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

MONITORING REPORT

Title of the project activity	**Angkor Bio Cogen Rice Husk Power Project**
Reference number of the project activity	**0363**
Version number of the monitoring report	**1.2**
Completion date of the monitoring report	**14 September 2012**
Registration date of the project activity	**10 August 2006**
Monitoring period number and duration of this monitoring period	**20/04/2011 – 31/05/2012**
Project participant(s)	Angkor Bio Cogen Co., Ltd (Cambodia) Mitsubishi UFJ Morgan Stanley Securities Co., Ltd (Japan), Asian Development Bank as Trustee of the Future Carbon Fund, Swedish Energy Agency (Sweden)
Host Party(ies)	Cambodia
Sectoral scope(s) and applied methodology(ies)	Sectoral scopes: Energy industries, Waste handling and disposal, Agriculture Applied methodologies: AMS-I.A. (Ver.7), AMS-III.E. (Ver.7)
Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD	57,701 tonnes CO2
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period	4,425 tonnes CO2

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

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The purpose of the project activity is to install a 2 MW biomass power plant that utilises rice husk that would otherwise be left to decay as fuel in order to generate electricity and sell it to Angkor Kasekam Roongroeung Rice Mill (Angkor Rice Mill; AKR) in Kandal province in Cambodia. The Project contributes to GHG emissions reduction by displacing diesel oil currently used for power generation at the rice mill. The Project also avoids methane emissions that would be produced from rice husk left to decay in the absence of the Project. It has been planned that Angkor Rice Mill sells a small amount of surplus electricity to neighbouring factories and community, however, a decision of Angkor Rice Mill to sell the surplus electricity to the community is positioned outside of the project boundary. The Project is the first renewable energy project to utilise rice husk as biomass fuel in Cambodia.

The technology employed for the project activity is the torbed process reactor technology selected after in-depth review of the suitability as well as maintenance and operation support given by manufacturer and supplier. This technology is designed by DGA, A Thailand-based contractor, based on a license from ERK Eckrohrkessel of Germany. The technology's characteristics include; 1) faster and more precise temperature control, 2) handling of irregularly shaped solid feed stocks which minimises feed stock shredding, chipping or mill, 3) low pressure drop allowing process gas recirculation for maximum turndown, 4) simple mechanics to operate, 5) small size with easy installation, 6) rapid start-up and configuration change, 7) no moving parts and 8) durable features in operation and maintenance. In addition, this technology produces amorphous ash with low carbon content (less than 2% carbon) as a by-product instead of the n-crystalline ash which is a carcinogenic substance. This feature contributes to the health and safety conditions to the operators working at the project site and the local residents in the vicinity.

The surplus steam generated by the Project, it is not used for power generation, but sent to the AKR for drying paddy. The rice paddy is presently placed on the ground and dried through its exposure to the sun. While utilisation of surplus steam does not lead to GHG emission reduction, it contributes to increased efficiency in paddy drying process.

The boundary and overview of the Project is demonstrated in the Figure 1.

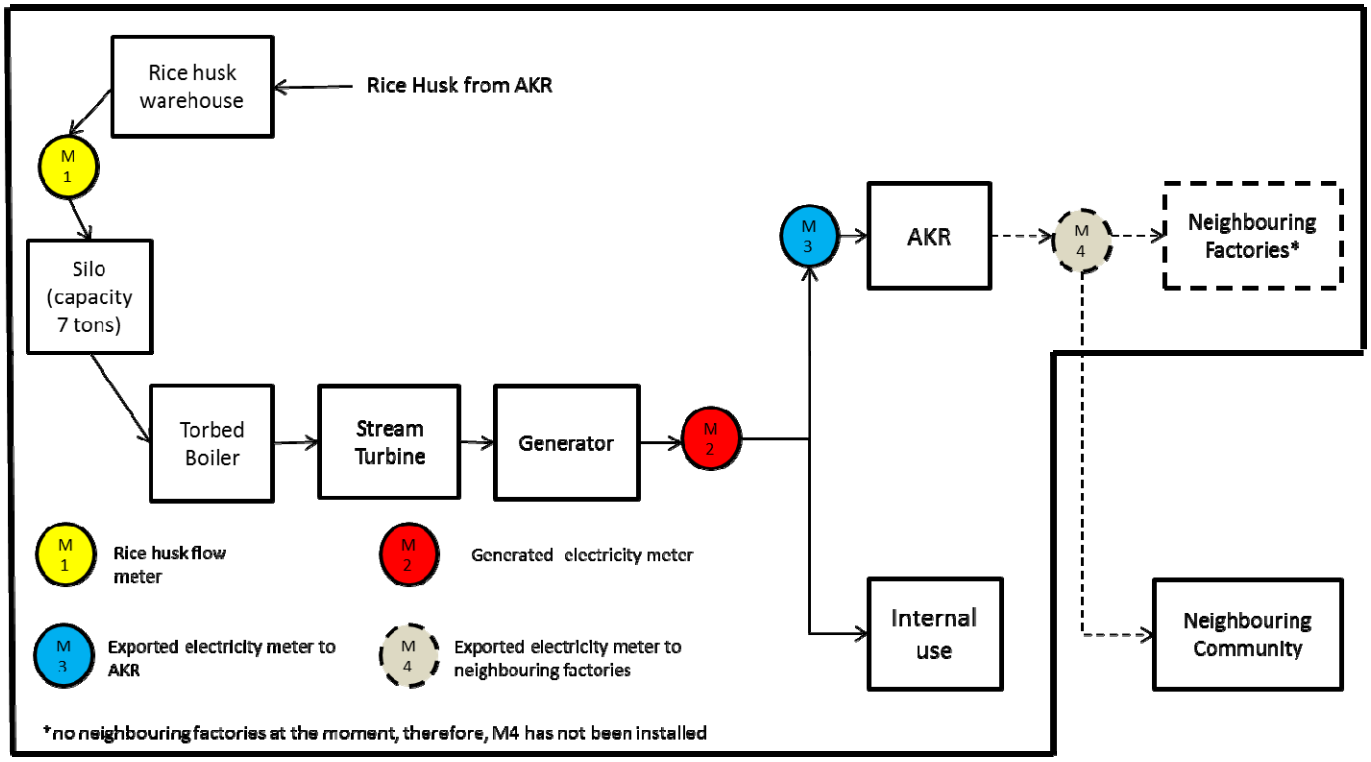

Figure 1. Schematic diagram of the project boundary

The construction of the Project began on 01/07/2006. The project starting date was 22/05/2006 which was the date on which equipment purchase contract was signed and the commercial operation started on 23/10/2011.

During this monitoring period, the total amount of electricity generated by project is 646.906 MWh. The electricity delivered to AKR is 250.235 MWh and the rest, 395.466 MWh is a parasitic load. The project has not yet exported the electricity to neighbouring factories and community. The operating hour of the project is 1,519 hours. The shut-down hours, 6,088 hours, were caused mainly by the power plant maintenance.

Total emission reductions achieved in this monitoring period is 4,425tonnes CO_2e

A.2. Location of project activity

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The Project is located in Kandal province in Cambodia. It is 23 km away from Phnom Penh, the capital of Cambodia.

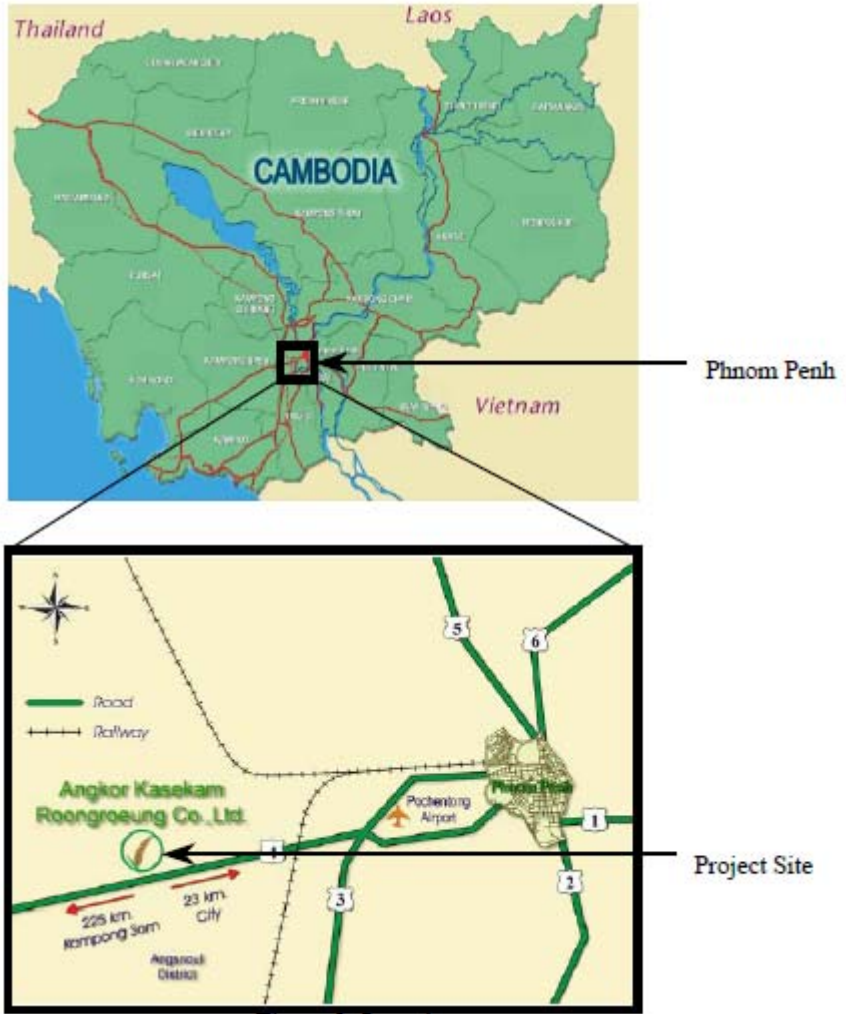

Figure 2. Location of the Project

A.3. Parties and project participant(s)

Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Cambodia (host)	Angkor Bio Cogen Co., Ltd (ABC) (Private entity)	No
Japan	Clean Energy Finance Committee, Mitsubishi UFJ Morgan Stanley Securities Co., Ltd (MUMSS) (Private entity)	No
Sweden	Asian Development Bank, as Trustee of the Future Carbon Fund; Swedish Energy Agency (Public entity)	No

A.4. Reference of applied methodology

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In accordance with Appendix B of the simplified modalities and procedures for small-scale CDM project activities ("SSC M&P"), the proposed Project falls under the following types and categories:

AMS-I.A.
Type I : Renewable energy projects
Category C : Electricity generation by the user
Reference : Version 7, Scope 1, valid from Reference 27/11/2005 onwards
AMS-III.E
Type III : Other project activities
Category E : Avoidance of methane production from biomass decay through controlled combustion
Reference : Version 7, Scope 13 and 15, valid from Reference 27/11/2005 onwards

A.5. Crediting period of project activity
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The starting date of the crediting period is 20/04/2011 and a renewable 7 year-crediting period is chosen for the project activity.

SECTION B. Implementation of project activity
B.1. Description of implemented registered project activity
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A summary of the implementation status of the project activity covering this monitoring period is described below:

(1) Main equipment installed and operated at the Project

The technology employed at the project site is a torbed reactor designed by DGA, Thailand-based contractor, based on a license from ERK Eckrohrkessel of Germany. The capacities of the turbine and generator are 17 t/h and 2MW, respectively.

(2) The starting date of the project activity: 22/05/2006

(3) Project commercial operation starting date: 23/10/2011

(4) Project does not involve with phased implementation and the project activities consist of only one site at the project site mentioned in section A.3.

(5) Actual operation of the project activity during this monitoring period

The details of actual operation during this monitoring period are as follows:-

List	Amount	Source/Remark
Gross Generation	646.906 MWh	-
Electricity Export to AKR	250.235 MWh	-
Electricity Export to neighbouring factories and community	0 MWh	The facility to export electricity to the neigbouring factories and community has not been installed.
Parasitic load	395.466 MWh	-
Operating hours	1,519 hours	-
Outage hours	6,088 hours	-

The operating hours were much less than the outage hours in this monitoring period. The power plant's operation was ceased often mainly due to the failure of equipment. Another main problem which causes long and frequent shutdowns of the operation was the lack of skilled manpower. These two problems are explained in details below;

- Equipment maintenance and repair – ash handling system was the main system in the power plant which caused significant operational problems. Production was stopped for the whole month in September in order to repair this system. Subsequent shutdowns were caused by the same problem for further adjustment of the ash handling system. In addition, most of parts for the ash handling system must be supplied from abroad (Thailand) and this also led to a prolong shutdown time. There were also minor failures which occurred to the other systems as shown in the table below. Similarly, many spare parts to repair the faults were not available locally. The length of time from the shutdown, repairing, and start-up for each fault was significantly long.
- Lacking of manpower for continuous operation – the local operators were lack of skill and many local operators resigned from the power plant after few weeks to months. This is a significant problem for the power plant since the operation must cease for a couple of days after 3-4 days operation to allow the operators and engineers to take a proper rest. The start up and cool-down of the boiler would require one or two days which means the actual operation is very short.

Summary of the events which disrupt the operation in this monitoring period are provided in the table below

Month	Main reason(s) for the power plant shut down
Jun 2011	Maintenance: deionised water system
July 2011	Maintenance: deionised water system/control valve for the returned water to boiler
August 2011	Maintenance: control valve for the returned water to boiler/burner/fuel handling system
September 2011	Maintenance: fuel handling system/boiler hopper/bag filter system/electricity supplied facility to AKR/ash handling system
October 2011	Maintenance: fuel handling system/burner/steam valve/hopper/bag filter system
November 2011	Maintenance: gate valve/electricity supplied facility to AKR/ash handling system
December 2011	Maintenance: blower system
January 2012	Maintenance: conveyor system for rice husk feeding to furnace/ash packaging system
February 2012	Maintenance: few equipments such as transmitter, ash silo filter, fans, motor
March 2012	Maintenance: Ash handling system
April 2012	Maintenance: Ash handling system
May 2012	Maintenance: Ash handling system

(6) Brief description of events or situations that occurred during the monitoring period, which may impact the applicability of the methodology and how the issues resulting from these events or situations are being addressed

There were no events or situations occurred during this monitoring period that have impacted on the applicability of the methodology.

The facilities for supplying electricity to neighbouring factories and community have not yet been installed. Therefore, electricity exported from the Project to neighbouring factories and community during this monitoring period is zero.

B.2. Post registration changes

B.2.1. Temporary deviations from registered monitoring plan or applied methodology

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Not applicable

B.2.2. Corrections

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Not applicable

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

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Not applicable

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

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Not applicable

B.2.5. Changes to start date of crediting period

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The start date of crediting period has been changed twice as follows.

(1) The change to the start date of the crediting period from 21 Apr 2007 to 19 Apr 2009 was approved on 03/11/2009. A reference number was not made available by UNFCCC Secretariat.

(2) The change to the start date of the crediting period from 19 April 2009 to 20 April 2011 was approved on 16 August 2012 as per PRC ref No. PRC-0363-001.

B.2.6. Types of changes specific to afforestation or reforestation project activity

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Not applicable

SECTION C. Description of monitoring system

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The main members of the organisation, shown in Figure 3, are Managing Director, Power Plant Manager, Operation Manager, Maintenance Manager, Shift Manager, Engineers, operators, and administrative staffs. Power plant Manager manages overall power plant operation and maintenance which under the supervision of Operation Manager and Maintenance Manager, respectively. Operators, who are under the supervision of Shift Supervisors, are assigned to monitor different parameters on a timely basis, as well as to record and archive data in an orderly manner. Monitoring log sheets are forwarded to and reviewed by Managing Director on a monthly basis in order to ensure the Project follows the requirements of the monitoring plan.

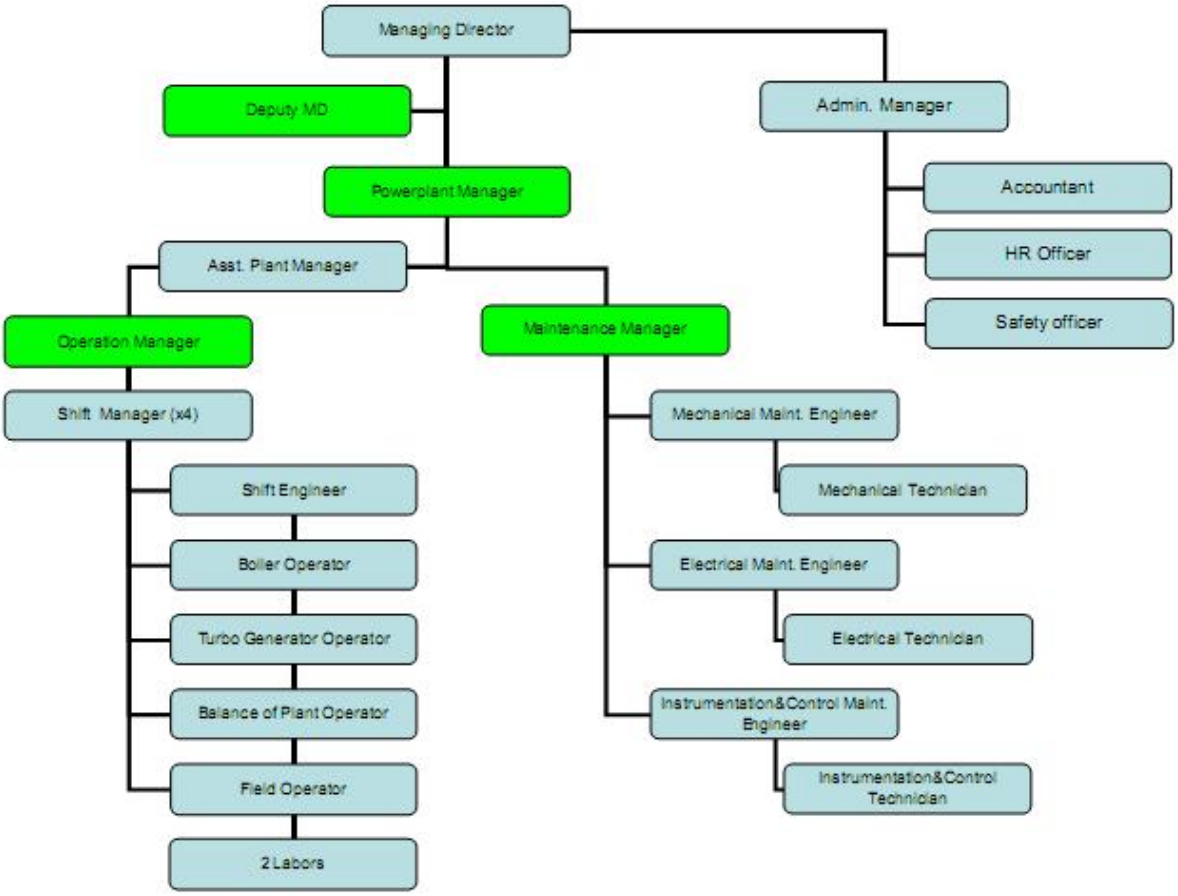

Figure 3 Orginisation chart of the monitoring team for the CDM activity

All the parameters, including the default values such as the ones set forth by IPCC, are under the responsibility of ABC's Operation and Management teams.

Monitoring will be conducted with appropriate number of personnel for the tasks according to the operation and maintenance structure in Figure 3. Operation Manager will be the main person responsible for monitoring while the Maintenance Manager will be responsible for the maintenance of monitoring equipment. Both Operation Manager and Maintenance Manager report to Power plant Manager who ultimately reports to the Managing Director. Operation will be conducted in 4 shifts, each with 1 shift manager and 7 staff members.

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante or at renewal of crediting period

Data / Parameter	-
Unit	kg CO2e/kWh
Description	Default CO2 emission coefficient for the fuel displaced
Source of data	AMS-I.A (Ver.7)
Value(s) applied	0.9

Purpose of data	Baseline emission calculations
Additional comment	The value is calculated as per the PDD. The value is set ex-ante.

Data / Parameter	*l*
Unit	-
Description:	average technical distribution losses that would have been observed in diesel powered mini-grids installed by public programmes or distribution companies in isolated areas, expressed as a fraction
Source of data	
Value(s) applied	0
Purpose of data	Baseline emission calculations
Additional comment	The diesel power plant is located on-site, therefore the distribution losses is zero

Data / Parameter	MCF
Unit	-
Description:	Methane Correction factor
Source of data	III.E. Avoidance of methane production from biomass decay through controlled combustion version 7
Value(s) applied	0.4
Purpose of data	Baseline emission calculations
Additional comment	The value is set ex-ante.

Data / Parameter:	DOC
Unit	-
Description:	Degradable organic carbon
Source of data	III.E. Avoidance of methane production from biomass decay through controlled combustion version 7.0
Value(s) applied	0.3
Purpose of data	Baseline emission calculations
Additional comment	The value is set ex-ante.

Data / Parameter	DOC_f
Unit	-
Description:	Fraction DOC dissimilated to landfill gas
Source of data	III.E. Avoidance of methane production from biomass decay through controlled combustion version 7.0
Value(s) applied	0.77
Purpose of data	Baseline emission calculations
Additional comment	The value is set ex-ante.

Data / Parameter	F
Unit	-
Description:	Fraction of CH_4in landfill gas
Source of data	III.E. Avoidance of methane production from biomass decay through controlled combustion version 7.0
Value(s) applied	0.5
Purpose of data	Baseline emission calculations

Additional comment	The value is set ex-ante.

D.2. Data and parameters monitored

Data / Parameter	**D.3-1**
Unit	MWh
Description	Generated Electricity and delivered to AKR
Measured /Calculated /Default	Measured
Source of data	Meter reading
Value(s) of monitored parameter	646.906 (gross electricity generation) , 250.235 (electricity delivered to AKR)
Monitoring equipment	(Gross generation) Device name: Electrical Power Meter Serial No.: 4C977606 Instrument type: Electricity Meter Manufacturer: Schneider Electric Accuracy class: Class 1 PT Ratio and CT Ratio: n/a Calibration/Test report reference ID: Date of Calibrated/Test: 19/05/2011 Calibration validity: 18/05/2013 Calibration frequency: Every two years (Electricity delivered to AKR) Device name: Electrical Power Meter Serial No.: 4C689D8F Instrument type: Electricity Meter Manufacturer: Schneider Electric Accuracy class: Class 1 PT Ratio and CT Ratio: n/a Calibration/Test report reference ID: Date of Calibrated/Test: 19/05/2011 Calibration validity: 18/05/2013 Calibration frequency: Every two years
Measuring/ Reading/ Recording frequency	Everyday
Calculation method (if applicable)	N/A

QA/QC procedures	The electricity meter is calibrated in accordance with the national standards or suggestion by meter supplier.
Purpose of data	Baseline emission calculations
Additional comment	The conformity certificate issued by supplier to demonstrated that the meter was calibrated before it was shipped to ABC and installed at the project site.

Data / Parameter	**D.3-2**
Unit	MWh
Description	Amount of electricity supplied to the local community
Measured /Calculated /Default	Measured
Source of data	n/a
Value(s) of monitored parameter	n/a
Monitoring equipment	
Measuring/ Reading/ Recording frequency	Monthly (aggregate)
Calculation method (if applicable)	n/a
QA/QC procedures applied	
Purpose of data	Baseline and Project emission calculations
Additional comment	This meter has not yet installed.

Device name	n/a
Serial No.	n/a
Instrument type	n/a
Manufacturer	n/a
Accuracy class	n/a
PT Ratio and CT Ratio	n/a
Calibration/Test report reference ID	n/a
Date of Calibrated/Test	n/a
Calibration validity	n/a
Calibration frequency	n/a

Data / Parameter	**D.3-3**
Unit	tonne
Description	Amount of rice husk combusted
Measured /Calculated /Default	Measured
Source of data	Rice Husk Flow Meter
Value(s) of monitored parameter	3,588.50
Monitoring equipment	

Device name	Rice Husk Flow Meter
Serial No.	087378 L005249

	Instrument type	Flow Meter
	Manufacturer	Pro. Face
	Accuracy class	n/a
	Calibration/Test report reference ID	036/11DML
	Date of Calibrated/Test	15/06/2011
	Calibration validity	19/08/2013
	Calibration frequency	Every 2 years
Measuring/ Reading/ Recording frequency	Monthly (aggregate)	
Calculation method (if applicable)	N/A	
QA/QC procedures applied	The rice husk flow meter is calibrated in accordance with the national standards or suggestion by meter supplier.	
Purpose of data	Baseline and Project emission calculations	
Additional comment	The meter is counted when door of the rice husk shutter is opened and rice husk is transferred to the furnace for the combustion. Each count is equivalent to 100 kilogramme.	

Data / Parameter	**D.3-4**
Data unit:	TJ/Tonne
Description:	Energy content of biomass treated
Measured /Calculated /Default	Measured
Source of data	Heating value analysis report
Value(s) of monitored parameter	0.01633
Monitoring equipment	n/a
Measuring/ Reading/ Recording frequency:	Every year
Calculation method (if applicable):	n/a
QA/QC procedures applied:	HHV (also LHV) is analysed by the certified laboratory.
Purpose of data	Project emission calculations
Additional comment	Two samples were sent to the laboratory. The value used in this monitoring report is an average value of these two samples.

D.3. Implementation of sampling plan

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Not applicable

SECTION E. Calculation of emission reductions or GHG removals by sinks

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

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(1) Grid electricity generation

The electricity generation component is conducted in accordance with the instructions provided in paragraphs 5 to 7 of Type I.A., Appendix B of the simplified modalities and procedures for small-scale CDM project activities. According to the instructions, there are two options that the project participants may choose from regarding the baseline formula. As stated in B.2, Option 2 is selected for this project activity.

The formula is expressed as follows:

$$E_B = \Sigma_i O_i /(1- l)$$

where,

E_B = annual energy baseline (in kWh per year)
Σ_I = the sum over the group of "i" renewable energy technologies implemented as part of the project
O_i = the estimated annual output of the renewable energy technologies of the group of "i" renewable energy technologies installed (in kWh per year)
l = average technical distribution losses that would have been observed in diesel powered mini- grids installed by public programs or distribution companies in isolated areas, expressed as a fraction.

According to paragraph 7 of Type I.A, Appendix B of the simplified modalities and procedures for small-scale CDM project activities, the emissions baseline is the energy baseline calculated above times the CO2 emission coefficient for the fuel displaced. Following the instruction, a default value of 0.9 kg $CO2_e$/kWh (or 0.9 tCO2e/MWh), which is derived from diesel generation units, will be used.

The distribution loss (l) is zero as the diesel power plant is currently located on-site.

Based on the total quantity of generated electricity (EB), 204.33 MWh/year, emission reduction due to electricity generation is calculated as per the following equation.

Baseline emissions for electricity generation (tCO_2e/year)	=	Total electricity generated minus the electricity supplied to the neighbouring community (MWh/year)	x	CO2 emission coefficient (tCO_2e/MWh)
	=	250.235	x	0.9
	=	**225**		

2) Methane avoidance

The baseline emission for methane avoidance is calculated based on item 3 of AMS-III.E., Version 7, expressed as follows:

BE_y (tCO_2e)	=	$Q_{biomass}$ (tonnes)	x	$CH_4\_IPCC_{decay}$ (tCH4/tonne of biomass)	x	GWP_CH_4 (tCO_2e/tCH4)
	=	3,588.50	x	0.0616	x	21
	=	**4,642**				

where

BE_y = Baseline methane emissions from biomass decay (tonnes of CO_2 equivalent)
$Q_{biomass}$ = Quantity of biomass treated under the project activity (tonnes)
GWP_CH_4 = GWP for CH_4 (tonnes of CO_2 equivalent/tonnes of CH_4, default is 21)

and

$CH_4\_IPCC_{decay}$ (tCH4/tonne of biomass)	=	MCF	x	DOC	x	DOC_f	x	F	x	16/12
	=	0.4	x	0.3	x	0.77	x	0.5	x	16/12
	=	**0.0616**								

where

$CH_4\_IPCC_{decay}$ = IPCC CH_4 emission factor for decaying biomass in the region of the project activity (tonnes of CH_4/tonne of biomass)
MCF = Methane correction factor (fraction, default is 0.4 for less than 5 metres in depth)
DOC = Degradable organic carbon (fraction, default is 0.3)
DOC_f = Fraction DOC dissimilated to landfill gas (default is 0.77)
F = Fraction of CH_4 in landfill gas (default is 0.5)

The sum of baseline emissions is calculated as below:

Total baseline emissions (tCO_2e)	=	Baseline emissions for displacement of grid electricity (tCO_2e)	+	Baseline emissions for methane avoidance (tCO_2e)
	=	225	+	4,642
	=	**4,867**		

E.2. Calculation of project emissions or actual net GHG removals by sinks
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Project emissions were calculated as per the following formula:

(1) Project emissions from combustion of biomass (PE_y)

PE_y (tones)	=	$Q_{biomass}$ (tonnes)	x	$E_{biomass}$ (TJ/tones)	x	(CH_4bio_comb x CH_4_GWP) + (N_2Obio_comb x N_2O_GWP) (tCO_2/TJ)
	=	3,558.50	x	0.01633	x	7.54*
	=	**442**				

* The emission of CH_4 and N_2O from biomass combustion
= (CH_4bio_comb * CH_4_GWP + N_2Obio_comb *N_2O_GWP)
= (0.3 tCH_4/TJ x 21 tCO_2e/tCH_4 + 0.004 tN_2O/TJ x 310 tCO_2e/tN_2O)
= 7.54 tCO_2e/TJ

where,

PE_y = Project activity emissions (tCO_2e)

$Q_{biomass}$ = Quantity of biomass treated under the project activity (tonnes)
E_{biomas} = Energy content of biomass (TJ/tonnes)
CH_4bio_comb = CH_4 emission factor for biomass waste (which includes dung and agricultural, municipal and industrial wastes) combustion (tCH_4/TJ, default value is 0.3)
CH_4_GWP = GWP for CH_4 (tCO_2e/tCH_4)
N_2Obio_comb = N_2O emission factor for biomass waste (which includes dung and agricultural, municipal and industrial wastes) combustion (tN_2O/TJ, default value is 0.004)
N_2O_GWP = GWP for N_2O (tCO_2e/tN_2O)

Other project emission

As prescribed in Appendix B of the SSC M&P, the GHG on-site emissions generated from ancillary activities, such as start-up operation within the project boundary, are considered negligible.

E.3. Calculation of leakage

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Leakage calculation associated with the electricity generation component of the Project Activity is not required. According to paragraph 4 of Type III.E., Appendix B (Version 7) of the simplified modalities and procedures for small-scale CDM project activities, leakage calculation is not required for the methane avoidance component of the Project Activity.

E.4. Summary of calculation of emission reductions or net anthropogenic GHG removals by sinks

Time Period	Baseline emissions or baseline net GHG removals by sinks (tCO_2e)	Project emissions or actual net GHG removals by sinks (tCO_{2e})	Leakage (tCO_2e)	Emission reductions or net anthropogenic GHG removals by sinks (tCO_2e)
Total	4,867	442	0	4,425

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

Item	Values estimated in ex-ante calculation of registered PDD	Actual values achieved during this monitoring period
Emission reductions or GHG removals by sinks (tCO_2e)	57, 701	4,425

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

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The actual emission reduction achieved during this monitoring period is much lower than the estimation anticipated in the registered CDM-PDD because during this period the power plant's operation was stopped by the technical shutdown/maintenance and lacking of skilled manpower to maintain the continuous operation which is summarised in Section B. 1 of this monitoring report.

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History of the document

Version	Date	Nature of revision
02.0	EB 66 13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01	EB 54, Annex 34 28 May 2010	Initial adoption.
Decision Class: Regulatory **Document Type**: Form **Business Function**: Issuance		