Project design document form for small-scale CDM project activities

(Version 06.0)

Complete this form in accordance with the Attachment "Instructions for filling out the project design document form for small-scale CDM project activities" at the end of this form.

PROJECT DESIGN DOCUMENT (PDD)	
Title of the project activity	Angkor Bio Cogen Rice Husk Power Project
Version number of the PDD	3.0
Completion date of the PDD	11 August 2015
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	Cambodia
Sectoral scope and selected methodology(ies), and where applicable, selected standardized baseline(s)	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), AMS-I.D (Ver.18)
Estimated amount of annual average GHG emission reductions	51,620 tCO_2e

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

The Project is designed to use for electricity generation rice husk that would otherwise be left to decay.

It involves the construction and operation of a 2 MWe new rice husk power generation plant adjacent to Angkor Kasekam Roongroeung Rice Mill (Angkor Rice Mill) in Kandal province in Cambodia. The project owner, Angkor Bio Cogen (ABC), will sell the electricity to the rice mill. The rice mill is currently using diesel oil to generate electricity for the rice mill operation.

At present, the rice mill operation requires 380 kW electricity input. However, the rice mill plans to increase its rice production from 10 tons/hour to 30 tons/hour of rice paddy input. This will result in an increase in electricity requirements from 380 kW to up to 2 MW gross electricity input.

The Project will displace the use of diesel oil for power generation at the rice mill. The Project will also avoid methane emissions that would be produced from rice husk left to decay in the absence of the Project. Some liquefied petroleum gas (LPG) will be consumed for start-up of the boiler only to preheat the combustion zone.

ABC will sell the electricity to Angkor Rice Mill in bulk under a power purchasing agreement. It is planned that Angkor Rice Mill sells a small amount of surplus electricity to neighbouring factories and community, as well as supplied electricity to the grid through power utility, such as Electricity Angsnoul Enterprise (EAE), in Angsnoul District in Cambodia. The factories are also using diesel oil to generate electricity for their own operations. The Project covers ABC's electricity sales to Angkor Rice Mill and possible Angkor Rice Mill's electricity sales to the factories. However, a decision of Angkor Rice Mill to sell the surplus electricity to the community is positioned outside of the project boundary (See Project Boundary in Section B.3 and Monitoring Plan in Section B.7).

The Project will become the first renewable energy project to utilize rice husk as biomass fuel in Cambodia. The estimated annual average emission reductions are 51,620 tCO_2e and the total emission reduction for the seven years crediting period are 361,340 tCO_2e.

The project activity installs 2 MWe electricity generator using renewable source fuel (rice husk) supplied to AKR and connected to the grid through power utility. It falls into 'Type 1: Renewable energy project activities with a maximum output capacity equivalent to up to 15 megawatts' and 'Type 3: Other project activities that both reduce anthropogenic emissions by sources and directly emit less than 60 kilotonnes of carbon dioxide equivalent annually'. The baseline scenario in the absence of project activity continues to use high carbon intensive (diesel oil) for electricity generation. Furthermore, this project is not a CPA from a registered CDM PoA.

Contribution to the sustainable development of the host country

Cambodian Designated National Authority (DNA) presents a document regarding sustainable development criteria for proposed CDM activities.[1] The instruction in the document indicates that the PDD must outline how the project meets Cambodia's sustainable development objectives. The following illustrates how the Project meets the four criteria outlined in the instruction.

The Project contributes to environmental protection and improvement in Cambodia and therefore meets the first criteria. The Project's contribution on reduction in air pollution and sustainable use of land resources are particularly significant. The Project reduces greenhouse gas (GHG)

[1] The document is titled Sustainable Development Criteria for Proposed Clean Development Mechanism (CDM) Projects and available from the DNA.

emissions by utilizing renewable energy sources that would have been abandoned. As described in Environmental Impact of Section D, the Project does not cause negative environmental impacts.

The Project brings social benefits to the neighbouring community and meets the second criteria. Angkor Rice Mill and ABC are jointly exploring a possibility of providing a small volume of electricity to a neighbouring village with a relatively small charge. As described in Local Stakeholder Consultation of Section E, ABC invited the members of the neighbouring community to a public consultation meeting on September 18th, 2004 and again on February 22nd, 2005. All the members expressed their support to the Project.

The Project leads to technology transfer as well as know-how transfer to Cambodia and meets the third criteria. The state-of-the-art technology for rice husk power generation for the Project will be procured either from Europe or Japan. Although it is a proven technology in some Southeast Asian countries, the Project will become the first case in Cambodia to utilize the technology (See A. 3.). In regards to know-how transfer, the Project establishes a training program for local engineers so that they can operate the plant on their own in the long run (See A. 3.).

The economic benefits that will be brought by the Project are significant and the Project meets the fourth criteria. The Project displaces the use of diesel oil and contributes greatly to decreasing dependency on fossil fuel and imported oil. It is noteworthy that Cambodia's renewable energy strategy and plan released by the government recognizes that biomass is a promising renewable energy in Cambodia and urges to explore the potential urgently.[2] The Project's plan is consistent with the objectives of the country's renewable strategy and plan.

A.2. Location of project activity

A.2.1. Host Party

Cambodia

A.2.2. Region/State/Province etc.

Kandal

A.2.3. City/Town/Community etc.

Phum Ang Snoul, Ang Snoul District

A.2.4. Physical/Geographical location

The Project is located in Kandal province in Cambodia. It is 23 km away from Phnom Penh, the capital of Cambodia. The geographical coordinates is latitude 11º 30´ 46.6´´ and longitude 104º 43´ 7.2´´.

[2] Strategy for Renewable Energy-based Rural Electrification in Cambodia, The Royal Government of Cambodia, Phnom Penh, May 2003. This document as well as other documents relating to Cambodia's renewable energy are available at http://www.recambodia.org.

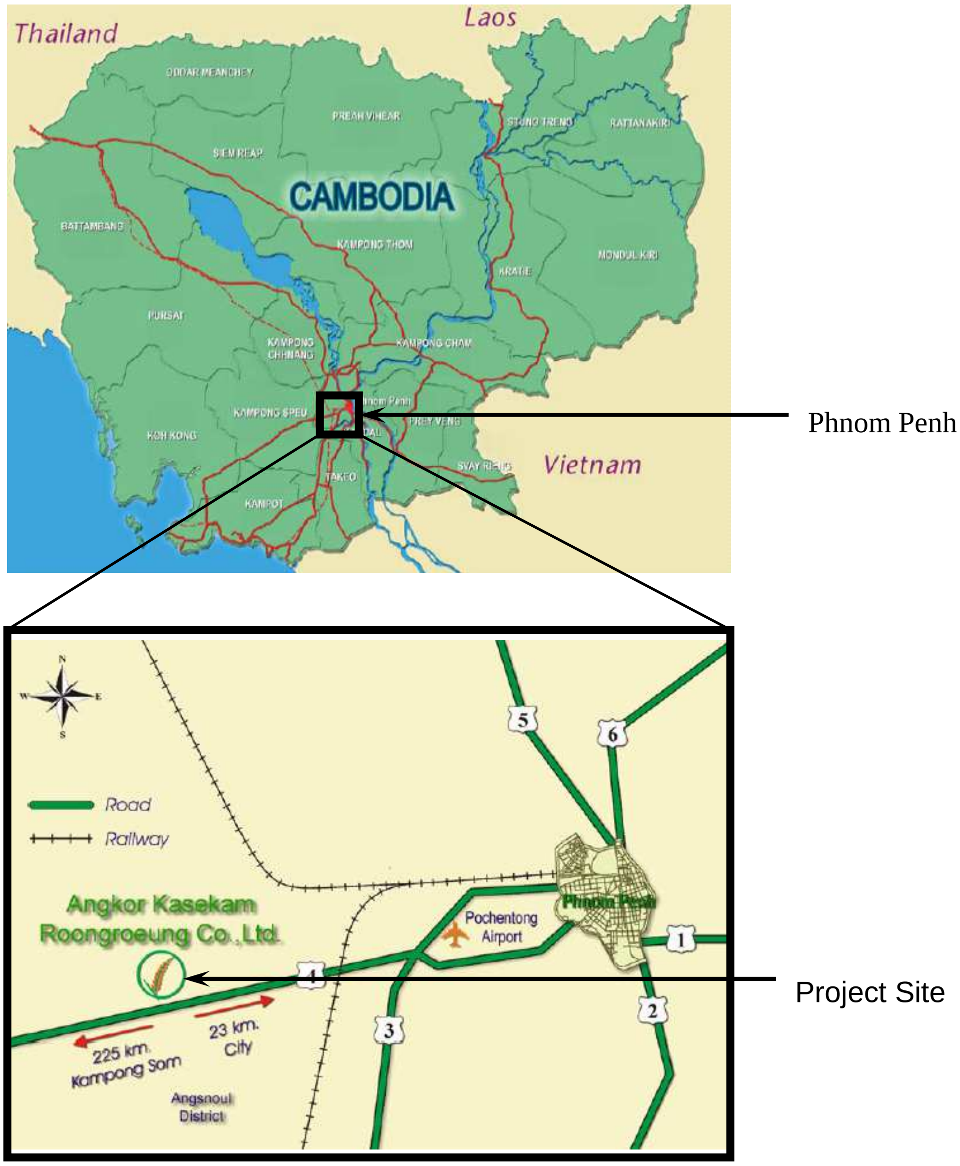

Figure 1: Location map

The power generation plant will be located adjacent to the rice mill. The location is indicated in the following illustration.

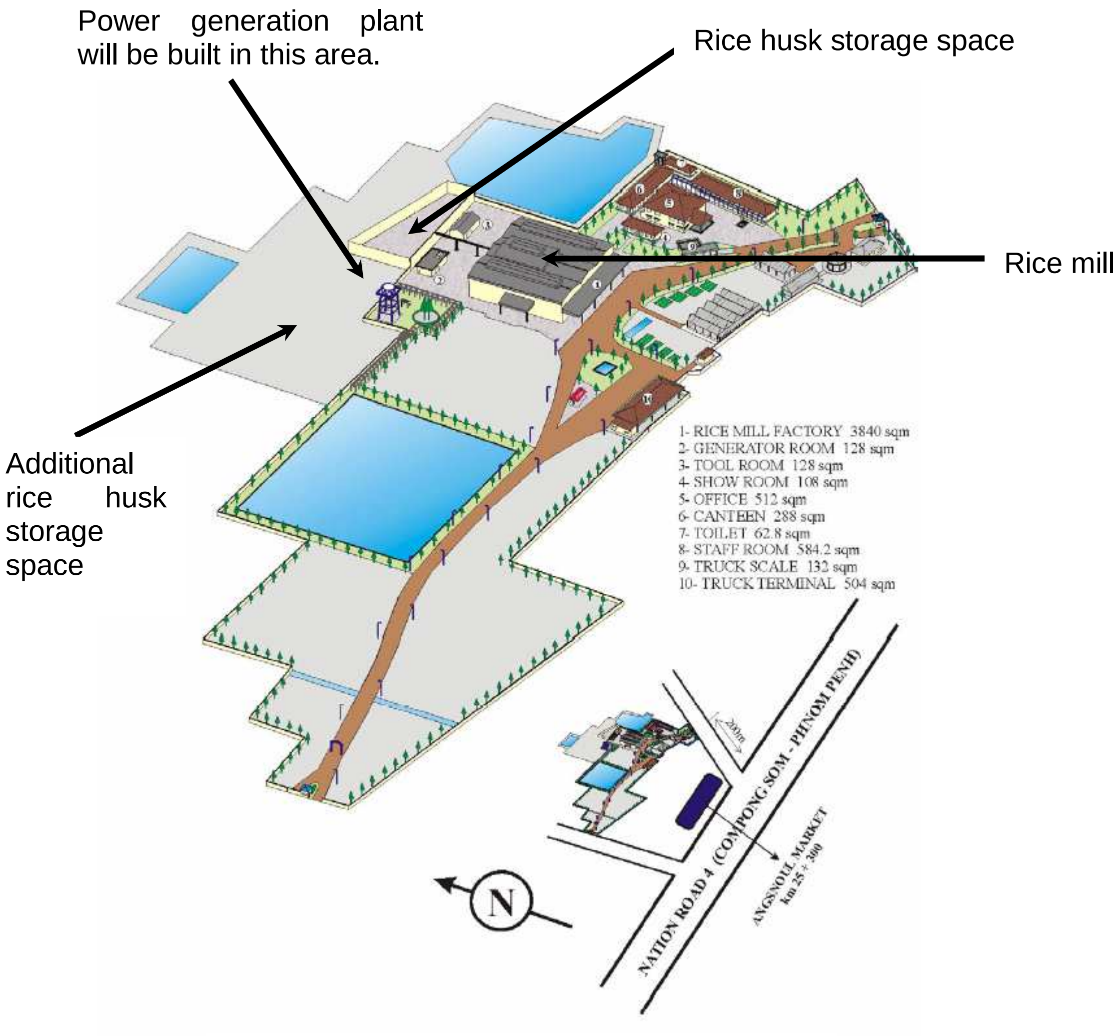

Figure 2: Location of the Power plant

A.3. Technologies and/or measures

It is proposed that the Project utilizes a travelling grate boiler, designed to burn rice husk at the moving platform of a furnace. This particular boiler is adopted due to its durable features in operation and maintenance. It maintains a reasonable efficiency rate at 76%. Based on experiences of rice millers in other countries, the travelling grate system is known to produce better quality of ash compared to other systems. It also has a good ability to control drying, combustion and de-ashing of fuel while the quantity of unburned fuel is found to be relatively low. The state-of-the-art technology for rice husk power generation will be procured either from Europe. Although this type of boiler is considered to be a proven technology in some Southeast Asian countries, there are no prior cases in Cambodia. The Project will become the first important case of the transfer of the technology in Cambodia.

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.

Main equipments

Furnace	Type: Torbed reactor
Boiler	Type: Eckrohr boiler, Single drum
Turbine	Model: Shinko RKR
	Type: Fully condensing type
	Capacity: 2000kw at alternator terminals

Generator	Capacity: 2000kw
Transformer	Model: Thai Maxwell Rated power: 1250 kVA

There will be surplus steam that is not used for power generation. The surplus steam will be used for drying paddy. The rice paddy is presently placed on the ground and dried through its exposure to the sun. The utilization of surplus steam will contribute to efficient paddy drying, while it will not lead to GHG emission reductions.

The following illustrates the project scheme:

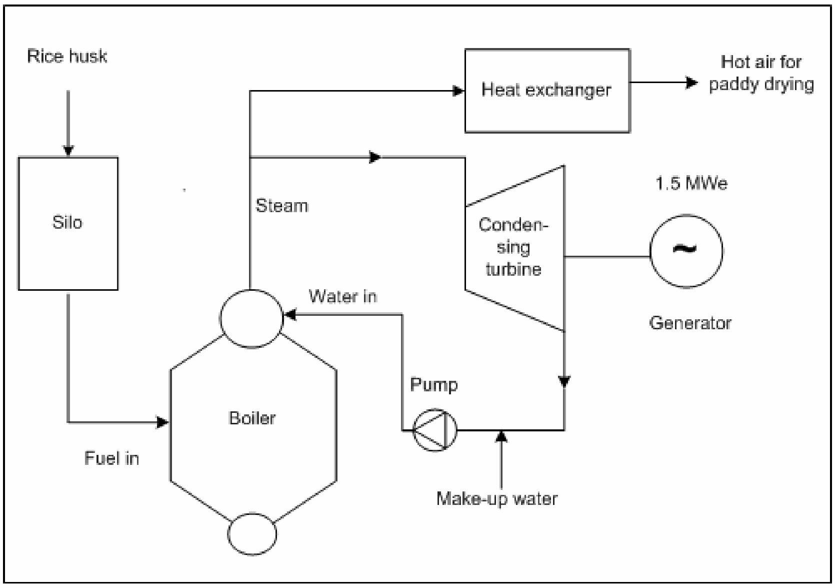

Figure 3: Project scheme

The technology and know-how being introduced by the Project is environmentally safe and sound. The Project will become a showcase as the first biomass power generation project in Cambodia and encourage similar activities in the future.

<u>Project plans</u>

(1) Electricity sales

(1.1) Electricity supplied to AKR

The produced electricity will be sold in bulk to the rice mill under a power purchasing agreement. A sales licence is required for any electricity sales in Cambodia. Before the Project implementation, ABC will obtain the license from Electricity Authority of Cambodia (EAC). Angkor Rice Mill will sell excess electricity to the factories in the vicinity. It is expected that the power plant will internally consume about 15% of the electricity it produces. The total quantity of electricity sales will be 13,464 MWh/year:

2 MW x 7,920 hours/year = 15,840 MWh/year[3]
15,840 MWh/year x (1-0.15) = 13,464 MWh/year

(1.2) Electricity supplied to the grid

Due to the low load environment of Angkor Kasekam Roongroeung Rice Mill (AKR), the Project supplies small amount of electricity generation to AKR, while the energy consumption for operating

[3] It is expected that the plant will be under operation for 330 days a year. The rest (35 days) is allotted for regular maintenance and other stoppages.

the power plant remains the same, which is not economic benefit to the project. As a result of this, the project proponent (ABC) plans to supply electricity to the grid through a power utility, namely Electricity Angsnoul Enterprise (EAE), which supplies electricity to the surrounding local areas in Angsnoul District in Cambodia. It assumes that amount of electricity generation supplied to the grid is zero for the purpose of *ex-ante* estimation of emissions reduction.

(2) Electricity to a neighbouring village

Angkor Rice Mill and ABC will also provide a small volume of electricity to Ang Snoul Village with a relatively small charge. Ang Snoul Village is situated in the vicinity of the project site. Access to the grid electricity system is currently unavailable at the village. Although there is one electricity distributor in the village who uses diesel oil as fuel, due to its high price[4] and unstable supply, the consumption of electricity among the villagers is very low. As a result, it is often the case that kerosene lamps are used for lighting and wood scraps for cooking. The supply of excess electricity will contribute to an improvement of the standard of living for people in the community and is welcomed by the community as described in Section E.

(3) Rice husk availability

The Project will utilize 33,419 tons/year rice husk for power generation. When the production capacity increases in 2005, the total quantity of rice husk produced from the rice mill operation becomes 47,520 tons/year. There will be no shortage in rice husk as fuel.

The following chart illustrates rice husk availability and utilization for power generation.

Rice husk availability				
	Rice paddy production per hour	Rice husk production per hour[5]	Operating hours per year	Rice husk production per year
Before 2004	10 tons	2 tons	7,920 hours	15,840 tons
After 2007	30 tons	6 tons	7,920 hours	47,520 tons
Rice husk utilization for power generation				
		Rice husk utilization per hour	Operating hours per year	Rice husk utilization per year
After 2007		4.22 tons	7,920 hours	33,422tons

(4) Financial plans

The initial investment cost of the Project is estimated at 4.75 million Euros. This includes the cost of an EPC contract as well as the cost of land, project development fees and contingencies.

ABC intends to finance 50% of the costs through equity investment and the remaining 50 % through loans. ABC is currently exploring opportunities for obtaining Japanese government's funding which provides up to 50% of the equipment cost.

[4] 1800 Riel per kWh or approximately 0.45 USD per kWh. ABC is proposing to provide electricity at a much lower rate. Villagers have expressed their wish to buy electricity at 900 Riels per KWh or lower (0.225 USD per kWh).

[5] An analysis conducted by Angkor Kasekam Roongroeung indicates that rice husk consists of approximately 20% of rice paddy.

The debt financing will be sourced from local banks under the terms of 3 to 5 years in maturity and a 9-13 % interest rate per annum. In addition, ABC is in contact with Thai banks based in Cambodia to explore another opportunity of financing. The company also intends to pursue a possibility of obtaining a supplier's credit from the equipment supplier.

Training program for local staff

Angkor Bio Cogen is planning to hire a cogeneration plant manager and one experienced engineer for a period of 1 or 2 years. They are assigned to control the operation of the plant in the beginning and train local engineers so that the local engineers can operate the plant in the long run. The O&M contractor will simultaneously provide more training for the plant engineer and operators, leading to a significant technology transfer and technical skill development of local workers

The training program will cover the following necessary issues:

- Basic plant operations, safety and engineering
- Fundamentals of rice husk-fired cogeneration operations
- Environmental management and awareness
- Wastewater and water treatment operations
- Power plant engineering and control systems
- Fire safety and evacuation

Fuel requirement

Cogen-AIT (Asian Institute of Technology) based in Bangkok conducted a laboratory test to measure the calorific value of ABC's rice husk. Two samples, one from the surface of the pile of rice husk and the other from inside of the pile were taken for testing in order to account for fluctuation due to the length of time the rice husk has been piled as well as the sampling spot. Then, each sample was tested three times in order to enhance the accuracy of the calorific value. The higher heating values on dry basis (HHV_d) based on a British Standard (No. BS 4379, Designation IP 12/73) delivered by the tests are as follows.

	Test 1	Test 2	Test 3	Average
Rice husk from surface of the pile (MJ/kg)	15.08	14.99	15.15	15.07
Rice husk from inside of the pile (MJ/kg)	14.52	14.56	14.68	14.59
Average				14.8

The fluctuation of the calorific value between the lowest and highest test results within the same sample is 1.1% for both samples while the maximum fluctuation between the two samples is 4.2%. As the fluctuation of the calorific value due to separate testing and sampling is small, the use of an average value is deemed appropriate as *ex ante* estimation of the energy content of rice husk. The average HHV_d for the rice husk from the surface was 15.07 MJ/kg while the average HHV_d for the rice husk from the inside was 14.59 MJ/kg. From these two values, the average calorific value of rice husk is arrived at 14.8 MJ/kg, equivalent to 0.0148 TJ/ton.

ABC expects to produce approximately 15,840 MWh of electricity annually, of which 13,464 MWh year will be sold to the Angkor Rice Mill, with the remaining 2,576 MWh consumed internally at the plant. In terms of energy, the amount of electricity produced at the power plant will equal 57.024 TJ/year:

15,840 MWh/yr x 3,600 MJ/MWh x (1 TJ/1millionMJ) = 57.024 TJ/year

It is expected that the power generator will convert approximately 17.5% of the heat generated in its boiler to electrical power. The boiler needs to provide approximately 244 TJ/year of heat in order for the plant to generate the planned amount of electricity:

(57.024 TJ/year) / 0.175 = 325.9 TJ/year

Additional heat equivalent to 50TJ/year is necessary for paddy drying. The total volume of required heat is 294TJ/year:

325.9 TJ/year + 50TJ/year = 375.9TJ/year

As indicated earlier, the boiler efficiency is 76%. The rice husk to be combusted at the ABC plant must contain the following amount of energy:

(375.9 TJ/year) / 0.76 = 494.6 TJ/year

Based on the calorific value of 0.0148 TJ/ton for the rice husk to be used as fuel, the quantity of rice husk needed to produce the required amount of energy is approximately 33,419 tons/year or 4.2 tons/hour:

(494.6 TJ/year) / (0.0148 TJ/ton) = 33,419 tons/year

(33,419 tons/year) / 7,920hours = 4.22 tons/hour

The relationships are summarized in the following diagram:

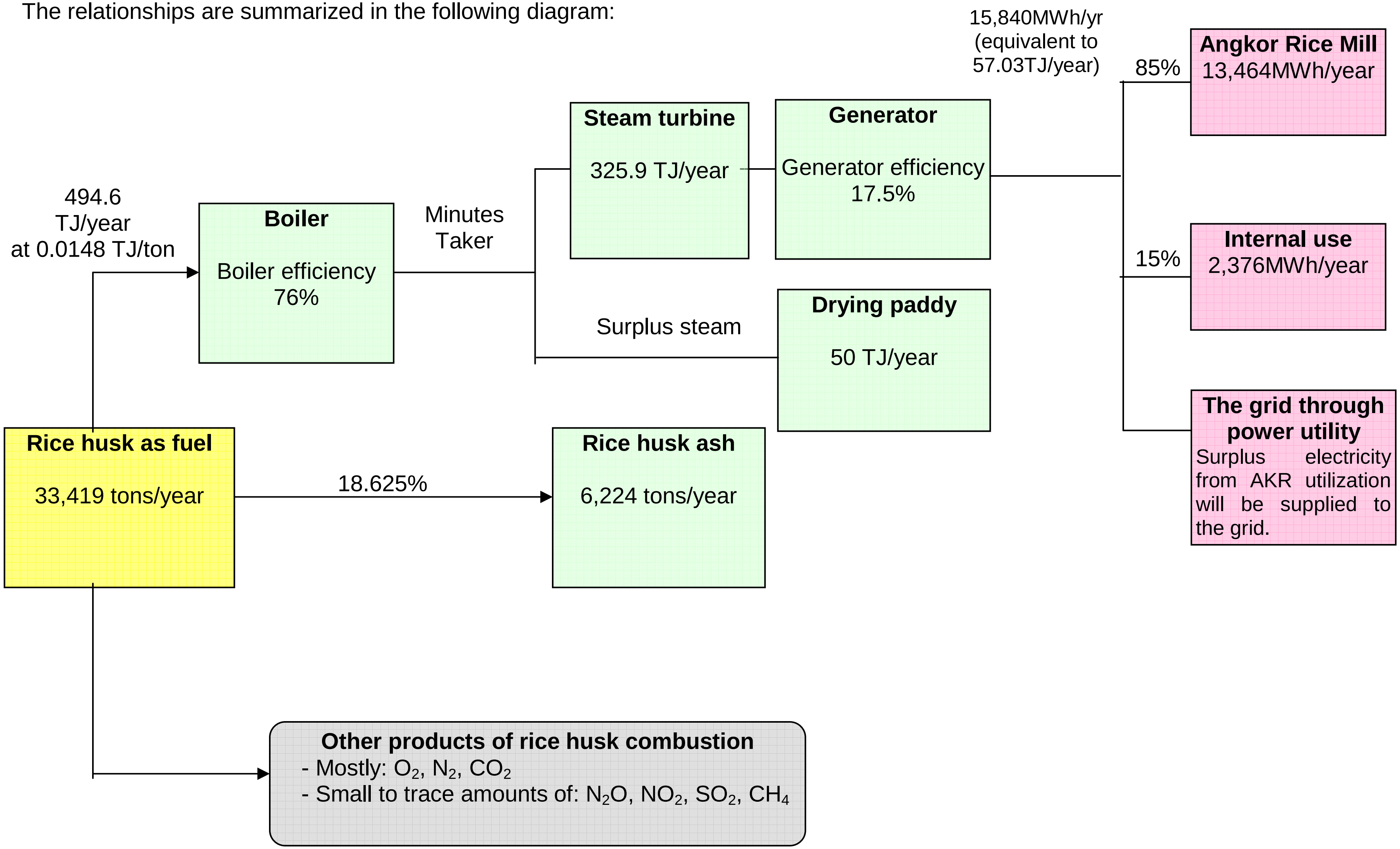

Figure 4: Fuel requirement

A.4. Parties and project participants

Party involved (host) indicates 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

Angkor Bio Cogen Co., Ltd (ABC)
Angkor Bio Cogen Co., Ltd (ABC) was established in August 2004 as a special purpose company for the rice husk power project. The company has a separate and independent shareholding structure from the rice mill operation company, Angkor Kasekam Roongroeung Co., Ltd (AKR).

AKR, as a shareholder partner, provides land for the rice husk power project. The ownership of the land will be fully transferred to ABC. The company also provides a guaranteed supply of rice husk and water under a purchasing agreement for the entire project period. The company has been operating the rice mill since 2001, purchasing only from contracted farmers who grow rice in a sustainable matter, using no pesticides and little chemical fertilizers. The rice mill supports the income of more than 30,000 farming families.

Mitsubishi UFJ Morgan Stanley Securities Co., Ltd (MUMSS)
The Clean Energy Finance Committee, Mitsubishi UFJ Morgan Stanley Securities (MUMSS) was established in February 2001. MUMSS diversified into the field of climate change, with the establishment of a specialized consultancy, Clean Energy Finance Committee (CEF), providing services to promote Clean Development Mechanism (CDM) and Joint Implementation (JI) projects. The group has established itself as one of the leading consultants in the field.

Asian Development Bank (ADB)
The Future Carbon Fund (FCF) is a trust fund established and managed by ADB on behalf of fund participants. It became operational in January 2009. ADB is a CER buyer of project activity.

A.5. Public funding of project activity

The project participant is considering the procurement of the funding by the New Energy and Industrial Technology Development Organization (NEDO), an incorporated administrative agency under Japan's Ministry of Economy, Trade and Industry through which capital for a large part of the equipment cost in will be provided. NEDO's funding is not counted as part of Japan's official development assistance.

A.6. Debundling for project activity

This Project is not a debundled component of any larger project activity. As defined, a proposed small-scale project activity shall be deemed to be a debundled component of a large project activity if there is a registered small-scale CDM project activity or a request for registration by another small-scale project activity:

- By the same project participants;
- In the same project category and technology/measure; and
- Registered within the previous 2 years; and

Whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point.

SECTION B. Application of selected approved baseline and monitoring methodology and standardized baseline

B.1. Reference of methodology and standardized baseline

In accordance with Appendix B of the simplified modalities and procedures for small-scale CDM project activities ("Appendix B": Version 7), the project activity falls under AMS-I.A. (Electricity generation by the user) and AMS-I.D (Grid connected renewable electricity generation) Version 18.0 regarding the electricity generation component and AMS-III.E. (Methane avoidance) regarding the methane avoidance component of the Project Activity.

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-I.D
Type I : Renewable energy projects
Category D : Grid connected renewable electricity generation
Reference : Version 18, Scope 1, valid from Reference 28/11/2014 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

It is also included 'Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion' (Version 02), 'Tool to calculate the emission factor for an electricity system' (Version 04), and 'Tool to calculate baseline, project and/or leakage emissions from electricity consumption (Version 01).

B.2. Project activity eligibility

Illustration of situations of project activity under which the methodology applies is given in the table below.

	Project type	**AMS-I.A**	**AMS-I.D**	**AMS-I.F**
1	Project supplies electricity to a national/regional grid		√	
2	Project displaces grid electricity consumption (e.g. grid import) and/or captive fossil fuel electricity generation at the user end (excess electricity may be supplied to a grid)			√
3	Project supplies electricity to an identified consumer facility via national/regional grid (through a contractual arrangement such as wheeling)		√	
4	Project supplies electricity to a mini grid system where in the baseline all generators use exclusively fuel oil and/or diesel fuel			√
5	Project supplies electricity to household users (included in the project boundary) located in off grid areas	√		

According to the applicable approved small-scale methodologies, the electricity generation component of the Project is eligible for I.A., as it is a renewable energy project that supplies

individual users with a small amount of electricity and I.D., as it is a renewable energy that supplies electricity to a national/regional grid. The capacity of the installed generator is 2 MWe and it does not exceed 15MW. The methane avoidance component of the Project is eligible for III.E., as it reduces anthropogenic GHG emissions by sources and the annual project emissions are less than 15 kilotons of CO_2e.[6]

For AMS-I.A, the calculation of the baseline emissions for the electricity generation component supplied to AKR (the user) is conducted in accordance with the instructions provided in paragraph 5 of Type I.A., Appendix B of the simplified modalities and procedures for small-scale CDM project activities (Version 7). According to the instructions, there are two options that the project participants may choose from regarding the baseline formulae. Option 2 is selected for this project activity.

For AMS-I.D, the calculation of the baseline emissions for the electricity generation component supplied to the grid is conducted in accordance with approved small scale methodology in paragraph 22 of AMS-I.D (Version 18).

For AMS-III.E, the calculation of the baseline emissions for the methane avoidance component of the Project is completed in accordance with the instructions provided in paragraph 3, Type III.E. of above-mentioned Appendix B (Version 7).

B.3. Project boundary

In accordance with paragraph 4 of Type I.A. Appendix B (Version 7), of the simplified modalities and procedures for small-scale CDM project activities, the project boundary for the project activity associated with electricity generation can be defined as follows:

> "The physical, geographical site of the generating unit and the equipment that uses the electricity produced delineates the project boundary."

In accordance with paragraph 18 of Type I.D. (Version 18), the project boundary for the project activity associated with electricity generation can be defined as follows:

> "The spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system that the CDM project power plant is connected to."

In accordance with paragraph 2 of Type III.E., Appendix B (Version 7) of the simplified modalities and procedures for small-scale CDM project activities, the project boundary for the project activity associated with methane avoidance can be defined as follows:

> "The project boundary is the physical, geographical site where the treatment of biomass takes place."

The project boundary is indicated by a bold dotted line in the following illustration:

[6] Paragraph 1 of Type III.E., Appendix B (Version 7) indicates that the measures that will be conducted by a project under this project category "shall both reduce anthropogenic emissions by sources, and directly emit less than 15 kilotonnes of carbon dioxide equivalent annually."

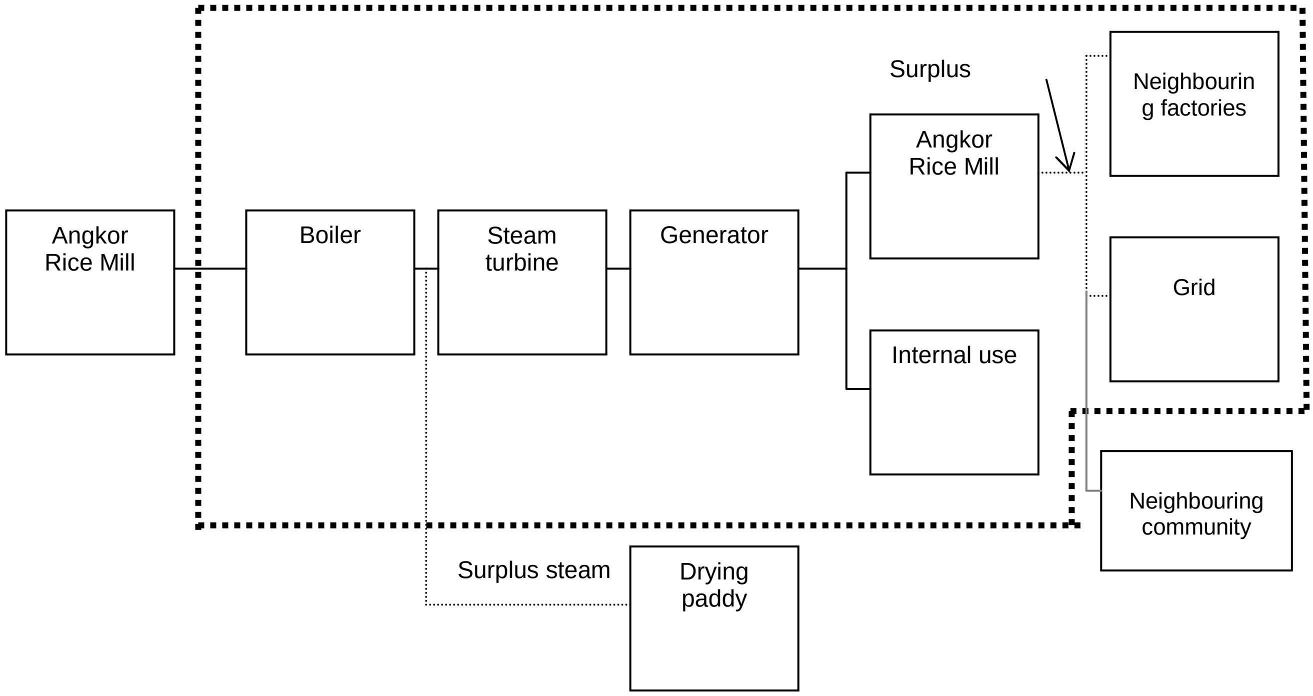

Figure 5: Project boundary

B.4. Establishment and description of baseline scenario

The calculation of the baseline emissions for the electricity generation component is conducted in accordance with the instructions provided in paragraph 5 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 formulae. Option 2 is selected for this project activity.

According to identification of the baseline scenario in AMS-I.D (version 18), if the project activity is the installation of a new grid-connected renewable power plant/unit, the baseline scenario is that the electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources into the grid. As for the project activity, it is the installation of a new renewable biomass power plant/unit to Phnom Penh Grid, so its baseline scenario is: Electricity delivered to Phnom Penh Grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the 'Tool to calculate the emission factor for an electricity system (Version 04)'.

The calculation of the baseline emissions for the methane avoidance component of the Project is completed in accordance with the instructions provided in paragraph 3 of Type III.E., from above-mentioned Appendix B (Version 7).

B.5. Demonstration of additionality

Additionality of project activity is presented as below.

Additionality

Angkor Rice Mill has three options for the disposal of rice husk.

Scenario 1: Piling for natural decomposition
Scenario 2: Open-air burning
Scenario 3: The Project without the CDM

The following sections elaborate on each of the scenarios.

Scenario 1: Piling for natural decomposition

The practice of rice husk disposal in Cambodia varies across regions. In some areas, rice husk is typically used as fuel in many factories while is to leave rice husk. Angkor Rice Mill is presently disposing its rice husk outside until it is naturally decomposed as for the vast amount of rice husk it generates, the demand for rice husk in the area is extremely limited as described in Section A.3. There are no major factories in the vicinity of Angkor Rice Mill that use rice husk as fuel and there are no incentives for potential buyers outside of the area to purchase rice husk from Angkor Rice Mill as the cost they would have to pay for transportation fuel is high. A large unoccupied space is also available to accommodate the disposal in the vicinity of the rice mill. There are currently no national or local safety requirements or regulations against this method of disposal. Nor are new regulations likely during the crediting period to require Angkor Rice Mill to change its current practice.

Scenario 2: Open-air burning

While conceptually possible, this scenario is not likely. Disposal of rice husk by burning it in the open air is not common practice in Cambodia due to concerns about causing significant health hazards to the local community, in terms of toxic emissions, particulate matters, smoke as well as fire hazards.

Scenario 3: The Project without the CDM

Due to the following barriers associated with the introduction of this renewable energy technology in Cambodia, the Project's implementation impeded without the CDM:

- Barrier due to prevailing practice
- Technological barrier

Barrier due to prevailing practice:

As stated above, there are currently no regulations for the management of rice husk. It is unlikely that new regulations are introduced during the crediting period to require Angkor Rice Mill to change its current practice. There is also no standard technology available to manage rice husk. It is a normal practice in Cambodia to leave rice husk outside until it is naturally decomposed. It is apparent that without incentives in the forms of carbon credits, Angkor Rice Mill will continue the current practice.

Technological barrier:

The Project represents the first case of applying the rice husk-fired power generation technology in Cambodia. The technology choice for the Project is the traveling grate system for its preferred features as described in Section A.3. While the technology has a proven track record of combusting rice husk for power generation, it is by no means guaranteed that the technology will not encounter unforeseen problems when it is applied to rice husk in Cambodia with their particular characteristics. Due to its high mineral content and composition, rice husk has a tendency to produce slag when the combustion temperature is not well controlled. Local staff will have to undergo extensive training to ensure adequate combustion temperature. Training must also be extended to cover ash disposal and other matters relating to the proper operation of the power plant, notably water treatment. The careful control and monitoring of the water quality needed for a high-pressure boiler system to prevent problems with the boiler and with the turbine blades requires training for a skilled technician. A proper maintenance is essential especially since in case that the power plant is damaged, there will not be spare parts that will be immediately available in Cambodia. The application of the new technology for the first time in the country will

be too risky to implement without financial assistance through obtaining CERs.

Faced with the barrier due to prevailing practice as well as technological barrier outlined above, the Project will not be carried out in the course of regular business. Hence, it is additional.

B.6. Emission reductions

B.6.1. Explanation of methodological choices

Baseline emissions

Baseline emissions are calculated based on baseline emissions for electricity generation plus baseline emissions for methane avoidance.

Baseline emissions for electricity generation

1) For electricity generation supplied to AKR, the calculation of the baseline emissions for 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

Oi = 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 CO_2 emission coefficient for the fuel displaced. Following the instruction, a default value of 0.9 kg CO_2e/kWh, 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.

2) For electricity generation supplied to the grid, the calculation of the baseline emissions is conducted in accordance with paragraph 22 of AMS-I.D (Version 18). The baseline emissions are calculated based on the net electricity generation provided to the grid (in MWh/year), and an emission factor for the displaced grid electricity (in tCO_2/MWh). The baseline emissions are to be calculated as follows:

$$BE_y = EG_{PJ,y} \times EF_{grid,y}$$

where,

BE_y = Baseline emissions in year y (t CO_2)

$EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year *y* (MWh)

$EF_{grid,y}$ = Combined margin CO_2 emission factor for grid connected power generation in year *y* calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (t CO_2/MWh) = $EF_{grid,CM,y}$

Calculation of $EF_{grid,y}$

According to '*Tool to calculate the emission factor for an electricity system* (version 4.0)', there are six steps to calculate the baseline emission factor of the grid.

This proposed project refers to *Grid Emission Factor of the Phnom Penh Electricity Grid* issued by Ministry of Environment Cambodia and Institute for Global Environmental Strategies in 2011. The detailed processes are as follows:

Step 1 Identify the relevant electric power system

The project electricity system of this proposed project is Phnom Penh Grid System. Electricity Authority of Cambodia (EAC), which is an autonomous body set up to regulate and monitor the electric power sector throughout the country, defines the Phnom Penh Grid System as follows:

"In 2009, The Phnom Penh Grid System was connected to the Vietnam Grid by double circuit 230kV line from Chau Doc in Vietnam to grid substation at Takeo and GS4 in Phnom Penh. By the end of 2009, the sources of power connected to Phnom Penh Grid System are Vietnam system at 230kV, CETIC Hydro station at Kirirom, Khmer Electrical Power Co. Ltd and (Cambodia) Electricity Private Co. Ltd at Phnom Penh at 115kV and Cambodia Utilities Pte Ltd., City Power Group Corporation, Colben Energy (Cambodia) Limited, SL Garment Processing (Cambodia) Ltd at Phnom Penh at 22kV. The Phnom Penh Grid System supplies power to Phnom Penh, parts of Kandal, Kampong Speu and Takeo Provinces". (Page 45, EAC 2010)

In addition, Électricité du Cambodge (EDC), comprised of one diesel power plant (C3) and two thermal power plants (C5 and C6) and small three diesel generator plants, supplies electricity to the Phnom Penh Grid system. The imported power from Vietnam is also considered as the electricity imports.

Step 2 Choose whether to include off-grid power plants in the project electricity system (optional).

The proposed project chooses the "Option I: only grid power plants are included in the calculation".

Step 3 Select a method to determine the operating margin (OM)

The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is based on one of the following methods:

(a) Simple OM
(b) Simple adjusted OM
(c) Dispatch data analysis OM
(d) Average OM

The simple OM method (option a) can only be used if low-cost/must-run resources constitute less than 50% of total grid generation in: 1) average of the five most recent years, or 2) based on long-term averages for hydroelectricity production.

Electrical output from low-cost/must-run sources in the Phnom Penh Grid System

Name of generator and power plant	Fuel type	Energy Sent Out / Input, MWh				
		2005	2006	2007	2008	2009
CETIC International Hydropower Development Co., Ltd	Hydro power	40,854	47,653	46,498	43,292	44,380
SL Garment Processing (Cambodia) Ltd	Wood		1,669	5,134	4,406	5,758

Average generation from low-cost/must-run resources		47,929				
Total grid generation		752,542	911,188	1,105,548	1,270,024	1,021,075
Average of total grid generation		1,012,075				
Low-cost/must-run resources share		4.74% < 50%				

Source: EAC 2010, 2009, 2008, 2007 and 2006.
*Imported electricity to the grid is excerpted in 2009

As the share of low-cost/must-run sources in the Phnom Penh Grid System is 4.74%, the simple OM method can be applied. For the simple OM, the emissions factor can be calculated using either of the two data vintages: *Ex ante* option or *Ex post* option. The Ex ante option is chosen.

Ex ante option: If the *ex ante* option is chosen, the emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required. For grid power plants, use a 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM PDD to the DOE for validation

Step 4 Calculate the operating margin emission factor according to the selected method
As for the chosen simple OM, there are two methods to calculate simple emission factor in this tool:
- Option A: based on the net electricity generation and a CO_2 emission factor of each power unit; or
- Option B: based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.

Option A is available and chosen for this project.

Option A - Calculation based on average efficiency and electricity generation of each plant
Under this option, the simple OM emission factor is calculated based on the net electricity generation of each power unit and an emission factor for each power unit, as follows:

$$EF_{grid,OM,simple,y} = \frac{\sum_m EG_{m,y} \bullet EF_{EL,m,y}}{\sum_m EG_{m,y}}$$

where:

$EF_{grid,OMsimple,y}$= Simple operating margin CO2 emission factor in year *y* (t-CO_2/MWh)
$EG_{m,y}$= Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
$EF_{EL,m,y}$= CO_2 emission factor of power unit *m* in year *y* (t-CO_2/MWh)
m= All power units serving the grid in year *y* except low-cost / must-run power units
y= The relevant year as per the data vintage chosen in Step 3

Determination of $EF_{EL,m,y}$
The emission factor of each power unit *m* should be determined as follows:

Option A1. If for a power unit *m* data on fuel consumption and electricity generation is available, the emission factor ($EF_{EL,m,y}$) should be determined as follows.

$$EF_{EL,m,y} = \frac{\sum_i FC_{i,m,y} \bullet NCV_{i,y} \bullet EF_{CO2,i,y}}{EG_{m,y}}$$

where:

$EF_{EL,m,y}$= CO_2 emission factor of power unit *m* in year *y* (t-CO_2/MWh)
$FC_{i,m,y}$= Amount of fuel type *i* consumed by power unit *m* in year *y* (Mass or volume unit)
$NCV_{i,y}$= Net calorific value (energy content) of fuel type *i* in year *y* (GJ/mass or volume unit)

$EF_{CO2,i,y}$= CO_2 emission factor of fuel type *i* in year *y* (t-CO_2/GJ)
$EG_{m,y}$= Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
m= All power units serving the grid in year *y* except low-cost/must-run power units
i= All fuel types combusted in power unit *m* in year *y*
y= The relevant year as per the data vintage chosen in Step 3

Option A2. If for a power unit *m* only data on electricity generation and the fuel types used is available, the emission factor should be determined based on the CO_2 emission factor of the fuel type used and the efficiency of the power unit, as follows:

$$EF_{EL,m,y} = \frac{EF_{CO2,i,y} \bullet 3.6}{\eta_{m,y}}$$

where:
$EF_{EL,m,y}$= CO_2 emission factor of power unit *m* in year *y* (t-CO_2/MWh)
$EF_{CO2,i,y}$= Average CO_2 emission factor of fuel type *i* used in power unit *m* in year *y* (t-CO_2/GJ)
$\eta_{m,y}$= Average net energy conversion efficiency of power unit *m* in year *y* (ratio)
m= All power units serving the grid in year *y* except low-cost/must-run power units
y= The relevant year as per the data vintage chosen in Step 3

Option A3. If for a power unit *m* only data on electricity generation is available, an emission factor of 0 t-CO_2/MWh can be assumed as a simple and conservative approach.
For imports from connected electricity systems located in another host country(ies), the emission factor is 0 t-CO_2 per MWh.

Calculation of the operating margin

Plant	2007		2008		2009	
	Electricity generated	CO_2 emission factor	Electricity generated	CO_2 emission factor	Electricity generated	CO_2 emission factor
	MWh	t-CO_2 /MWh	MWh	t-CO_2 /MWh	MWh	t-CO_2 /MWh
Electricité du Cambodge						
C3	21,770	0.6834	43,410	0.6705	22,610	0.6631
C5	20,130	0.6602	24,440	0.6245	19,840	0.6881
C6	51,820	0.6983	75,990	0.6756	43,700	0.7060
Cambodia Utilities Pte. Limited	258,490	0.7097	258,713	0.7061	182,224	0.7119
Khmer Electrical Power Co., Ltd	277,991	0.6830	317,848	0.6818	256,247	0.6721
City Power Group Corporation	38,238	0.6997	41,816	0.7023	34,113	0.7156
Colben Energy (CAMBODIA) Ltd	54,019	0.7842	45,696	0.8129	53,235	0.7818
SHC (Cambodia) International Pte Ltd	14,700	0.7514	34,501	0.7514	17,307	0.7509
(Cambodia) Electricity Private Co, Ltd	315,550	0.6906	325,883	0.6901	269,480	0.6951
Sovanna Phum Investment Co., Ltd			23,359	0.5934	28,033	0.6249
Colben Energy (Cambodia) PPSEZ Limited			35,658	0.7513	45,061	0.7713
Imported from Vietnam					374,166	0.0000
Electricity Tramkhnar					537	0.6702
Mr. Bun Huy					8	0.6702
Mr. Toeng Samouv					176	0.6702
Annual Electricity generation in total	1,052,708		1,227,315		1,346,739	

Simple operating margin CO_2 emission factor (t-CO_2 /MWh)	**0.6989**	**0.6951**	**0.5236**
OM (t-CO_2 /MWh)			**0.6257**

Step 5 Calculate the build margin (BM) emission factor

The sample group of power units *m* used to calculate the build margin consists of either:
(a) The set of five power units that have been built most recently; or
(b) The set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

Project participants should use the set of power units that comprises the larger annual generation. In this case, (b), which is 269,348MWh, is larger than (a), which is 79,037MWh from Colben Energy (Cambodia) PPSEZ Limited, Sovanna Phum Investment Co., Ltd, Mr. Toeng Samouv, Mr. Bun Huy and SL Garment Processing (Cambodia) Ltd. As this set of five power units and (Cambodia) Electricity Private Co, Ltd comprises 20% of the system generation, these are adopted for the calculation.

The build margin emissions factor is the generation-weighted average emission factor (tCO_2/MWh) of all power units m during the most recent year y for which power generation data is available, calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \bullet EF_{EL,m,y}}{\sum_m EG_{m,y}}$$

where:

$EF_{grid,BMsimple,y}$= Build margin CO_2 emission factor in year *y* (t-CO_2/MWh)
$EG_{m,y}$= Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
$EF_{EL,m,y}$= CO_2 emission factor of power unit *m* in year *y* (t-CO_2/MWh)
m= Power units included in the build margin
y= Most relevant historical year for which power generation data is available.

Calculation of the build margin for 2009

Power Plant	Year of operation	Fuel Type	Electricity Generated, MWh	CO2 Emission Factor, t-CO2/MWh
Colben Energy (Cambodia) PPSEZ Limited	2008	HFO	45,061	0.7713
Sovanna Phum Investment Co., Ltd	2008	Coal	28,033	0.6249
Mr. Toeng Samouv	2007	DO	176	0.6702
Mr. Bun Huy	2007	DO	8	0.6702
SL Garment Processing (Cambodia) Ltd	2006	Wood	5,758	0.0000
(Cambodia) Electricity Private Co, Ltd	2006	HFO	269,480	0.6951
Total			**348,517**	
BM (t-CO_2/MWh)				**0.6878**

Step 6 Calculate the combine margin emission factor

CM emission factor is weighted average OM margin emission factor and BM margin emission factor:

$$EF_{grid,CM,y} = W_{OM} \times EF_{grid,OM,y} + W_{BM} \times EF_{grid,BM,y}$$

where:

$EF_{grid,CM,y}$ = Combined margin CO_2 emission factor for grid connected power generation in year y (tCO2e/MWh)

$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year y (tCO_2/MWh)

$EF_{grid,OM,y}$ (i.e. $EF_{grid, OM, simple,y}$) = Operating margin CO_2 emission factor in year y (tCO_2/MWh);

W_{OM} = Weighting of operating margin emissions factor (%);

W_{BM} = Weighting of build margin emissions factor (%);

In this PDD for the first crediting period, the weights W_{OM} and W_{BM} are 50%. So, $EF_{grid,CM,y}$ is 0.6568 tCO_2/MWh.

Baseline emissions for methane avoidance

The calculation of the baseline emissions for the methane avoidance component of the Project is completed in accordance with the instructions provided in paragraph 3 of Type III.E., Appendix B (Version 7) of the simplified modalities and procedures for small-scale CDM project activities (Version 7). The formulae used in the calculation are following:

$$CH_4\_IPCC_{decay} = (MCF * DOC * DOC_F * F * 16/12)$$

where,

$CH_4\_IPCC_{decay}$	IPCC CH_4 emission factor for decaying biomass in the region of the project activity	(tons of CH_4/ton of biomass)
MCF	methane correction factor	(fraction, default is 0.4 for less than 5 meters in depth)
DOC	degradable organic carbon	(fraction, default is 0.3)
DOC_F	fraction DOC dissimilated to the gas	(default is 0.77)
F	Fraction of CH_4 in gas	(default is 0.5)

$$BE_y = Q_{biomass} * CH_4\_IPCC_{decay} * GWP\_CH_4$$

where,

BE_y	Baseline methane emissions from biomass decay (tons of CO_2e)
$Q_{biomass}$	Quantity of biomass treated under the project activity (tons)
CH_4_GWP	GWP for CH_4 (tons of CO_2e/ton of CH_4)

Project emissions

Project emissions are calculated based on project emissions from combustion of biomass plus project emissions from combustion of fossil fuels due to the project activity.

Project emissions from combustion of biomass

Following paragraph 5 of Type III.E., Appendix B (Version 7) of the simplified modalities and procedures for small-scale CDM project activities, the project activity emissions will be determined as follows:

$$PE_{biomass,y} = Q_{biomass} * E_{biomass} (CH_4bio\_comb * CH_4\_GWP + N_2Obio\_comb * N_2O\_GWP)/10^6$$

where,

$PE_{biomaas,y}$	Project activity emissions from combustion of biomass (kilotons of CO_2e)
$Q_{biomass}$	Quantity of biomass treated under the project activity (tons)

$E_{biomass}$ Energy content of biomass (TJ/ton)[7]
CH_4bio_comb CH_4 emission factor for biomass combustion (kg of CH_4/TJ, default value is 300)
CH_4_GWP GWP for CH_4 (tons of CO_2e/ton of CH_4)
N_2Obio_comb N_2O emission factor for biomass combustion (kg/TJ, default value is 4)
N_2O_GWP GWP for N_2O (tons of CO_2e/ton of NO_2)

Project emissions from combustion of fossil fuels

This project emission from on-site consumption of fossil fuels are calculated based on the quantity of fuels combusted and the CO_2 emission coefficient of those fuels in accordance with "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (Version 02)", as follows:

$$PE_{FC,j,y} = \sum_i FC_{i,j,y} \times COEF_{i,y}$$

where,

$PE_{FC,j,y}$ CO_2 emissions from fossil fuel combustion in process j during the year *y* (tCO_2/yr)
$FC_{i,j,y}$ Quantity of fuel type *i* combusted in process *j* during the year *y* (mass unit/yr)
COEFi,y CO_2 emission coefficient of fuel type *i* in year *y* (tCO_2/mass unit)
i Fuel types combusted in process *j* during the year *y*

The CO_2 emission coefficient can be calculated using one of the following two Options, which are
Option A: calculate based on the chemical composition of the fossil fuel, and
Option B: calculate based on net calorific value and CO_2 emission factor of the fossil fuel.

Due to incomplete and unavailability of fossil fuel data from supplier, there is no sufficient data, which are mass fraction of carbon in fuel and density of fuel, for using Option A. As a result of this, Option B is selected to calculate emission from combustion of fossil fuels.

Option B: Calculate based on net calorific value and CO_2 emission factor of the fossil fuel

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

where,
$NCV_{i,y}$ Weighted average net calorific value of the fuel type *i* in year *y* (GJ/mass unit)
$EF_{CO2,i,y}$ Weighted average CO_2 emission factor of fuel type *i* in the year *y* (tCO_2/GJ)

The Project may consume a small amount of liquefied petroleum gas (LPG) for start-up of the boiler to preheat the combustion zone until rice husk is able to sustain its own combustion. LPG is used for start-up propose only. The consumption of LPG will be considered as a project emission for a conservative manner.

For ex-ante calculation, project emission from LPG combustion is negligible and therefore $PE_{LPG,y}$ =0 . For ex-post, it will be monitored and the project emission from LPG combustion will be accounted as per the above tool.

Project emissions from electricity consumption by the project activity

Among the three scenarios described in the 'Tool to calculate baseline, project and/or leakage

[7] The basis for determining the energy content of biomass is described in Section A.3 "Fuel requirement". As the fluctuation between separate tests and samples is small, the use of an average value is deemed appropriate for *ex ante* estimation.

emissions from electricity consumption (Version 01)', the following Scenario A applies to the Project case.

Scenario A: ***Electricity consumption from the grid****. The electricity is purchased from the grid only. Either no captive power plant is installed at the site of electricity consumption or, if any on-site captive power plant exists, it is not operating or it can physically not provide electricity to the source of electricity consumption.*

Therefore, the project emission from electricity consumption is calculated based on the quantity of electricity consumed, an emission factor for electricity generation and a factor to account for transmission losses, as stated below:

$$PE_{EC,y} = \sum_{i} EC_{PJ,j,y} \times EF_{EL,j,y} \times (1 + TDL_{j,y})$$

where:

$PE_{EC,y}$ *Project emissions from electricity consumption in year y* (tCO_2/yr)

$EC_{PJ,j,y}$ *Quantity of electricity consumed by the project electricity consumption source j in year y (MWh/yr)*

$EF_{EL,j,y}$ *Emission factor for electricity generation for source j in year y* (tCO_2/MWh)

$TDL_{j,y}$ *Average technical transmission and distribution losses for providing electricity to source j in year y (use default values of 20%)*

j *Sources of electricity consumption in the project*

Between Options A1 and A2, the emission factor for electricity generation is determined by Option A1 given below:

Option A1: Calculate the combined margin emission factor of the applicable electricity system, using the procedures in the latest approved version of the "Tool to calculate the emission factor for an electricity system" ($EF_{EL,j,y} = EF_{grid,CM,y}$).

Leakage

As stated earlier, 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.

Emission Reductions

Emission reductions of the project activity are determined by subtracting the project emissions during period y from the baseline emissions during the same period y.

$ER_y = BE_y – PE_y – LE_y$

where,

ER_y Emission reduction in year y

BE_y Baseline emissions in year y

PE_y Project emissions in year y

LE_y Leakage in year y

B.6.2. Data and parameters fixed ex ante

Data / Parameter	-
Unit	kg CO_2e/kWh
Description	Default CO_2 emission coefficient for the fuel displaced

Source of data	AMS-I.A (Ver.7)
Value(s) applied	0.9
Choice of data or Measurement methods and procedures	Default values in AMS-I.A (Ver. 7)
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	AMS-I.A (Ver.7)
Value(s) applied	0
Choice of data or Measurement methods and procedures	The diesel power plant is located on-site, therefore the distribution losses is zero
Purpose of data	Baseline emission calculations
Additional comment	The value is set ex-ante.

Data / Parameter	MCF
Unit	-
Description	Methane Correction factor
Source of data	AMS-III.E (Ver. 7)
Value(s) applied	0.4
Choice of data or Measurement methods and procedures	Default value in AMS-III.E (Ver. 7)
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	AMS-III.E (Ver. 7)
Value(s) applied	0.3
Choice of data or Measurement methods and procedures	Default value in AMS-III.E (Ver. 7)
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	AMS-III.E (Ver. 7)
Value(s) applied	0.77
Choice of data or Measurement methods and procedures	Default value in AMS-III.E (Ver. 7)
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	AMS-III.E (Ver. 7)
Value(s) applied	0.5
Choice of data or Measurement methods and procedures	Default value in AMS-III.E (Ver. 7)
Purpose of data	Baseline emission calculations
Additional comment	The value is set ex-ante.

Data / Parameter	$EF_{grid,OM,y}$
Unit	tCO_2e/MWh
Description	OM emission factor of Phnom Penh Electricity Grid
Source of data	Grid Emission Factor of the Phnom Penh Electricity Grid issued by Ministry of Environment Cambodia and Institute for Global Environmental Strategies in 2011
Value(s) applied	0.6257
Choice of data or Measurement methods and procedures	Specific national value as per the requirements in “Tool to calculate the emission factor for an electricity system” Version 4.0
Purpose of data	Baseline emission calculations
Additional comment	-

Data / Parameter	$EF_{grid,BM,y}$
Unit	tCO_2e/MWh
Description	BM emission factor of Phnom Penh Electricity Grid
Source of data	Grid Emission Factor of the Phnom Penh Electricity Grid issued by Ministry of Environment Cambodia and Institute for Global Environmental Strategies in 2011
Value(s) applied	0.6878
Choice of data or Measurement methods and procedures	Specific national value as per the requirements in “Tool to calculate the emission factor for an electricity system” Version 4.0
Purpose of data	Baseline emission calculations
Additional comment	-

Data / Parameter	$EF_{grid,CM,y}$
Unit	tCO_2e/MWh
Description	CM emission factor of Phnom Penh Electricity Grid
Source of data	Grid Emission Factor of the Phnom Penh Electricity Grid issued by Ministry of Environment Cambodia and Institute for Global Environmental Strategies in 2011
Value(s) applied	0.6568
Choice of data or Measurement methods and procedures	Specific national value as per the requirements in “Tool to calculate the emission factor for an electricity system” Version 4.0

Purpose of data	Baseline emission calculations
Additional comment	-

Data / Parameter	$TDL_{j,y}$
Unit	-
Description	Average technical transmission and distribution losses for providing electricity to source *j* in year *y*
Source of data	"Tool to calculate baseline, project and/or leakage emissions from electricity consumption"
Value(s) applied	20%
Choice of data or Measurement methods and procedures	Default value in the tool
Purpose of data	Project emission calculations
Additional comment	As the project activity fits to scenario A, the default value of 20% for project electricity consumption source is applied. This is consistent with the tool.

B.6.3. Ex ante calculation of emission reductions

Baseline emissions for electricity generation

1) The calculation of the baseline emissions for the electricity generation component supplied to AKR is conducted in the formula 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.

Based on the calculation of the total quantity of generated electricity (E_B) supplied to AKR in A.3, 13,464 MWh/year, emission reduction due to electricity generation supplied to AKR is calculated as follows.

Fuel consumption in energy equivalent (tCO_2/year)	=	Net electricity supplied to AKR (MWh/year)	x	CO_2 emission coefficient (kg CO_2e/kWh)	x	(kWh/MWh)	x	(ton/kg)
	=	13,464	x	0.9	x	1,000	x	1/1,000
	=	12,118	tCO_2/year					

2) The calculation of the baseline emissions for the electricity generation component supplied to the grid is conducted in the formula as follows:

$$BE_y = EG_{PJ,y} \times EF_{grid,y}$$

where,

BE_y = Baseline emissions in year *y* (t CO_2)
$EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year *y* (MWh)
$EF_{grid,y}$ = Combined margin CO_2 emission factor for grid connected power generation in year *y* calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (t CO_2/MWh) = $EF_{grid,CM,y}$

Surplus electricity generation after supplying to AKR will be sold to the grid and it assumes quantity of net electricity generation supplied to the grid is 0 MWh/year for *ex-ante* calculation. *Ex-post* calculation will be calculated according to net electricity generation supplied to the grid monitored by electricity meter. Emission reduction due to electricity generation supplied to the grid is calculated as follows.

BE for electricity generation to the grid (tCO_2 /year)	=	Net electricity supplied to the grid (MWh/year)	x	Combined margin CO_2 EF (t CO_2e/MWh)
	=	0	x	0.6568
	=	0	tCO_2 /year	

<u>Baseline emissions for methane avoidance</u>

The calculation of the baseline emissions for the methane avoidance component of the Project is completed as follows;

$$CH_4\_IPCC_{decay} = (MCF * DOC * DOC_F * F * 16/12)$$

where,

$CH_4\_IPCC_{decay}$ IPCC CH_4 emission factor for decaying biomass in the region of the project activity (tons of CH_4/ton of biomass)

MCF	methane correction factor	(fraction, default is 0.4 for less than 5 meters in depth)
DOC	degradable organic carbon	(fraction, default is 0.3)
DOC_F	fraction DOC dissimilated to the gas	(default is 0.77)
F	Fraction of CH_4 in gas	(default is 0.5)

$$BE_y = Q_{biomass} * CH_4\_IPCC_{decay} * GWP\_CH_4$$

where,

BE_y	Baseline methane emissions from biomass decay (tons of CO_2e)
$Q_{biomass}$	Quantity of biomass treated under the project activity (tons)
CH_4_GWP	GWP for CH_4 (tons of CO_2e/ton of CH_4)

Calculation of baseline methane emissions

$$CH_4\_IPCC_{decay} = MCF \times DOC \times DOC_F \times F \times 16/12$$

$$= 0.4 \times 0.3 \times 0.77 \times 0.5 \times 16/12$$

= 0.0616 (ton CH_4/ton)

MCF	0.4: IPCC default value
DOC	0.3: IPCC default value
DOC_F	0.77: IPCC default value
Fraction of CH_4 in gas	0.5: IPCC default value

BE_y (tons/year)	=	$Q_{biomass}$ (tons/year)	x	$CH_4\_IPCC_{decay}$ (ton CH_4/ton)	x	GWP_CH_4 (ton CO_2/ton CH_4)
	=	33,419		0.0616		21
	=	43,231		CO_2 tons/year		

Project emissions from combustion of biomass

Following paragraph 5 of Type III.E., Appendix B (Version 7) of the simplified modalities and procedures for small-scale CDM project activities, the project activity emissions will be determined as follows:

$$PE_{biomass,y} = Q_{biomass} * E_{biomass} (CH_4bio\_comb * CH_4\_GWP + N_2Obio\_comb * N_2O\_GWP)/10^6$$

where,

$PE_{biomaas,y}$	Project activity emissions from combustion of biomass (kilotons of CO_2e)
$Q_{biomass}$	Quantity of biomass treated under the project activity (tons)
$E_{biomass}$	Energy content of biomass (TJ/ton)[8]
CH_4bio_comb	CH_4 emission factor for biomass combustion (kg of CH_4/TJ, default value is 300)
CH_4_GWP	GWP for CH_4 (tons of CO_2e/ton of CH_4)
N_2Obio_comb	N_2O emission factor for biomass combustion (kg/TJ, default value is 4)
N_2O_GWP	GWP for N_2O (tons of CO_2e/ton of NO_2)

Calculation

$PE_{biomaas,y}$ (CO_2 tons/year)	=	$Q_{biomass}$ (tons/year)	x	$E_{biomass}$ (TJ/ton)	x	(CH_4bio_comb x CH_4_GWP (kg CH_4/TJ x ton CO_2/ ton CH_4)	+	N_2Obio_comb x N_2O _GWP) (kg N_2O /TJ x ton CO_2/ ton N_2O)	÷	1000 (kg/ton)
	=	33,419	x	0.0148	x	(300 x 21	+	4 x 310)	÷	1000
	=	3,729		CO_2 tons/year						

Project emissions from combustion of fossil fuels

[8] The basis for determining the energy content of biomass is described in Section A.4.2 "Fuel requirement". As the fluctuation between separate tests and samples is small, the use of an average value is deemed appropriate for *ex ante* estimation.

This project emission from on-site consumption of fossil fuels are calculated based on the quantity of fuels combusted and the CO_2 emission coefficient of those fuels in accordance with "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (Version 02)", as follows:

$$PE_{FC,j,y} = \sum_i FC_{i,j,y} \times COEF_{i,y}$$

where,

$PE_{FC,j,y}$	CO_2 emissions from fossil fuel combustion in process j during the year *y* (tCO_2/yr)
$FC_{i,j,y}$	Quantity of fuel type *i* combusted in process *j* during the year *y* (mass unit/yr)
$CO_{EFi,y}$	CO_2 emission coefficient of fuel type *i* in year *y* (tCO_2/mass unit)
i	Fuel types combusted in process *j* during the year *y*

As stated in B.6.1, Option B is selected for this project activity.

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

where,

$NCV_{i,y}$	Weighted average net calorific value of the fuel type i in year y (GJ/mass unit)
$EF_{CO2,i,y}$	Weighted average CO_2 emission factor of fuel type i in the year y (tCO_2/GJ)

The Project may consume a small amount of liquefied petroleum gas (LPG) for start-up of the boiler to preheat the combustion zone until rice husk is able to sustain its own combustion. LPG is used for start-up propose only. The consumption of LPG will be considered as a project emission for a conservative manner.

For ex-ante calculation, project emission from LPG combustion is negligible and therefore $PE_{LPG,y}$ =0 . For ex-post, it will be monitored and the project emission from LPG combustion will be accounted as per the above tool.

<u>Project emissions from electricity consumption by the project activity</u>

Project emission from electricity consumption is calculated based on the quantity of electricity consumed, an emission factor for electricity generation and a factor to account for transmission losses, as stated below:

$$PE_{EC,y} = \sum_i EC_{PJ,j,y} \ x \ EF_{EL,j,y} \ x \ (1 + TDL_{j,y})$$

where:

$PE_{EC,y}$	*Project emissions from electricity consumption in year y (tCO_2/yr)*
$EC_{PJ,j,y}$	*Quantity of electricity consumed by the project electricity consumption source j in year y (MWh/yr)*
$EF_{EL,j,y}$	*Emission factor for electricity generation for source j in year y (tCO_2/MWh)*
$TDL_{j,y}$	*Average technical transmission and distribution losses for providing electricity to source j in year y (use default values of 20%)*
j	*Sources of electricity consumption in the project*

For ex-ante calculation, project emission from electricity generation is negligible and therefore $PE_{EC,y}$ =0 . For ex-post, it will be monitored and the project emission from electricity consumption will be accounted as per the above tool.

<u>Leakage</u>

As stated earlier, 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.

B.6.4. Summary of ex ante estimates of emission reductions

Year	Baseline emissions ($t CO_2e$)	Project emissions ($t CO_2e$)	Leakage ($t CO_2e$)	Emission reductions ($t CO_2e$)
20/04/2011-19/04/2012	55,349	3,729	-	51,620
20/04/2012-19/04/2013	55,349	3,729	-	51,620
20/04/2013-19/04/2014	55,349	3,729	-	51,620
20/04/2014-19/04/2015	55,349	3,729	-	51,620
20/04/2015-19/04/2016	55,349	3,729	-	51,620
20/04/2016-19/04/2017	55,349	3,729	-	51,620
20/04/2017-19/04/2018	55,349	3,729	-	51,620
Total	387,443	26,103	-	361,340
Total number of crediting years	7 years (renewable crediting period)			
Annual average over the crediting period	55,349	3,729	-	51,620

Note: The registration date of this project activity was on 10 August 2006 and the starting date of crediting period was from 19 April 2009 until 18 April 2016. Due to the change of starting date of crediting period, the crediting period has been changed to 20 April 2011-19 April 2018[9].

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

Data / Parameter	D.3-1
Unit	MWh
Description	Total amount of electricity generation from the project activity
Source of data	Measured
Value(s) applied	15,840
Measurement methods and procedures	Onsite measurement - using electricity meter
Monitoring frequency	Monthly (aggregate) Data is to be recorded monthly and aggregated yearly and will be archived electronically. The archived data will be kept during the crediting period and two years after the end of the crediting period.
QA/QC procedures	The amount of the electricity generated from the project will be monitored by electricity meter which will be maintained and calibrated according to the manufacturer's standards.
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data / Parameter	**D.3-2**
Unit	MWh
Description	Amount of electricity delivered to AKR
Source of data	Measured
Value(s) applied	13,464
Measurement methods and procedures	Onsite measurement - using electricity meter

[9] Source from UNFCCC's website: http://cdm.unfccc.int/Projects/DB/DNV-CUK1144657688.42/

Monitoring frequency	Monthly (aggregate) Data is to be recorded monthly and aggregated yearly and will be archived electronically. The archived data will be kept during the crediting period and two years after the end of the crediting period.
QA/QC procedures	The amount of the electricity delivered to AKR will be monitored by electricity meter which will be maintained and calibrated according to the manufacturer's standards. The data will be subject to annual financial audit. The consistency of the data will be verified through the actual sale record.
Purpose of data	Calculation of baseline emissions
Additional comment	ABC has a separate and independent shareholding structure from Angkor Kasekam Roongroeung, the rice mill. The electricity generation record will be kept at ABC that will be subject to a financial auditing every year.

Data / Parameter	**D.3-3**
Unit	MWh
Description	Amount of electricity supplied to the local community
Source of data	Measured
Value(s) applied	-
Measurement methods and procedures	Onsite measurement - using electricity meter
Monitoring frequency	Monthly (aggregate) Data is to be recorded monthly and aggregated yearly and will be archived electronically. The archived data will be kept during the crediting period and two years after the end of the crediting period.
QA/QC procedures	The amount of the electricity supplied to the local community will be monitored by electricity meter which will be maintained and calibrated according to the manufacturer's standards. The data will be subject to annual financial audit. The consistency of the data will be verified through the actual sale record.
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data / Parameter	**D.3-4**
Unit	MWh
Description	Amount of electricity supplied to the grid
Source of data	Measured
Value(s) applied	-
Measurement methods and procedures	Onsite measurement - using a two-way electricity meter (to measure both electricity supplied to and imported from the grid)
Monitoring frequency	Monthly (aggregate) Data is to be recorded monthly and aggregated yearly and will be archived electronically. The archived data will be kept during the crediting period and two years after the end of the crediting period.
QA/QC procedures	The amount of the electricity supplied to the grid through a power utility will be monitored by the two-way electricity meter (recorded imported from and exported electricity to the grid) which will be maintained and calibrated according to the manufacturer's standards. The data will be subject to annual financial audit. The consistency of the data will be verified through the actual sale record with the power utility.
Purpose of data	Calculation of baseline emissions
Additional comment	

Data / Parameter	**D.3-5**
Unit	MWh
Description	Amount of electricity imported from the grid
Source of data	Measured
Value(s) applied	-

Measurement methods and procedures	Onsite measurement - using a two-way electricity meter (to measure both electricity supplied to and imported from the grid)
Monitoring frequency	Monthly (aggregate) Data is to be recorded monthly and aggregated yearly and will be archived electronically. The archived data will be kept during the crediting period and two years after the end of the crediting period.
QA/QC procedures	The amount of the electricity imported from the grid through a power utility will be monitored by the two-way electricity meter (recorded imported from and exported electricity to the grid) which will be maintained and calibrated according to the manufacturer's standards. The data will be subject to annual financial audit. The consistency of the data will be verified through the actual sale record with the power utility.
Purpose of data	Calculation of project emissions
Additional comment	

Data / Parameter	**D.3-6**
Unit	tonne
Description	Amount of rice husk combusted
Source of data	Measured
Value(s) applied	33,419
Measurement methods and procedures	Onsite measurement - using rice husk flow meter
Monitoring frequency	Monthly (aggregate) Data is to be recorded monthly and aggregated yearly and will be archived electronically. The archived data will be kept during the crediting period and two years after the end of the crediting period.
QA/QC procedures	The amount of biomass combusted in the boiler will be monitored by a flow meter with scale function. Maintenance and calibration of the equipments will be carried out according to the manufacturer's standards. The consistency of the data will be verified through the actual supply records between AKR and ABC.
Purpose of data	Calculation of baseline and project emissions
Additional comment	-

Data / Parameter	**D.3-7**
Unit	TJ/Tonne
Description	Energy content of biomass treated
Source of data	Measured
Value(s) applied	Heating value analysis report
Measurement methods and procedures	It will be measured by an independent third party laboratory. The archived data will be kept during the crediting period and two years after the end of the crediting period.
Monitoring frequency	Yearly
QA/QC procedures	The energy content of biomass will be measured on a yearly basis according to the international approved standards and procedures through a qualified laboratory.
Purpose of data	Project emission calculations
Additional comment	Two samples were sent to the qualified laboratory.

In case fossil fuel is used, data and parameters to be monitored based on "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" (Version 02) is as below.

Data / Parameter	**D.3-8 ($FC_{i,j,y}$)**
Unit	Mass unit per year (i.e. ton/yr)
Description	Quantity of fuel type i combusted in process j during the year y
Source of data	Onsite measurement

Value(s) applied	For ex-ante, 0 It will be recorded and calculated.
Measurement methods and procedures	Use a mass meter to monitor small daily tanks of LPG that are used for start-up the boiler. It will be recorded on a daily basis and calibrated at least once a year.
Monitoring frequency	Data is to be recorded daily and aggregated monthly and yearly and will be archived electronically. The archived data will be kept during the crediting period and two years after the end of the crediting period.
QA/QC procedures	The measurement results will be cross-checked with purchased fuel invoices and stock changes of LPG consumption to ensure consistency.
Purpose of data	Project emission calculations
Additional comment	

Data / Parameter	**D.3-9 ($NCV_{i,y}$)**
Unit	GJ per mass unit (e.g. GJ/ton)
Description	Weighted average net calorific value of fuel type i in year y
Source of data	The following data sources may be used if the relevant conditions apply:

Data source	Conditions for using the data source
a) Values provided by the fuel supplier in invoices	This is the preferred source if the carbon fraction of the fuel is not provided (Option A)
b) Measurements by the project participants	If a) is not available
c) Regional or national default values	If a) is not available These sources can only be used for liquid fuels and should be based on well documented, reliable sources (such as national energy balances).
d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories	If a) is not available

Value(s) applied	-
Measurement methods and procedures	For a) and b): Measurements should be undertaken in line with national or international fuel standards
Monitoring frequency	For a) and b): The NCV should be obtained for each fuel delivery, from which weighted average annual values should be calculated For c): Review appropriateness of the values annually For d): Any future revision of the IPCC Guidelines should be taken into account The archived data will be kept during the crediting period and two years after the end of the crediting period.
QA/QC procedures	Verify if the values under a), b) and c) are within the uncertainty range of the IPCC default values as provided in Table 1.2, Vol. 2 of the 2006 IPCC Guidelines. If the values fall below this range collect additional information from the testing laboratory to justify the outcome or conduct additional measurements. The laboratories in a), b) or c) should have ISO17025 accreditation or justify that they can comply with similar quality standards.
Purpose of data	Project emission calculations
Additional comment	Applicable where Option B of the "*Tool to calculate project or leakage CO2 emissions from fossil fuel combustion (Version 02)*" is used.

<table>
<tr><td>Data / Parameter</td><td>D.3-10 ($EF_{CO2,i,y}$)</td></tr>
<tr><td>Unit</td><td>tCO_2/GJ</td></tr>
<tr><td>Description</td><td>Weighted average CO_2 emission factor of fuel type i in year y</td></tr>
<tr><td>Source of data</td><td>The following data sources may be used if the relevant conditions apply:
<table>
<tr><th>Data source</th><th>Conditions for using the data source</th></tr>
<tr><td>a) Values provided by the fuel supplier in invoices</td><td>This is the preferred source</td></tr>
<tr><td>b) Measurements by the project participants</td><td>If a) is not available</td></tr>
<tr><td>c) Regional or national default values</td><td>If a) is not available These sources can only be used for liquid fuels and should be based on well documented, reliable sources (such as national energy balances).</td></tr>
<tr><td>d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories</td><td>If a) is not available</td></tr>
</table></td></tr>
<tr><td>Value(s) applied</td><td>-</td></tr>
<tr><td>Measurement methods and procedures</td><td>For a) and b): Measurements should be undertaken in line with national or international fuel standards</td></tr>
<tr><td>Monitoring frequency</td><td>For a) and b): The CO2 emission factor should be obtained for each fuel delivery, from which weighted average annual values should be calculated. For c): Review appropriateness of the values annually
For d): Any future revision of the IPCC Guidelines should be taken into account</td></tr>
<tr><td>QA/QC procedures</td><td>For a): If the fuel supplier does provide the NCV value and the CO2 emission factor on the invoice and these two values are based on measurements for this specific fuel, this CO2 factor should be used. If another source for the CO2 emission factor is used or no CO2 emission factor is provided, Options b), c) or d) should be used.</td></tr>
<tr><td>Purpose of data</td><td>Project emission calculations</td></tr>
<tr><td>Additional comment</td><td>Applicable where Option B of the “Tool to calculate project or leakage CO2 emissions from fossil fuel combustion (Version 02)” is used.</td></tr>
</table>

The Project will neither lead to fuel diversion to carbon-intensive fuels or displacement of existing or planned rice husk plants. The demand for rice husk other than from the Project is very limited and will remain so in the future. Monitoring a possibility of leakage is unnecessary.

In case where Angkor Rice Mill sells surplus electricity to the neighbouring community, the amount of the sold electricity will be subtracted from the amount of generated electricity in GHG emission reduction calculation.

B.7.2. Sampling plan

The project activity does not involve any monitoring data that needs to be determined by a sampling approach.

B.7.3. Other elements of monitoring plan

Monitoring will be conducted with appropriate number of personnel for the tasks described in D.3 according to the operation and maintenance structure in Figure 6. 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.

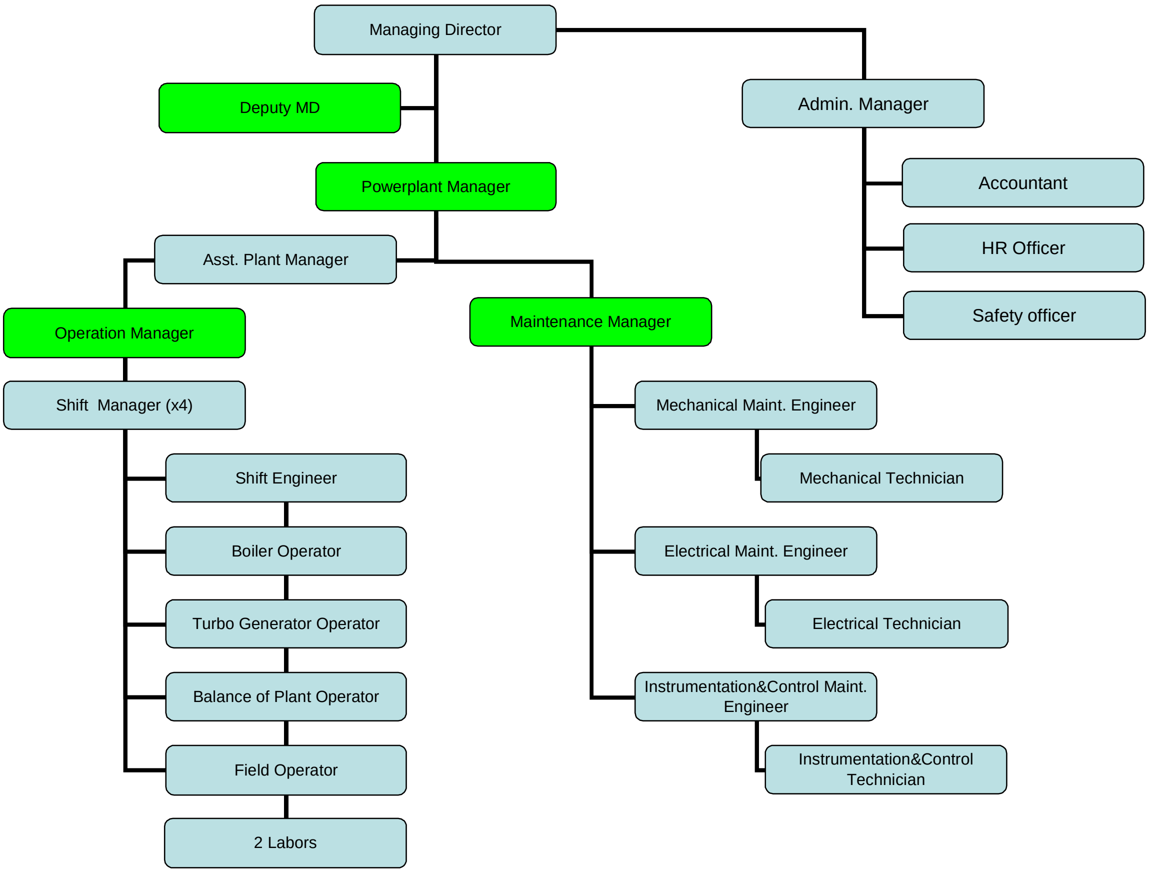

Figure 6: Operation and Maintenance Structure

B.8. Date of completion of application of methodology and standardized baseline and contact information of responsible persons/ entities

Date of completion of application of methodology and standardized baseline: 11/08/2015
Contact information of responsible entities: Mitsubishi UFJ Morgan Stanley Securities Co., Ltd.
E-mail: toyofuku-masayuki@sc.mufg.jp

SECTION C. Duration and crediting period

C.1. Duration of project activity

C.1.1. Start date of project activity

25/04/2006

The starting date of the project activity is here defined as the earliest date on which construction work may begin. Should construction be delayed, the starting date of the project activity will be delayed accordingly.

C.1.2. Expected operational lifetime of project activity

Minimum 21 years.

C.2. Crediting period of project activity

C.2.1. Type of crediting period

Renewable crediting period.
This is the first renewable crediting period.

C.2.2. Start date of crediting period

20/04/2011

The starting date of the first crediting period is here defined as the earliest date on which the commercial operation may begin. Should operation be delayed, the starting date of the first crediting period will be delayed accordingly.

C.2.3. Length of crediting period

7 years 0 month. (It can be renewable crediting period 2 times.)

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

An Environmental Impact Assessment (EIA) is not required for a power generation project of less than 5MW in capacity except for hydropower project for which EIA is required if the generation capacity is greater than 1MW in Cambodia.

The Project does not cause negative environmental impacts. The environmental concerns relating to steam turbine is virtually zero. Other points noted for ABC's plant are following:

- The combustion of rice husk may present some concerns because of the low density of the husk and the high particulate in the flue gas. However, automation of the combustion control as well as wet scrubber will help in reducing the particular emissions at the stack.

- SO_2 emissions from combusting biomass will be minimal and be reduced compared to using fossil fuel. NOx emissions will also be low and maintained within the prevailing emission standards promulgated by the Sub-Decree on Air Pollution Control and Noise Disturbance (2000) under the jurisdiction of Ministry of Environment (MOE). The monitoring of the emissions will be decided in consultation with the MOE.

Wastewater will be treated at site before being released to either natural ponds or small waterways. Regular testing of effluent will be carried out by in -house operations team in order to ensure that the effluent standards are in line with the Sub-Decree on Water Pollution Control which is also administered by MOE.

SECTION E. Local stakeholder consultation

E.1. Solicitation of comments from local stakeholders

To ensure a correct process for stakeholders' comments for the Project, Angkor Bio Cogen consulted with Cambodia's Ministry of Environment, Ministry of Industry, Mines and Energy (MIME), Ministry of Environment and relevant government entities on numerous occasions.

ABC conducted a public consultation meeting on September 18th 2004 on general aspects of the project activity and another meeting on 23 February 2005 specifically to speak to Ang Snoul villagers about provision of electricity to their community. The first meeting took place at Angkor

Kasekam Roongroeung office at the rice mill while the second meeting took place in the Peuk Commune Office.

<u>First public consultation meeting</u>
There were twenty-two participants in the meeting who live nearby the project site. The participants included employees of the rice mill as well as members of Ang Snoul Village. Ang Snoul Village is situated in Perk Commune that covers several villages in Ang Snoul District. The chief of Ang Snoul Village and the chief of Perk Commune attended the meeting to represent the village and commune respectively. The power plant will be located in the Ang Snoul Village that is the only village in the vicinity of the project site. Ang Snoul Village is a village where resident villagers, chiefs and rice mill operators are on friendly terms. It was possible for all attendees to express their opinions freely. Appendix shows the list of the attendees.

The followings are brief descriptions of ABC's presentation at the meeting.

- Described the main objective of the Project to utilize biomass to generate electricity.
- Explained the process that uses heat from rice husk combustion to generate steam and to drive a generator to produce power.
- Explained how the Project contributes to reducing GHG emissions.
- Explained how the produced electricity may become available at nearby villages including Ang Snoul Village. (Access to the electricity distribution system is currently unavailable at the villages. As described in A. 2, Angkor Rice Mill and ABC are jointly planning to provide a small volume of electricity to the villages with a relatively small charge.)
- Described safety of the machines as well as maintenance and operation of the machines controlled by experienced team carefully.
- Explained how well the particulate emissions will be managed.

E.2. Summary of comments received

All the attendees expressed their support to the Project. They hoped that the Project would begin soon in order to access to lower price and reliable electricity that Angkor Rice Mill plans to provide. They recognized that the Project would bring environmental and economic benefits to the community and contributes to the improvement of the quality of life in the neighbourhood.

There were no negative comments on the Project.

E.3. Report on consideration of comments received

Due to the considerable amount of interest among the villagers for the availability of electricity to their community, ABC held a second public consultation session on 23 February 2005. The session was held specifically to consult the village chief of Ang Snoul village and chiefs of other villages in Peuk Commune as well as the Peuk Commune chief about the provision of electricity and ask the village chiefs and commune chief of their support. The village chiefs and a commune chief representing 19 villages and 1174 households who attended the meeting are listed in the Appendix.

All chiefs agreed to the Project and wrote a supporting letter. They also expressed their wish to purchase the electricity at the price of less than 900 Riels per kWh (approximately 0.225USD).

SECTION F. Approval and authorization

Letters of approval from authorized participants are provided.

Appendix 1. Contact information of project participants and responsible persons/ entities

Project participant and/or responsible person/ entity	☒ Project participant ☐ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	1. Angkor Bio Cogen Co., Ltd (ABC)
Street/P.O. Box	Phum Angsnoul
Building	
City	
State/Region	Angsnoul District, Kandal Province
Postcode	
Country	Cambodia
Telephone	(+855)-23-369218
Fax	(+855)-23-364228
E-mail	angkorrice@hotmail.com
Website	*www.angkorrice.com*
Contact person	
Title	Managing Director
Salutation	Mr.
Last name	Chieu
Middle name	
First name	Adisorn
Department	
Mobile	
Direct fax	
Direct tel.	
Personal e-mail	

Project participant and/or responsible person/ entity	☒ Project participant ☒ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	2. Mitsubishi UFJ Morgan Stanley Securities Co., Ltd
Street/P.O. Box	3-2-20 Toyosu
Building	5th Floor, Toyosu Front
City	Koto-ku, Tokyo
State/Region	
Postcode	135-0061
Country	Japan
Telephone	+81 3 6213 6278
Fax	+81 3 6213 6175
E-mail	toyofuku-masayuki@sc.mufg.jp
Website	http://www.sc.mufg.jp/english/
Contact person	
Title	General Manager

Salutation	Mr.
Last name	Toyofuku
Middle name	
First name	Masayuki
Department	Clean Energy Finance Division
Mobile	
Direct fax	
Direct tel.	
Personal e-mail	

Project participant and/or responsible person/ entity	☒ Project participant ☐ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	3. Asian Development Bank, as trustee of the Future Carbon Fund
Street/P.O. Box	6 ADB Avenue
Building	Asian Development Bank
City	Mandaluyong City
State/Region	Metro Manila
Postcode	1550
Country	Philippines
Telephone	+63 2 632 4444
Fax	+63 2 632 5114
E-mail	futurecarbonfund@adb.org
Website	www.adb.org
Contact person	
Title	Deputy Director General
Salutation	Mr.
Last name	Um
Middle name	
First name	Woochong
Department	Regional and Sustainable Development Department
Mobile	
Direct fax	
Direct tel.	
Personal e-mail	

Appendix 2. Affirmation regarding public funding

The project plans to obtain funding for a portion of the equipment cost from Japan's New Energy and Industrial Technology Development Organization (NEDO). The public funding for the Project is not counted towards Japan's official development assistance obligations.

Appendix 3. Applicability of methodology and standardized baseline

N/A

Appendix 4. Further background information on ex ante calculation of emission reductions

N/A

Appendix 5. Further background information on monitoring plan

N/A

Appendix 6. Summary of post registration changes

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.

Permanent changes from registered monitoring plan, applied methodology or applied standardized baseline

(1) Permanent change to include the monitoring of fossil fuel consumption in the project activity

It was observed during the 1st monitoring period (20 April 2011 to 31 May 2012) that project activity is used fossil fuel i.e. LPG for start-up operations at the project site and this parameter has not been discussed and neither has been included in the registered monitoring plan in the registered PDD that was registered on 10 August 2006. Though the consumption of fossil fuel (LPG) is small, the post-registration change to include the monitoring of fossil fuel consumption has been included in order to come up with conservative emission reductions. In doing this, emissions due to fossil fuel consumption from the project activity are deducted from total emission reductions. This approach will result in accurate and conservative emission reductions during the crediting period. Permanent change from registered monitoring plan or applied methodology was approved on 27 January 2014 as per PRC ref No. PRC-0363-002.

Since permanent changes from registered monitoring plan was requested after the withdrawal of Request for Issuance for 1st verification period (20 April 2011 to 31 May 2012) and also webhosting of monitoring report for 2nd verification period (01 June 2012 to 31 December 2012), the revised monitoring plan cannot be implemented for these two verification periods plus the period till the date of submitting the Request for Revision in the Monitoring Plan i.e. January 2013 till date of submission of request for revision in the monitoring plan. In such case, in the absence of mass meters, PP wishes to conservatively calculate the project emissions from the LPG consumption based on the number of LPG tanks used in a particular monitoring period and the standard weight of LPG tank. The same would be verified from the LPG gas tank purchase invoices and stock changes during the respective monitoring period.

(2) Permanent change to include a small scale methodology; AMS.I-D (Grid connected renewable electricity generation) in the project activity

Due to the low load environment of Angkor Kasekam Roongroeung Rice Mill (AKR) since 2012 only requiring small amount of electricity for polishing and cleaning, and not heavy electricity consumption for milling rice, the Project supplies small amount of electricity to AKR. While the energy consumption for operating the power plant remains the same, such situation does not bring any economic benefit to the project. As a result of this, the project proponent (ABC) has planned to supply electricity to the grid through a power utility, namely Electricity Angsnoul Enterprise (EAE), in Angsnoul District in Cambodia. The post registration change to include a small scale methodology (AMS.I-D; Grid connected renewable electricity generation) and monitoring parameters according to this methodology are required to revise in this registered PDD.