



Monitoring report form (Version 03.1)

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	1.0
Completion date of the monitoring report	06 June 2013
Registration date of the project activity	10 August 2006
Monitoring period number and duration of this monitoring period	Second monitoring period From 01/06/2012 to 31/12/2012 (214 days)
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 (Scope 1), Waste handling and disposal (Scope 13), Agriculture (Scope 15). 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	30,264 tonnes CO ₂ (214 days) ¹
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period	988 tonnes CO ₂ (214 days)

¹ The annual emission reduction in the registered PDD is 51,620 tCO₂/year. The estimated amount for this monitoring period is 30,264 tCO₂, which is derived from 51,620 tCO₂/365 days*214 days.

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

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 Roongroeng 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 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.

This monitoring period is covered the period from 01/06/2012 to 31/12/2012. The total amount of electricity generated by project is 161.209 MWh. The electricity delivered to AKR is 49.416 MWh and the rest, 111.793 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 307 hours. The shut-down hours, 4,829 hours, were caused mainly by the low environmental loading required by AKR as explained in the below table of Section B.1.

The start date of the crediting period is started on 20/04/2011. The first verification period is covered from 20/04/2011 – 31/05/2012 (408 days). For this 2nd monitoring report, the actual duration of this monitoring period has been covered 01/06/2012 – 31/12/2012 (214 days). Total emission reductions achieved in this monitoring period is 988 tonnes CO₂e.

A.2. Location of project activity

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

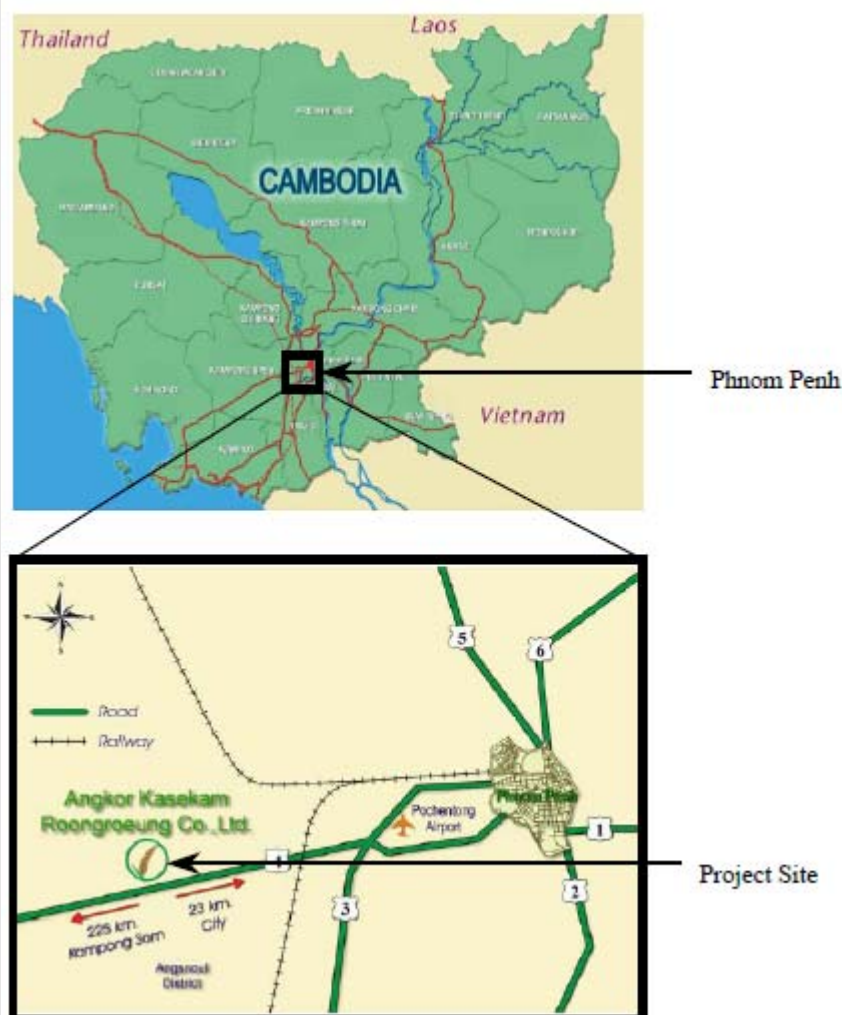


Figure 1. Location of the Project

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

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

The starting date of the crediting period is 20/04/2011 and the end date of the crediting period is 19/04/2018. 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**

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	161.209 MWh	-
Electricity Export to AKR	49.416 MWh	-
Electricity Export to neighbouring factories and community	0 MWh	The facility to export electricity to the neighboring factories and community has not been installed.
Parasitic load	111.793 MWh	-
Operating hours	307 hours	-
Outage hours	4,829 hours	-

The operating hours were much less than the shutdown hours in this monitoring period. The power plant's shut-downs occurred due to the low environmental loading required by AKR. During this period of time, AKR was ordered to cleaning, grading and packing of the rice. These processes required small loading of electricity, which was around 100 amp (or, approximately 51.14kW). Under this situation, it was not economically profitable for ABC to operate the power plant at its maximum capacity.

(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

Not applicable

B.2.2. Corrections

Not applicable

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

Not applicable

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

Not applicable

B.2.5. Changes to start date of crediting period

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

Not applicable

SECTION C. Description of monitoring system

The boundary and overview of the Project is demonstrated in the Figure 2.

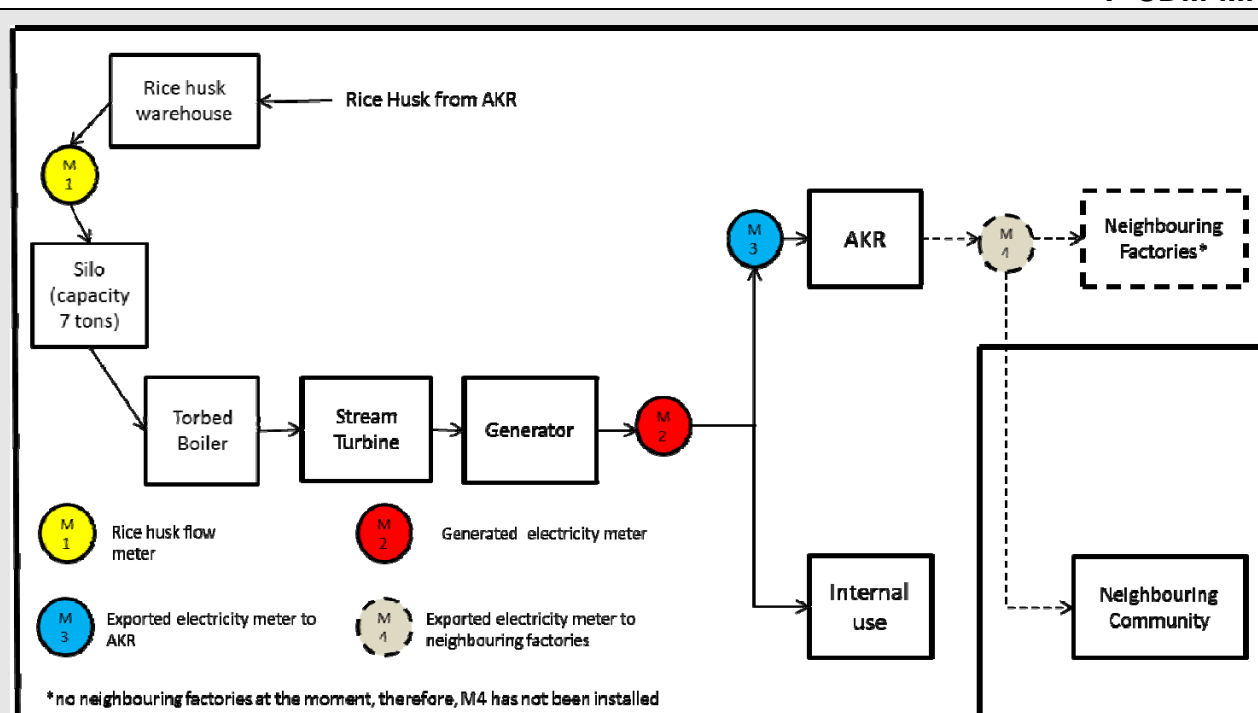


Figure 2. Schematic diagram of the project boundary

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.

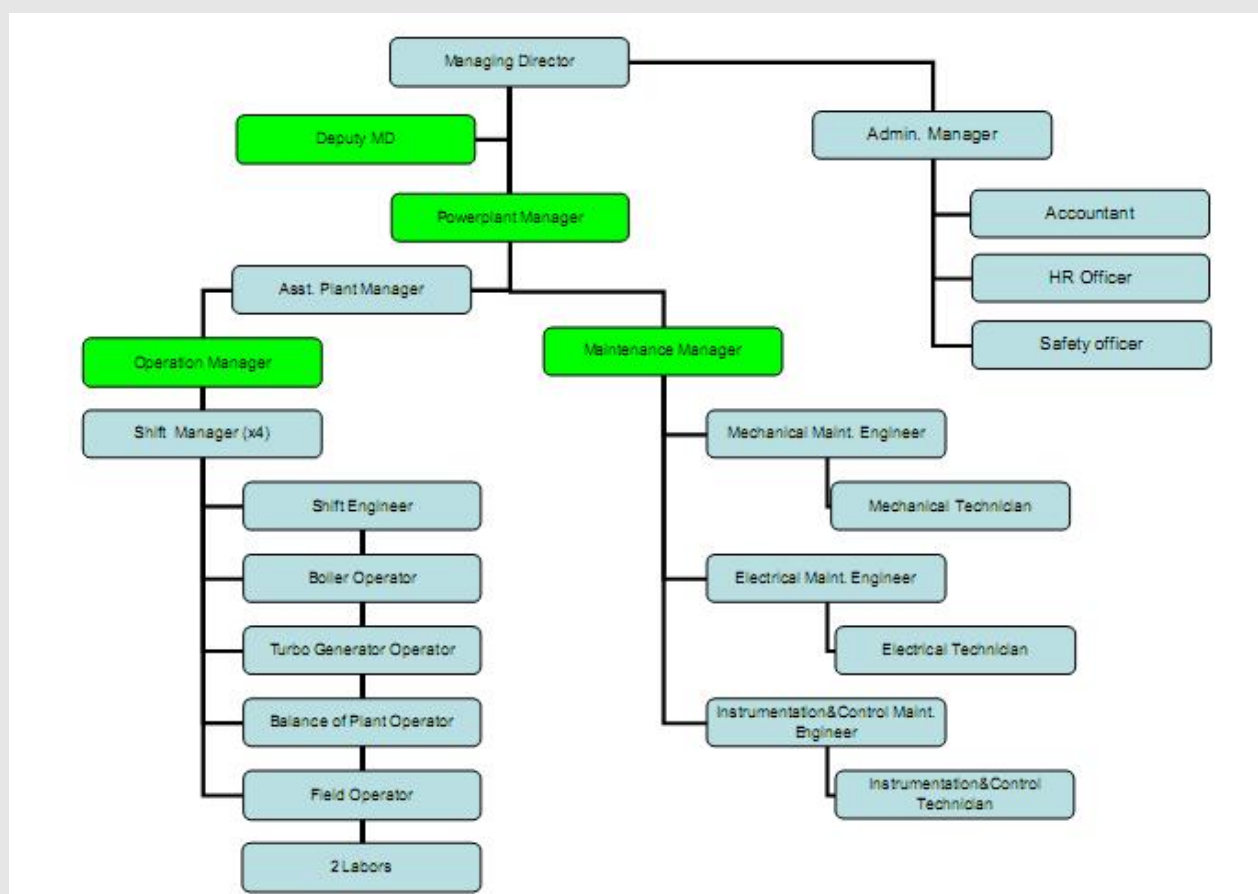


Figure 3 Organisation chart of the monitoring team for the CDM activity

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 CO ₂ e/kWh
Description:	Default CO ₂ 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:	/
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 ₄ in 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:	161.209 (gross electricity generation) , 49.416 (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	n/a
	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	n/a	
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 demonstrate 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:	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	
Measuring/ Reading/ Recording frequency:	Monthly (aggregate)		
Calculation method (if applicable):	n/a		
QA/QC procedures:			
Purpose of data:	Baseline and Project emission calculations		
Additional comment:	This meter has not yet installed.		
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:	806.80		

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:	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 kilogrammes.	

Data / Parameter:	D.3-4
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:	0.01615
Monitoring equipment:	n/a
Measuring/ Reading/ Recording frequency:	Every year
Calculation method (if applicable):	n/a
QA/QC procedures:	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

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

(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:

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

where,

- E_B = annual energy baseline (in kWh per year)
- \sum_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 CO₂e/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), 49.416 MWh/year, emission reduction due to electricity generation is calculated as per the following equation.

Baseline emissions for electricity generation (tCO₂e/year)	=	Total electricity generated minus the electricity supplied to the neighbouring community (MWh/year)	x	CO ₂ emission coefficient (tCO ₂ e/MWh)
	=	49.416	x	0.9
	=	44		

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_v (tCO₂e)	=	Q_{biomass} (tonnes)	x	CH₄_IPCC_{decay} (tCH₄/tonne of biomass)	x	GWP_CH₄ (tCO₂e/tCH₄)
	=	806.80	x	0.0616	x	21
	=	1,043.68				

Where,

BE_v = Baseline methane emissions from biomass decay (tonnes of CO₂ equivalent)
 $Q_{biomass}$ = Quantity of biomass treated under the project activity (tonnes)
 GWP_{CH_4} = GWP for CH₄ (tonnes of CO₂ equivalent/tonnes of CH₄, default is 21)

and

CH₄_IPCC_{decay} (tCH ₄ /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 CH₄ emission factor for decaying biomass in the region of the project activity (tonnes of CH₄/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 CH₄ in landfill gas (default is 0.5)

The sum of baseline emissions is calculated as below:

Total baseline emissions (tCO ₂ e)	=	Baseline emissions for displacement of grid electricity (tCO ₂ e)	+	Baseline emissions for methane avoidance (tCO ₂ e)
	=	44	+	1,043
	=	1,087		

E.2. Calculation of project emissions or actual net GHG removals by sinks

Project emissions were calculated as per the following formula:

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

PE_v (tonnes)	=	$Q_{biomass}$ (tonnes)	x	$E_{biomass}$ (TJ/tonnes)	x	(CH ₄ bio_comb x CH ₄ _GWP) + (N ₂ Obio_comb x N ₂ O_GWP) (tCO ₂ /TJ)
	=	806.80	x	0.01615	x	7.54*
	=	99				

* The emission of CH₄ and N₂O from biomass combustion
 = (CH₄bio_comb * CH₄_GWP + N₂Obio_comb * N₂O_GWP)
 = (0.3 tCH₄/TJ x 21 tCO₂e/tCH₄ + 0.004 tN₂O/TJ x 310 tCO₂e/tN₂O)
 = 7.54 tCO₂e/TJ

where,

PE_v = Project activity emissions (tCO₂e)
 $Q_{biomass}$ = Quantity of biomass treated under the project activity (tonnes)
 $E_{biomass}$ = Energy content of biomass (TJ/tonnes)
 CH₄bio_comb = CH₄ emission factor for biomass waste (which includes dung and agricultural, municipal and industrial wastes) combustion (tCH₄/TJ, default value is 0.3)
 CH₄_GWP = GWP for CH₄ (tCO₂e/tCH₄)
 N₂Obio_comb = N₂O emission factor for biomass waste (which includes dung and agricultural, municipal and industrial wastes) combustion (tN₂O/TJ, default value is 0.004)
 N₂O_GWP = GWP for N₂O (tCO₂e/tN₂O)

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.

The Project has used LPG, a fuel to be burned during start-up of the boiler, to preheat the combustion zone, before the rice husk can sustain its own combustion. The total LPG usage for this monitoring period totals to 4,725 Kg. The calculated GHG emission from the LPG consumption is 14.10 tCO₂e². However, according to Para 10(e) of "Guideline on application of materiality in verification (Version 01.0)", for small-scale project activities under which the project activity is categorized, information is considered material when it leads to overestimation of GHG emission reduction by equal to or higher than 5%.

The calculated GHG emission from the LPG consumption is 14.10 tCO₂e, which does not exceed 5% of total emission reductions of 988 tCO₂e. Thus, its impact is considered negligible.

E.3. Calculation of leakage

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

Item	Baseline emissions or baseline net GHG removals by sinks (t CO ₂ e)	Project emissions or actual net GHG removals by sinks (t CO ₂ e)	Leakage (t CO ₂ e)	Emission reductions or net anthropogenic GHG removals by sinks (t CO ₂ e)
Total	1,087	99	0	988

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 (t CO ₂ e)	30,264 tonnes CO ₂ (214 days)	988 tonnes CO ₂ (214 days)

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

The actual emission reduction achieved during this monitoring period is much lower than the estimation anticipated in the registered CDM-PDD due to the low environmental loading of AKR which is explained in Section B. 1 of this monitoring report.

E.7. Actual emission reductions or net anthropogenic GHG removals by sinks during the first commitment period and the period from 1 January 2013 onwards

Item	Actual values achieved up to 31 December 2012	Actual values achieved from 1 January 2013 onwards
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Emission reductions or GHG removals by sinks (t CO₂e)	4,768 tonnes CO ₂ (3,780 tCO ₂ for the period of 20/04/2011-31/05/2012 plus 988 tCO for the period of 01/06/2012-31/12/2012)	Not Available
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Document information

<i>Version</i>	<i>Date</i>	<i>Description</i>
03.1	2 January 2013	Editorial revision to correct table in section E.5.
03.0	3 December 2012	Revision required to introduce a provision on reporting actual emission reductions or net anthropogenic GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB70, Annex 11).
02.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01	28 May 2010	EB 54, Annex 34. Initial adoption.
Decision Class: Regulatory Document Type: Form Business Function: issuance Keywords: monitoring report, performance monitoring		