



## CDM proposed standardized baseline form (Version 01.0)

*(To be used by a designated national authority (DNA) when submitting a proposed standardized baseline in accordance with the "Procedure for submission and consideration of standardized baselines".)*

### SECTION 1: GENERAL INFORMATION

<b>DNA submitting this form:</b>	Cambodia (Ministry of Environment)
<b>Developer of the standardized baseline:</b> <i>(Parties, project participants, international industry organizations or admitted observer organizations)</i>	Institute for Global Environmental Strategies (IGES)
<b>Party or Parties to which the standardized baseline applies:</b>	Cambodia
<b>Sector to which the proposed standardized baseline applies:</b> <i>(the sector according to the definition of sector in the "Guidelines for the establishment of sector specific standardized baselines")</i>	Rice mill sector

### SECTION 2: LIST OF DOCUMENTS TO BE ATTACHED TO THIS FORM *(please check)*

- ☐ An assessment report presenting how the data was collected, processed and compiled to establish the proposed standardized baselines;
- ☐ Where the proposed standardized baseline applies to a group of Parties, letters of approval of all the DNAs of the Parties to which the standardized baseline applies;
- ☒ Additional documentation supporting the submission (e.g. relevant data, documentation, statistics, studies, calculation tables, etc.), when applicable.

<b>Name of authorized officer signing for the DNA:</b>	<b>H.E. Thuk Kroeun Vutha</b> , Secretary of State, Ministry of Environment, Cambodia
<b>Date and signature for the DNA:</b>	
<b>Name and contact details of the focal point(s) for any follow up communication:</b> <i>(all communication regarding procedural or technical issues will be sent to the focal point(s))</i>	<b>Mr. Sum Thy</b> , Director of Climate Change Department, Ministry of Environment, No.48, Samdech Preah Sihanouk Blvd, Tonle Bassac, Chomkarmon, Phnom Penh, Cambodia Tel: +855 23 218 370 Fax: +855 23 218 370 Email: cceap@online.com.kh

### SECTION BELOW TO BE COMPLETED BY THE UNFCCC SECRETARIAT

<b>CDM-PSB ID number:</b>	
<b>Date when the form was received at UNFCCC secretariat:</b>	
<b>Have <u>all</u> Parties for which the standardized baseline is applicable fewer than 10 registered CDM project activities as of 31 December 2010?</b>	

PROPOSED STANDARDISED BASLINE  
(CDM-PSB) - Version 01.0



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(Y/N):	
CDM-PSB ID number and version: (to be completed by UNFCCC)	



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**CLEAN DEVELOPMENT MECHANISM  
PROPOSED STANDARDIZED BASELINE  
(CDM-PSB)  
(VERSION 01.0)**

**“Standardized baseline of energy use in rice mill sector of Cambodia**

**Submission date: 25 September 2012**

**Version Number: 1.0**

**Source**

If the standardized baseline was developed using a methodological approach contained in an approved methodology or tool please provide the name, number (if applicable) and version of the approved methodology or tool used.

- Approved methodologies  
AMS-I.A. Version 15, AMS-I.B. Version 10 and AMS-I.F. Version 2
- Guidelines for quality assurance and quality control of data used in the establishment of standardized baselines, Version 1.0
- Guideline for demonstrating additionality of micro scale project activities, Version 4.0
- Standard for sampling and surveys for CDM project activities and programme of activities, Version 2.0

If it was developed using the “*Guidelines for the establishment of sector specific standardized baselines*” please state the version of the guidelines used.

Version 2.0

If a table of calculation is available for the development of the standardized baseline, please state the version of the table used, and submit it with this form.

Calculation sheet version 1

**Type of standardized baseline approach**

The standardized baseline is developed for:

- ☒ Additionality demonstration;
- ☒ Baseline identification;
- ☒ Baseline emission estimation.

Please note that one, two or all three items can be checked.

**Version 01.0**

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## **SECTION A: STANDARDIZED BASELINE DEVELOPED USING THE “GUIDELINES FOR THE ESTABLISHMENT OF SECTOR SPECIFIC STANDARDIZED BASELINES”**

This section should only be completed when the standardized baseline is developed using the “Guidelines for the establishment of sector specific standardized baselines”.

### **Applicability of the standardized baseline**

Please provide the following information:

- The host country(ies) or region(s) within a host country to which the standardized baseline is applicable. In case of region(s) within a host country, please document transparently the geographical boundaries of the region (e.g. provinces, electric grids, etc).

Cambodia

- The sector(s) to which the standardized baselines is applied. Note that a sector refers to a segment of a national economy that delivers defined output(s) (e.g. clinker production, domestic / household energy supply). The sector is characterized by the output(s)  $O_i$  it generates.

Rice mill sector

- The output(s) to which the standardized baseline is applied, i.e. the goods or services with comparable quality, properties, and application areas (e.g. clinker, lighting, residential cooking).

Milled rice

- The measure to which the standardized baseline is applicable:

☐ Fuel and feedstock switch; or

☒ Switch of technology with or without change of energy source (including energy efficiency improvement); or

☐ Methane destruction; or

☐ Methane formation avoidance.

### **Additionality demonstration**

Please explain how the “Guidelines for the establishment of sector specific standardized baselines” were applied to demonstrate additionality and develop a positive list of project activities that are deemed additional. Follow the steps and guidance of the “Guidelines for the establishment of sector specific standardized baselines”. Document all underlying data, data sources, assumptions, calculation steps and outcomes are in a clear and transparent manner.



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>Procedures of additionality demonstration for a measure of switch of technology with or without change of energy source (including energy efficiency improvement) in the “*Guidelines for the establishment of sector specific standardized baselines version 2.0*” (“the guideline” hereafter) are as follows;

- *The cumulative percent of output  $O_i$ , produced based on technologies is arranged in descending order of carbon intensity of such technologies.*
- *Technologies that have lower greenhouse gas intensity than any of the technologies used to produce aggregately more than  $Y_a\%$  of the output(s)  $O_i$  of the sector and are less commercially attractive than any of these technologies, are deemed additional.*
- *Technologies are deemed less commercially attractive if their cost per unit of output is higher than that of all technologies used to produce aggregately more than  $Y_a\%$  of the output(s)  $O_i$  of the sector, and,*
  - (a) There is no national or sub-national enforced regulation mandating the use of these technologies;*
  - (b) The Board clarifications on the consideration of national and or sectoral policies and circumstances in baseline scenarios is taken into account.*

### 1. Technology identification

There are 27,407 rice millers registered by the Ministry of Industry, Mines and Energy of Cambodia (MIME) (MIME 2011), and the annual range in milled rice capacity varies widely from 1 to 48,000 tonnes.

Existing studies give the status of the rice mill sector in Cambodia as follows:

- EC-ASEAN Energy Facility (EAEF) ;  
*A cluster of 8 rice mills (79 rice millers) were surveyed near Battambang, and were chosen in order to complement the existing data collected by the COGEN3 project in 2003. All mills were belt-driven by a diesel engine (i.e., not electric) and all had small gen-sets on-site, used mainly for lighting, except one that was supplied by a local REE (Rural Electricity Entrepreneur).*
- According to Cambodia Research Center for Development (2010), Salam, PA. et al (2010) and SME renewable (2011), there are six biomass gasification system suppliers and 48 rice mills with biomass gasification systems installed in Cambodia.
- Angkor Bio Cogen Co., Ltd (ABC), which implements CDM projects (reference No. 363), applies a state-of-the-art technology (TORBED) for burning rice husk at the moving platform in a furnace to generate electricity. This technology was transferred from Japan and Europe and is the first such case in Cambodia.

According to the many studies available, including a survey conducted by EAFF focusing on Battambang province (one of the 24 provinces in Cambodia), the extent of penetration of biomass utilization technologies is still quite small. However, such studies do not sufficiently identify the composition of energy used in the rice mill sector and the details on fossil fuel usage. Therefore, a survey was needed to obtain a clearer picture of the current situation and emissions, with a view to establishing a baseline scenario and to demonstrate additionality. A sampling survey was thus implemented in accordance with the sampling plan as described in Annex I.

Based on the literature review and the sampling survey, four technologies were identified as being used in the rice mill sector in Cambodia, then the carbon intensity of each technology per tonne of milled rice production (“the emission factor” hereafter) was calculated.

Data vintage for energy generation in an isolated system is required for the most recent three years according to the guideline. Based on the sampling survey, most rice millers keep paper-based daily records and do not store annual summery reports. Data extrapolated from this survey is comprised of estimated averages of daily data and annual operating days (based on daily records and on-site interviews



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with rice millers). As per the “Guidelines for quality assurance and quality control of data used in the establishment of standardized baselines”, Cambodia was eligible for applying the data vintage of one year instead three years.

### Technology 1: Power-driven by a diesel engine

A diesel engine in a rice mill factory generates mainly power for directly driving rice mill machines (transporters, shakers, threshers, polishers and sewing machines for packing bags). Some rice millers use a dynamo connected to a diesel engine to generate electricity which is used for appliances and lighting. Since rice millers in Cambodia dry rice in the open and dryers require to be connected to a grid or generator for 24-hour operation, not many dryers are installed.

Most rice millers use a second-hand vehicle engine. The capacity of the engines used is normally around 350 hp (264.4 kW) for a mid-size rice mill, costing 8,000-10,000 USD. Small-scale rice mills use an 11 hp engine (11.34 kW), which costs 400-1,000 USD. Diesel fuel in Cambodia costs 0.98 USD/l<sup>1</sup>. In the survey, production of one tonne of milled rice requires 20.1 litres of fuel. The emission factor of Technology 1 is based on a baseline emissions calculation as given in AMS-I.B, as follows:

$$EF_{t1,m,y} = \frac{DC_{m,y} \times DD \times EF_{CO2,diesel} \times 10^{-3}}{MR_{m,y}} \quad (1)$$

$$EF_{t1,y} = \sum_m EF_{t1,m,y} \div N \quad (2)$$

Where:

$EF_{t1,y}$	Emission Factor of Technology 1 in year y (t-CO <sub>2</sub> /t-rice)
$EF_{t1,m,y}$	Emission Factor of rice mill $m$ adopting Technology 1 in year y (t-CO <sub>2</sub> /t-rice)
$DC_{m,y}$	Quantity of diesel consumption in rice mill $m$ in year y (l)
$DD$	Density of diesel (0.8439 kg/l (International Energy Agency et al, 2004))
$EF_{CO2,diesel}$	CO <sub>2</sub> emission factor of diesel (3.2 kg-CO <sub>2</sub> per kg of diesel, AMS-I.B.)
$MR_{m,y}$	Quantity of milled rice production in rice mill $m$ in year y (t)
$M$	Rice mill adopting Technology 1
$Y$	The relevant year
$N$	Number of rice mills adopting Technology 1

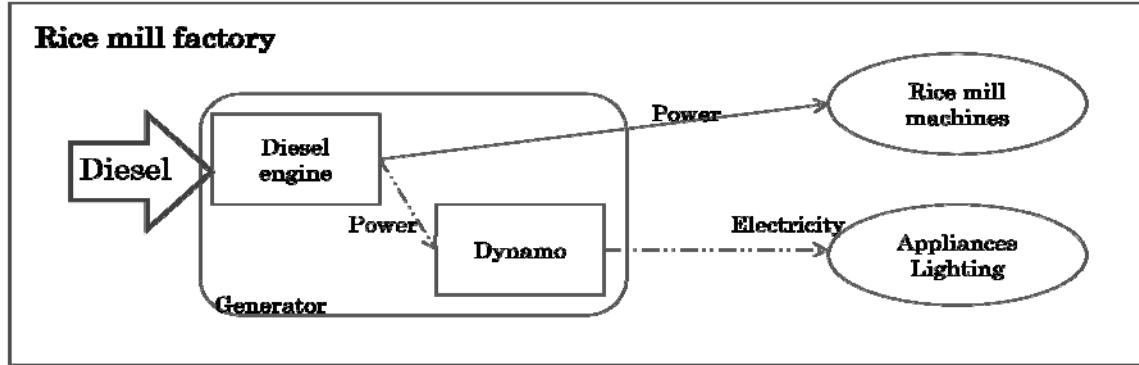
The emission factor of Technology 1 was calculated from the data of 62 rice mills as follows;

$$EF_{t1,y} = 0.0542 \text{ t-CO}_2/\text{t-rice}$$

<sup>1</sup> As of 27 June 2012, <http://data.worldbank.org/indicator/EP.PMP.DESL.CD>



Figure 1: Energy flow diagram for Technology 1



### Technology 2: Electricity supplied from REE

According to the International Energy Agency (2010), the electrification rate in Cambodia is 24%, most of which is consumed in urban areas. The electrification rate of rural households in Cambodia is 15.3% (8.4% from grid systems of Electricite du Cambodge (national electricity supplier) and 6.9% from diesel mini-grid systems) (Japan International Cooperation Agency, 2006). As rice millers are located in rural rice production areas, most of them do not have access to electricity. The sampling survey revealed that only one rice mill operates on an electricity supplied from REE. Based on an Electricity Authority of Cambodia report (2010), the average capacity of installed generators of Cambodia's 162 licensees is 570 kW. Based on Table I.F.1 in the approved methodology AMS-I.F, an emission factor of 0.8t-CO<sub>2</sub>/MWh is applied for Technology 2, which comprises diesel generators of over 200 kW.

However, this figure was arrived at based only on one case and is thus not reliable. With the electrification status in Cambodia as described above, this case adopting Technology 2 is not an option available for Cambodia's rice millers.

According to the Electricity Authority of Cambodia, the average tariff of REE is 0.56 USD per kWh of electricity. Electrically controlled rice mill machines have a high installation cost and require skilled operators.

The emission factor of Technology 2 is calculated using the electricity consumption and the emission factor of REE, as follows:

$$EF_{t2,m,y} = \frac{EC_{m,y} \times EF_{REE}}{MR_{m,y}} \quad (3)$$

$$EF_{t2,y} = \sum_m EF_{t2,m,y} \div N \quad (4)$$

Where:

$EF_{t2,y}$	CO <sub>2</sub> emission Factor of Technology 2 in year y (t-CO <sub>2</sub> /t-rice)
$EC_{m,y}$	Quantity of electricity consumption, supplied by a grid to a rice mill $m$ in year y (MWh)
$EF_{REE}$	Emission Factor of REE (Rural Electricity Entrepreneur) (0.8t-CO <sub>2</sub> /MWh)
$MR_{m,y}$	Quantity of milled rice production in rice mill $m$ in year y (t)



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$M$  Rice mill adopting Technology 2

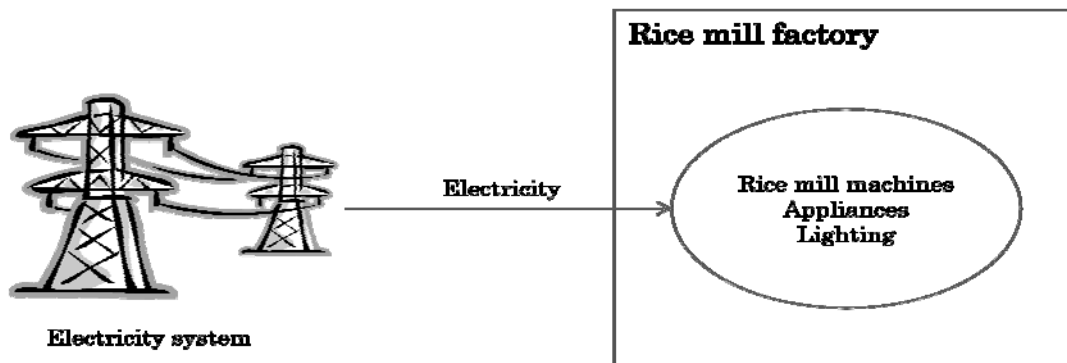
$Y$  The relevant year

$N$  Number of rice mills adopting Technology 2

The emission factor of Technology 2 is calculated from the data of one rice mill as follows;

$$EF_{t2,y} = 0.036 \text{ t-CO}_2/\text{t-rice}$$

**Figure 2: Energy flow diagram for Technology 2**



**Technology 3: Power-driven by a dual mode engine and rice husk gasification**

Technology 3 uses a gasification system in addition to the same system of Technology 1. The fuel is diesel and the gas generated from rice husk, the energy of which is converted to combustible gases (mixture of CO, CH<sub>4</sub> and H<sub>2</sub>) which are used in a dual mode engine.

According to the Cambodia Research Center for Development, Indian Ankur gasifiers (the first gasifier system introduced to Cambodia) cost from 64,000–140,000 USD (150 kW–400 kW). A Cambodian 300 kW gasifier system was developed based on the Ankur system, and costs from 15,000–45,000 USD, but is low in efficiency. Civil construction costs, including for supplemental equipment, are 70,000–10,000 USD. The diesel engines that have been used by rice mills up to now can be modified for dual mode use so that both diesel and gas can be used. If a diesel engine cannot be modified, an additional engine is purchased. The introduction of gasifiers systems in Cambodia has reduced diesel consumption by 50–80% in comparison with Technology 1. Rice husk is a by-product of the milling process and two people are required to operate a gasifier system—one to feed the rice husk into the system and another to remove ash. A technician is also needed for system maintenance. A wet scrubber is used to remove tar and other contaminants in the gas systems used in Cambodia (Salam, P. A et al, 2010), and this water-based gas cleaning system generates a large volume of tar-condensed water which requires treating before returning to the environment. A water treatment system or other type of gas cleaning system (sand, charcoal or oil filter) therefore needs to be installed, which increases the capital outlay and operating costs.

The emission factor of Technology 3 is the same formula as in Technology 1, as follows:

$$EF_{t3,m,y} = \frac{DC_{m,y} \times DD \times EF_{CO2,diesel} \times 10^{-3}}{MR_{m,y}} \quad (5)$$

$$EF_{t3,y} = \sum_m EF_{t3,m,y} \div N \quad (6)$$





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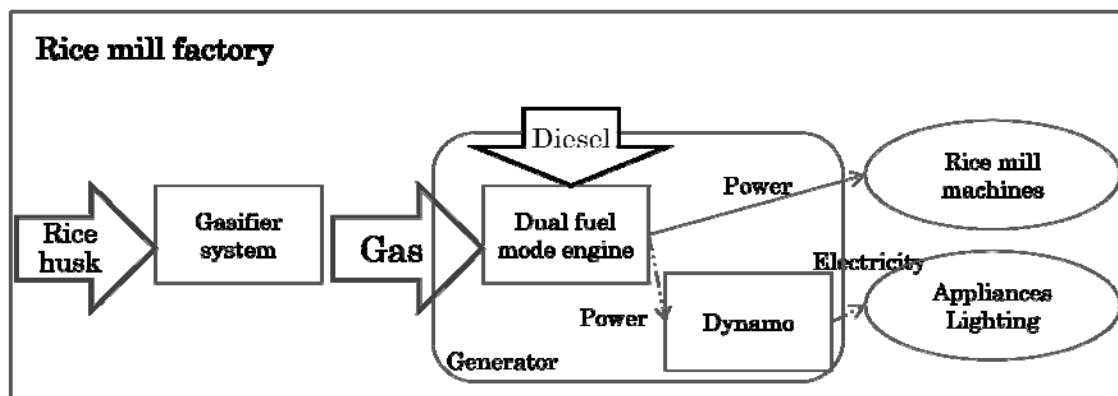
Where:

$EF_{t3,y}$	Emission Factor of Technology 3 in year $y$ (t-CO <sub>2</sub> /t-rice)
$EF_{t3,m,y}$	Emission Factor of rice mill $m$ adopting Technology 3 in year $y$ (t-CO <sub>2</sub> /t-rice)
$DC_{m,y}$	Quantity of diesel consumption in rice mill $m$ in year $y$ (l)
DD	Density of diesel (0.8439 kg/l (International Energy Agency et al, 2004))
$EF_{CO_2,diesel}$	CO <sub>2</sub> emission factor of diesel (3.2 kg-CO <sub>2</sub> per kg of diesel, AMS-I.B.)
$MR_{m,y}$	Quantity of milled rice production in rice mill $m$ in year $y$
$M$	Rice mill adopting Technology 3
$Y$	The relevant year
$N$	Number of rice mills adopting Technology 3

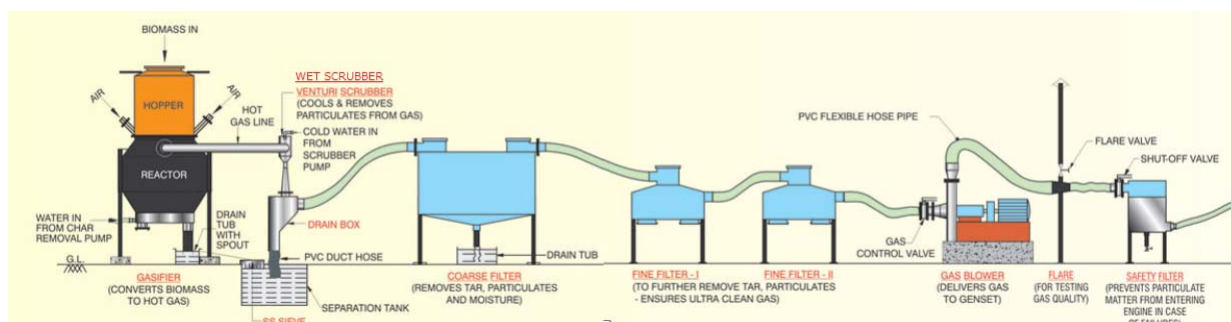
The emission factor of Technology 3 is calculated from the data of one rice mill as follows;

$$EF_{t3,y} = 0.0162 \text{ t-CO}_2/\text{t-rice}$$

**Figure 3.1: Energy flow diagram for Technology 3**



**Figure 3.2: Components of a gasifier system**



Source: Website of Ankur, <http://www.ankurscientific.com/powergeneration.htm#1>

## Technology 4: Electricity generated by a steam turbine with rice husk combustion

ABC is the only rice mill identified in Cambodia that generates electricity via steam power using rice husk, and utilises the methodology in AMS-I.A (Electricity generation by the user) and AMS-III.E (Methane avoidance). According to ABC's project as described above and New Energy and Industrial Technology Development Organization's survey (2011), this technology does not consume any fuel other



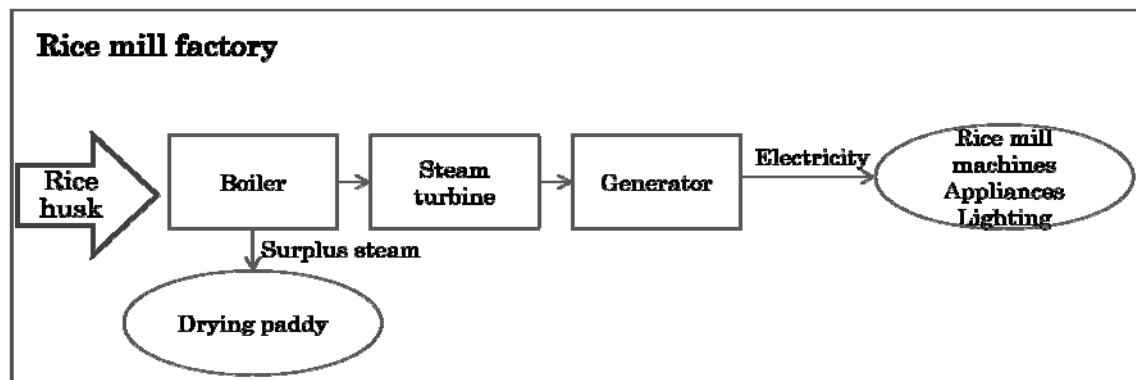
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than rice husk, a by-product of the milling process. Emissions from this technology are zero t-CO<sub>2</sub>. Rice mill machines are electrically controlled, as in Technology 2.

EF<sub>t4,y</sub> CO<sub>2</sub> emission Factor of Technology 4 in year y (0 t-CO<sub>2</sub>/t-rice)

Y The relevant year (2011)

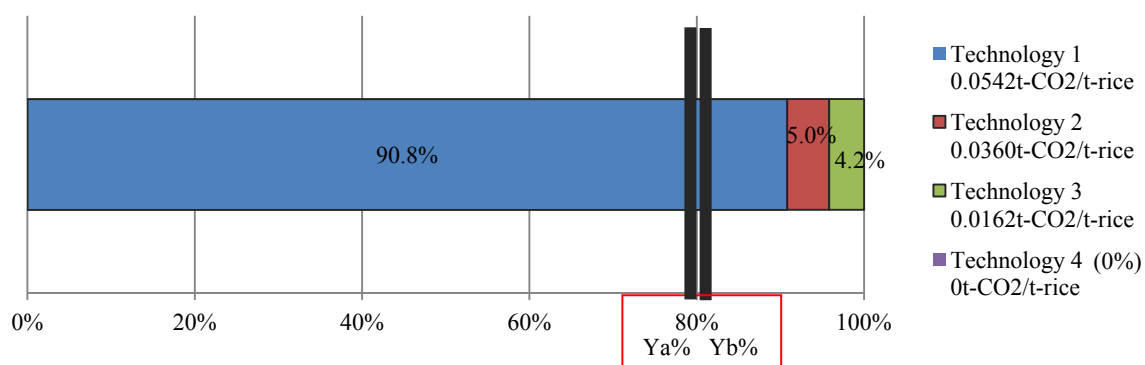
Figure 4: Energy flow diagram for Technology 4



## 2. Comparison of carbon intensity of identified technologies

The figure Ya% for energy generation in isolated systems is stated as 80% in the guideline. Figure 5 shows the four technologies, in descending order of carbon intensity. Technology 1 covers 90.8% of rice production. Technologies 2 and 3 are used by only two rice mills (one for each). There were no rice mills using Technology 4 in the survey. Technologies 2, 3 and 4 exceed the criteria of Ya%.

Figure 5. Energy generation technology of rice mill sector in Cambodia



## 3. Cost comparison

A rice mill with an annual production of around 4,000 t is assumed for cost comparison for the four technologies (Table 1). Although rice mills of this scale are categorized as large and few in number in Cambodia, the scale standard for the cost comparison needs to be adjusted to this scale more than which



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are applicable for Technologies 2 and 4. According to Agrifood Consulting International (2002), about 80% of rice millers have to finance themselves and less than 5% are eligible for bank financing. Thus, rice millers in Cambodia have great difficulty in investing in facilities and are limited in scale. Both initial costs and operating costs for Technologies 2 and 4 are higher than those of Technology 1. Electrically controlled rice mill machines used with Technologies 2 and 4 can produce high quality rice because the percentage of damaged rice is reduced. Although the operating costs of Technology 3 are slightly lower than for Technology 1, Technology 3 is still not attractive due to the large difference in initial cost as well as technological barrier, compared to Technology 1.

Despite the fact that Technology 2 meets the criteria of additionality, it cannot be promoted due to the lack of electricity access in Cambodia. Therefore, according to this proposal Technologies 3 and 4 are deemed in a positive list.

**Table 1. Cost assumption of the four technologies**

Technology	Technology 1 Power-driven by a diesel engine	Technology 2 Electricity supplied from REE	Technology 3 Power-driven by a dual mode engine and rice husk gasification	Technology 4 Electricity generated by steam turbine with combustion of rice husk	unit
Carbon intensity CO <sub>2</sub> emissions equivalent per one tonne of milled rice production	0.0542	0.0360	0.0162	0	t-CO <sub>2</sub> /t-rice
Annual milled rice production	4,000	4,800	4,000	3,600	t
Energy generation equipment capacity	Diesel engine: 250 kW	Electricity consumption : 90 kWh/h	Engine: 250 kW Gasifier: 200 kW	Generator: 120 kW	
<b>Initial cost</b>					
Rice mill machine	177,500	1,175,000	177,500	1,175,000	USD
Energy generation system	10,000	0	108,500	1,562,500	USD
Construction	Included	18,750	10,000	37,500	USD
<b>Initial cost total</b>	<b>187,500</b>	<b>1,193,750</b>	<b>296,000</b>	<b>2,775,000</b>	USD
<b>Initial cost per unit of milled rice</b>	<b>47</b>	<b>249</b>	<b>74</b>	<b>771</b>	USD/t
<b>Annual operating cost</b>					
Electricity/fuel	78,792	120,960	28,224	0	USD
Maintenance	9,862	28,125	44,662	56,250	USD
Employment cost	4,800	15,000	8,000	18,750	USD
Interest	1,706	10,863	7,494	25,253	USD
<b>Annual operating cost total</b>	<b>95,160</b>	<b>174,948</b>	<b>88,379</b>	<b>100,253</b>	USD
<b>Annual operating cost per unit of milled rice</b>	<b>24</b>	<b>36</b>	<b>22</b>	<b>28</b>	USD/t

1. The following costs are not included;

Initial cost: dryer, land and other factors unrelated to investments in rice mill processing facilities.

Operating cost: sales of cost (paddy, bags, transportation, etc.) and other factors unrelated to milling process and facility investment).

2. Finance cost: 70% of initial cost for loan, 10 year repayment period, 13% interest.

Most rice mills in Cambodia are of a small scale, and according to several surveys produce between 5–30 tonnes of rice using a diesel engine with a capacity of 50–600 kW. As a large-scale rice miller, ABC has a 2 MW electricity generation capacity and produces approx. 150 tonnes of rice per day. Therefore, the



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energy generation capacity of almost all rice mills in Cambodia is assumed to be lower than 5 MW. The “*guideline for demonstrating additionality of micro scale project activities*” states that project activities of up to 5 MW of renewable energy technology are deemed additional if the geographical location of the project activity is in a Least Developed Country or a Small Island Developing States (LDC/SIDS). For this reason, projects employing less than 5 MW of renewable energy in Cambodia are not required to demonstrate additionality.

### 4. Regulations

There are no national or sub-national enforced regulations mandating the use of Technologies 3 and 4 in the rice mill sector in Cambodia. A 2010 Cambodian government policy paper explored promoting rice paddy production and export, but does not mention policy or regulations for improving the technology and energy use in the rice milling process.

### Baseline identification

Please explain how the “*Guidelines for the establishment of sector specific standardized baselines*” were applied to identify the baseline for the measures. Follow the steps and guidance of the “*Guidelines for the establishment of sector specific standardized baselines*”. Document all underlying data, data sources, assumptions, calculation steps and outcomes in a clear and transparent manner.

>Procedures of baseline identification for a measure of switch of technology with or without change of energy source (including energy efficiency improvements) are as follows;

*Identify the technologies with the highest emission factors and contributing to production in aggregate Yb% of the output O<sub>i</sub> produced in the sector. The technology with the lowest carbon emission factor among them is the baseline technology.*

The figure Yb% for energy generation in isolated systems is stated as 80% in the guideline. As Figure 5 shows, Technology 1 is the Baseline Technology in the rice mill sector in Cambodia.

### Baseline emission factor estimation (if applicable)

Please explain how the “*Guidelines for the establishment of sector specific standardized baselines*” were applied to determine a baseline emission factor. Follow the steps and guidance of the “*Guidelines for the establishment of sector specific standardized baselines*”. Document all underlying data, data sources, assumptions, calculation steps and outcomes in a clear and transparent manner.

>The emission factor of the Baseline Technology is the same as that for Technology 1 as calculated in the section of additionality demonstration:

$$EF_{BL,m,y} = \frac{DC_{m,y} \times DD \times EF_{CO_2,diesel} \times 10^{-3}}{MR_{m,y}} \quad (7)$$

$$EF_{BL,y} = \sum_m EF_{BL,m,y} \div N \quad (8)$$

Where:

$EF_{BL,y}$  Emission Factor of Baseline Technology (Technology 1) in year y (t-CO<sub>2</sub>/t-rice)



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$EF_{BL,m,y}$	Emission Factor of rice mill $m$ adopting Baseline Technology in year $y$ (t-CO <sub>2</sub> /t-rice)
$DC_{m,y}$	Quantity of diesel consumption in rice mill $m$ in year $y$ (l)
DD	Density of diesel (0.8439 kg/l (International Energy Agency et al, 2004))
$EF_{CO_2,diesel}$	CO <sub>2</sub> emission factor of diesel (3.2kg-CO <sub>2</sub> per kg of diesel, AMS-I.B.)
$MR_{m,y}$	Quantity of milled rice production in rice mill $m$ in year $y$
$m$	Rice mill adopting Baseline Technology
$y$	The relevant year
$N$	Number of rice mills adopting Baseline Technology

The emission factor of the Baseline Technology is calculated from the data of 62 rice mills, as follows;

$$EF_{BE,y} = 0.0542 \text{ t-CO}_2/\text{t-rice}$$

### Use of the standardized baseline with an approved methodology

Please explain how the standardized baseline will be used with the relevant approved methodology(ies) or an approved tool, i.e. which (parts of) the approved methodology(ies) or the approved tool are replaced by the standardized baseline. Note that a standardized baseline derived from the “*Guidelines for the establishment of sector specific standardized baselines*” will usually replace the sections on demonstration of additionality, identification of the baseline scenario and the determination of baseline emissions, while the methodology sections on applicability, project boundary, project emissions, leakage emissions and provision to monitor project and leakage emissions may not be affected by the use of the standardized baseline. If an approved methodology is not available, a new methodology should be submitted to be used with the standardized baseline, following the relevant procedures (“*Procedure for the submission and consideration of a proposed new baseline and monitoring methodology for large scale CDM project activities*” or “*Procedures for the submission and consideration of a proposed new small scale methodology*”).

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#### 1. Demonstration of additionality and identification of the baseline scenario

This proposed standardized baseline replaces the section on demonstration of additionality and identification of the baseline scenario, which are usually used with “*Tool for the demonstration and assessment of additionality*” and “*Combined tool to identify the baseline scenario and demonstrate additionality*”.

#### 2. Determination of baseline emissions

A project adopting Technology 3 applies the approved methodology *AMS-I.B. version 10 (Mechanical energy for the use with or without electrical energy)*, and a project adopting Technology 4 applies the approved methodology *AMS-I.A. version 15 (Electricity generation by the user)*, in which the calculation of baseline emissions in projects is replaced as follows:

$$BE_{CO_2,y} = MR_y \times EF_{BL} \times DR_i$$

Where:



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$BE_{Co2,y}$	Emissions in the baseline year $y$ (t-CO <sub>2</sub> )
$MR_y$	Quantity of milled rice production in year $y$
$EF_{BL,y}$	Emission Factor of Baseline Technology in year $y$ (t-CO <sub>2</sub> /t-rice)
DR	Diesel replacement rate (%)
$y$	The relevant year
$i$	Type of technology adopted in a project

As described in the section on demonstration of additionality, Technology 3 does not completely replace diesel with rice husk as the fuel used; the replacement rate depends on the performance of the gasifier system. According to Mansvelt (2011), the diesel replacement rate of the three manufactures in Cambodia and an imported Ankur's system was 70–80% and others had a lower rate. DR for Technology 3 refers to the specific performance of a product installed in a project. If the figure is not provided from the gasifier system manufacture or the system provider, 65%, which is the average diesel replacement rate of 25 rice mills, is used. This survey interviewed rice millers who had been introduced to a gasifier system provider (SME renewable) and two rice miller associations in Cambodia.

Since Technology 4 does not use any fuel other than rice husk, DR for Technology 4 is 100%. If a project use diesel supplementarily, an appropriate value for DR is set according to the project boundary and amount consumed.

<b>Validity of the standardized baseline</b>
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Please state the period of time for which the standardized baseline is valid. Please note that Appendix I of the “Guidelines for the establishment of sector specific standardized baselines” provide interim values for data vintage and the frequency of update.

>This proposed standardized baseline is valid for 3 years from the date when CDM Executive Board approves it.



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## **SECTION B: STANDARDIZED BASELINE DEVELOPED USING A METHODOLOGICAL APPROACH CONTAINED IN AN APPROVED METHODOLOGY OR TOOL**

This section should only be completed when the standardized baseline is developed using a methodological approach to estimate baseline emissions contained in an approved methodology or tool. An example for this is the application of the “Tool to calculate the emission factor for an electricity system” to estimate the emission factor for a electric grid.

### **Applicability of the standardized baseline**

Please state the host country(ies) or region(s) within a host country to which the standardized baseline is applicable. In case of region(s) within a host country, please document transparently the geographical boundaries of the region (e.g. provinces, electric grids, etc).

NA

### **Baseline emission estimation**

Please explain how the methodological approach contained in the approved methodology or tool was applied to estimate the baseline emissions of a project activity in (a) country(ies) or region. Follow the steps and guidance of the approved methodologies or tools. Document all underlying data, data sources, assumptions, calculation steps and outcomes in a clear and transparent manner. Note that the underlying methodology or tool has to provide a methodological approach to derive the baseline emissions for a country or region in order to apply this step. This applies, for example, to the methodological tool “Tool to determine the emission factor of an electricity system”.

NA

### **Use of the standardized baseline with an approved methodology**

Please explain how the standardized baseline will be used with the relevant approved methodology(ies) or approved tool, i.e. which (parts of) the approved methodology(ies) or the approved tool are replaced by the standardized baseline.

NA

### **Validity of the standardized baseline**

Please state the vintage of the parameters used to derive the standardized baseline, in accordance with the requirements contained in the approved methodology or tool.

NA





## REFERENCES AND ANY OTHER INFORMATION

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### Annex I: Sampling plan

This sampling plan utilized “*Standard for sampling and surveys for CDM project activities and programme of activities version 2.0*” (“the sampling guideline” hereafter).

(a) Sampling Design:

(i) Sampling Objective:

- Estimating the energy use status in the rice mill sector in Cambodia
- Estimating the average quantity of fossil fuel consumption per tonne of rice production by a certain technology for comparison of carbon intensity and for calculating the baseline emission factor.

Reliability Requirements:

- Requirements for the sampling data in complying with measure 2 (switch of technology with or without change of energy source) and energy generation in isolated systems in “Guidelines for the establishment of sector specific standardized baselines version 2.0” are as follows;
  - ✓ Most recent three years for data vintage
  - ✓ Quantity of annual milled production in rice mill
  - ✓ Quantity of fuel and electricity consumed
  - ✓ Type of technology of energy generation
- As rice mills in Cambodia are of small scale, projects with this proposed standardized baseline will be developed as a programme of activities (PoAs). The sampling reliability criteria is provided as 95/10 confidence/precision for the PoAs in the sampling guideline, and 90/10 confidence/precision in an approved methodology AMS-I.A. version 15. Thus, 95/10 confidence/precision was chosen to be conservative.

(ii) Target Population

All rice mills in Cambodia

(iii) Sample Method.

Given the low electrification rate in Cambodia, the usage of energy is assumed to vary among provinces, thus samples were gathered over a wide area. As shown in Table 2, the scale of rice mills varies largely throughout the country. Since energy efficiency and technology usage depends on the business scale, stratified random sampling with a scale-based category was chosen to ensure effective information collection in the survey. Rice mills were divided into three groups based on average of production capacity by province. The number of samples in each group was chosen according to both production capacity and number of rice mills.



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**Table 2. Number of rice mills in Cambodia**

Province	Total production capacity in province	Number of rice mills	Average of production capacity of rice mills	Group	Required number of samples
Kep	210	121	2	Small	27
Prey Veng	18,874	5,089	4		
Stung Treng	1,234	183	7		
Kampong Cham	22,533	2,431	9		
Kampong Speu	59,726	2,344	25		
Kampong Chhnang	28,156	817	34		
Takeo	25,549	730	35		
Svay Rieng	73,668	1,967	37		
Kandal	58,170	1,353	43		
Mondul Kiri	2,012	45	45		
Preah Vihear	140	3	47		
Siemreap	155,466	1,519	102	Medium	26
Phnom Penh	1,955	17	115		
Pursat	222,421	1,665	134		
Kratie	70,731	507	140		
Kampot	429,795	2,882	149		
Oddor Meanchey	7,675	51	150		
Ratanak Kiri	330	2	165		
Battambang	200,298	345	581	Large	9
Banteay Mean Chey	232,680	326	714		
Total*	1,611,623*	22,397*			62

Established based on MIME data (2011)

\*Data of Kampong Thom is excluded. Data for Koh Kong, Kampong som, and Pailin was not included in MIME data.

(iv) Sample Size.

LeBlanc (2004) provides a formula to calculate sample size as follows;

$$n^* = \left( Z_{\alpha/2} / m^* \right)^2 \hat{P}(1 - \hat{P})$$

Where:

$n^*$	Sample size required to attain the margin of error $m^*$
$Z_{\alpha/2}$	Z-value corresponding to the desired confidence level $100(1-\alpha)$
$m^*$	Desired margin of error (Precision)
$\hat{P}$	Estimate of the population proportion

When the confidence level is 95%,  $Z_{\alpha/2}$  is 1.96. Due to the status of electricity supply in Cambodia and EAEF, diesel (Technology 1) is the main source of energy used in the rice mill sector, which is assumed to be over 80% of the baseline scenario criteria in the guideline. Thus,



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0.8 can be used for  $\hat{P}$ . As a result of the calculation, the required sample size is at minimum 62 sets.

(v) Sampling Frame

Registered entrepreneurs numbering 27,407 and categorized as working in a rice mill factory, as given in a list in “Statistics of Small Industries and Handicrafts 2009-2010” (MIME). Figures for capacity for 5,010 rice mills in Kampong Thom province differed greatly from other provinces, thus were excluded from the sampling frame.

(b) Data:

(i) Field Measurements

**Table 3. Variables for field measurements**

Variables	Timing / Frequency	Note
Quantity of milled rice production	Once daily	For annual accrual
Quantity of fuel consumption	Once daily	For annual accrual
Quantity of electricity consumption	Once daily	For annual accrual

(ii) Quality Assurance/Quality Control:

Data is collected via on-site interviews with rice mill owners involving record checking. When a sample does not fulfill the minimum requirements, the sample is regarded as a non-response sample and not included in the data. Interview targets were rice mill owners, their substitutes or those familiar with rice mill operations; others were regarded as outliers. If the collected data is biased in terms of scale of rice mill compared with other surveys, a supplemental survey was required. Rice mills of too large or small scale were also regarded as outliers, as they could influence the sector status, which is defined by production volume.

(iii) Analysis

First, data collection needs to be checked for appropriacy and any outliers and non-response samples excluded. As a result of the filtering, decisions as to whether the data can be used as-is or whether an additional survey needs to be carried out. After the data is summarized on one spreadsheet, required parameters are then calculated in accordance with the relevant guideline.

(c) Implementation:

(iv) Implementation plan

The survey schedule was from February to June 2012. Skills necessary for the data collection included knowledge of the technologies described in this proposal and the rice milling process, calculation, using calculation software (Excel) and ability to speak Khmer and English. Required skills for data analysis included using calculation software (Excel) and having knowledge of the technologies described in this proposal and sampling survey.

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PROPOSED STANDARDIZED BASELINE  
(CDM-PSB) - Version 01.0



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History of the document

Version	Date	Nature of revision(s)
01.0	23 March 2012	Initial publication.
<b>Decision Class:</b> Regulatory <b>Document Type:</b> Form <b>Business Function:</b> Methodology		