Table 6: Power density of the Sibulan plants

Plant	Installed Capacity (MW)	Head Pond Surface Area (m^2)	Power Density (W/m^2)
Plant A	16.5	16,200	1,019
Plant B	26	14,100	1,844
Total	42.5	30,300	1,403

The power density of the Project is well over 10W/m^2. Therefore, there are no associated project emissions.

E.3. Leakage calculation

ACM0002 Version 06 stipulates that neither positive nor negative leakage in relation to activities such as power plant construction, fuel handling and land inundation are not to be accounted for. No leakage is associated with the Project.

E.4. Emission reductions calculation / table

Since there is no project emission or leakage associated with the Project as explained in Sections E.2 and E.3, emission reductions are equal to baseline emissions.

The summary table is provided below.

Period	Baseline emissions (tCO_2)	Project emissions (tCO_2)	Leakage emissions (tCO_2)	Emission reductions (tCO_2)
26 February 2010 – 25 April 2011	137,086	0	0	137,086

E.5. Comparison of actual emission reductions with estimates in the CDM-PDD

Item	Values applied in ex-ante calculation of the registered CDM-PDD	Actual values reached during the monitoring period
Emission reductions at full operation (tCO_2e/yr)	95,174	N/A
Emission reductions during the 14-month monitoring period (tCO_2e)	111,037	137,086

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

As can be seen in Section E.5, a significant difference in CERs between the estimated value in the PDD and MR has been observed, where the amount of CERs in the MR is greater by 23%.

The CER amount is a product of (a) the electricity supplied to the grid by the Project (EG_y) and (b) the CO_2 emission factor of the grid (EF_y), where for the 14-month monitoring period:

(a) The electricity supplied to the grid by the Project was lower than the estimated performance in the PDD by 32%. The reason for the shortfall is mainly due to a combination of less-than-average rainfall and the fact that Plant A was commissioned only in the last quarter of 2010 and only Plant B was commissioned in March 2010.

(b) CO_2 emission factor of the grid, which is to be monitored *ex post* as per the registered PDD, increased significantly – by 87% – largely due to the commissioning of two large coal plants in Mindanao.

Given that there was less-than-projected generation and the increase in CERs is solely caused by the change in the grid emission factor, no further discussion is made.

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