資料1　標準化ベースライン（案）

* This document shall be applied to proposed standardized baseline submission form (form F-CDM-PSB) when submitting to UNFCCC CDM EB.

JAPAN NUS. Co., Ltd.

23/12/2011

Standardized Baseline for off-grid biomass electricity generation in Cambodia

I. Level of aggregation

Table 1 shows the level of aggregation for standardized baseline for off-grid biomass electricity generation in Cambodia.

Table 1: level of aggregation

Host country	Cambodia
Sector	Electricity generation in Cambodian territory that has no connection to grid systems defined by Electricity Authority of Cambodia (EAC); The Phnom Penh Grid System, The Banteay Meanchey Grid System, The Kampong Cham Grid System, The Vietnam MV Grid System, and The Thai MV Grid System.
Output	Electricity
Measure	Switch of technology with change of energy sources
Applicable technology	Electricity generation using either of the following specified biomass: woody biomass, grass, and mix of woody biomass and grass.

II. Additionality demonstration

Projects up to 5 MW: Exemption from demonstrating additionality according to “Guidelines for demonstrating additionality of microscale project activities”.

Projects more than 5 MW: Judge whether the proposed project meets simultaneously all the criteria below:

☐ Fuels and technologies are in the list:

- ✓ Fuels: woody biomass, grass, mix of woody biomass and grass
- ✓ Technologies: gas engine combustion, gas turbine combustion, direct combustion

☐ The “Investment Analysis” of the project as indicated in “Tool for the demonstration and assessment of additionality” concludes that the project is not economically or financially feasible, without the revenue from the sale of certified emission reductions (CERs).

☐ There is no national or local enforced regulation mandating use of the technologies.

☐ There is no national or local enforced regulation prohibiting use of the biomass as fuel.

☐ No EB clarification promoting its use.

III. Baseline identification

Baseline technology is electricity generation by ICE (Internal Combustion Engine) from diesel oil fuel with 200 kW capacity.

Among 85% of Cambodians who are living in rural areas, only 7.9 percent have access to grid electricity. Of the rest, 17.4 percent use lead-acid (LA) batteries, and 69.5 percent rely on kerosene for lighting (UNDP 2007). According to “Report on Power Sector for the Year 2010” by EAC, there are three distinct grid systems operating in Cambodia and two systems, one connected to the system in Thailand and the other connected to the system in Vietnam, which amount to supply with about 400,000 consumers. The rest of supply systems are isolated grid systems consisting of its own generation and supplying a small area operated by rural electricity enterprises (REEs) (EAC 2010). In rural areas of Cambodia, over 700 REEs play a dominant role in the private sector by generating electricity through diesel-powered generators (UNDP 2007). Table 2 shows distribution of capacity of electricity generator operated by licensed REEs. Capacity with less than 249 kW shares 70%. Therefore, baseline should be set under 250 kW. In accordance with rules set out in 3/CMP.1, Annex, paragraph 45, baseline shall be established in conservative manner. Since larger capacity tends to consume less fuel per unit of electricity generation, baseline is set as 200kW of diesel generator.

Table 2: Distribution of capacity of electricity generator operated by licensed REEs

Capacity (kW)	Number of licensee	Rate
20 ~ 95	34	21%
95 ~ 149	37	23%
150 ~ 249	42	26%
250 ~ 349	20	12%
350 ~ 449	14	8%

450 ~ 549	**5**	**3%**
550 ~ 649	**1**	**0.6%**
650 ~ 749	**3**	**2%**
750 ~ 849	**3**	**2%**
850 ~ 949	**1**	**0.6%**
950 ~	**3**	**2%**
Total	**163**	**100%**

Source: Report on Power Sector of the Kingdom of Cambodia 2010 Edition (EAC)

IV. Baseline emission factor

In Cambodia, a switch to electricity generation from biomass fuel technology is additional to displace diesel generation in off-grid locations with corresponding emission factor (EF) of 0.81tCO2/MWh. The specific value is derived by the steps below.

$$BE_y = EG_{BI,y} \times EF_{CO2,BL,y}$$

Where:

BE_y	=	Baseline emissions in year y (tCO_2)
$EG_{BI,y}$	=	Quantity of net electricity generated as a result of the implementation of the CDM project activity in year y (MWh)
$EF_{CO2,BL,y}$	=	baseline CO_2 emission factor in year y (tCO_2/MWh)

In order to obtain an accurate estimation for $EF_{CO2,BL,y}$, it is divided into several factors so as to take advantage of the available well-established data.

$$EF_{CO2,BL,y} = FC_{BL,y} \times DST_{DO} \times E\_INT_{DO} \times C\_INT_{DO} \times CF$$

In this baseline, the specific value for each parameter is determined as follows with the sources indicated.

$FC_{BL,y}$ = 0.3 (L/kWh) Sustainable Rural Electrification Plans for Cambodia: National level plans

DST_{DO} = 0.847 (kg/L) EIA Documentation for Emissions of GHG in the USA 2006

E_DST_{DO} = 0.043 (GJ/kg) 2006 IPCC Guidelines for National Greenhouse Gas Inventories

C_DST_{DO} = 20.2 (kg/GJ) 2006 IPCC Guidelines for National Greenhouse Gas Inventories

CF = 44/12 Ratio of molecular weight CO_2 (44) to the molecular weight Carbon 12

The baseline emission factor is derived from data by MIME (MIME 2011). To confirm the validity of the data applied for developing baseline emission factor ($0.8tCO_2/MWh$), survey on REEs was conducted (Table 3). The result of the data relies on primary data from the field interview with REEs and secondary data from Electricite du Cambodge (EDC) and EAC. The result explains the data employed for developing emission factor of diesel (0.3L/kWh) is conservative. DNA shall check the validity of emission factor every three years.

Table 3: Situation of rural electricity enterprises

	Province	Fuel Type	Capacity (kW)	Electric Generated/ month (kWh)	Fuel Consumption /month (Liter)	Liter/kWh
1	Siem Reap	LFO	3,500	38,380	10,330	0.27
2	Siem Reap	HFO		93,390	22,560	0.24
3	Sihanouk ville	LFO	2,800	1,900	510	0.27
4	Sihanouk ville	HFO		568,118	146,745	0.26
5	Kampong Cham	DO	12	600	300	0.50
6	Kampong Cham	DO	35	1,700	600	0.35
7	Takeo	LFO	520	2,983	859	0.29
8	Battambang	LFO	800	1264	311	0.25
9	Battambang	LFO	800	1,075	288	0.27
10	Battambang	DO	60	13,800	7,070	0.51
11	Battambang	DO	3,080	68,774	19,594	0.28
12	Kampot	LFO	1,540	36,812	10,487	0.28
13	Prey Veng	DO	410	30,000	8,700	0.29
14	Prey Veng	LFO	820	36,838	10,678	0.29
15	Svay Rieng	LFO	800	13,952	4,326	0.31
16	Banteay eanchey	LFO	1540	5,923	1,684	0.28
17	Stung Treng	LFO	820	7,742	2,206	0.29
18	Mondul kiri	LFO	300	6,396	3,398	0.53
19	Preah Vihear	DO	20	1,000	600	0.60
20	Kampong hhnang	Gasoline	2	198	90	0.45
21	Kampong Chhnang	Gasoline	6	882	600	0.68
22	Kampong Chhnang	DO	4	551	275	0.50
23	Kampong Chhnang	DO	4	331	300	0.91
24	Kampong Chhnang	DO	6	529	300	0.57
25	Kampong Chhnang	DO	6	353	300	0.85
26	Kampong Chhnang	DO	5	430	300	0.70
27	Kampong Chhnang	DO	6	353	300	0.85
28	Kampong Chhnang	DO	5	463	300	0.65
29	Kampong Chhnang	DO	6	529	300	0.57

30	Kampong Chhnang	DO	4	7	3	0.41
31	Kampong Chhnang	DO	3	23	19	0.82
32	Kampong Chhnang	DO	18	159	130	0.82
33	Kampong Chhnang	DO	2	20	13	0.66
34	Kampong Chhnang	DO	6	706	300	0.43
35	Kampong Chhnang	DO	2	18	8	0.45
36	Kampong Chhnang	DO	18	4,410	2,540	0.58
37	Kampong Chhnang	DO	13	3,969	1,800	0.45
38	Kampong Chhnang	DO	6	353	300	0.85
39	Kampong Chhnang	DO	13	794	600	0.76
40	Kampong Chhnang	DO	12	706	300	0.43
41	Kampong Chhnang	DO	12	235	100	0.43
42	Kampong Chhnang	DO	12	353	150	0.43
43	Kampong Chhnang	DO	2	198	130	0.66
44	Kampong Chhnang	DO	2	198	130	0.66
45	Kampong Chhnang	DO	12	1,058	450	0.43
46	Kampong Chhnang	DO	26	5,402	2,100	0.39
47	Kampong Chhnang	DO	18	3,704	3,000	0.81
48	Kampong Chhnang	DO	9	827	300	0.36
49	Kampong Chhnang	DO	33	10,915	6,000	0.55
50	Kampong Chhnang	DO	6	529	450	0.85

References:

UNDP (2007) Energy and Poverty in Cambodia, Challenges and the Way Forward

World Bank (2006) Cambodia Energy Sector Strategy Review Issues paper

Electricity Authority of Cambodia (2010) Report on Power Sector of the Kingdom of Cambodia 2010 Edition

Ministry of Industry, Mines and Energy (MIME) (2011) SREP: Sustainable Rural Electrification Plans for Cambodia: National level plans

IPCC (2006) 2006 IPCC Guidelines for National Greenhouse Gas Inventories

資料２　ステークホルダーインタビュー用紙

Questionnaire for Stakeholders of Preah Vihear Eco-Village Biomass Power Plant

Section 1 Respondent basic information

1. Age
☐Below 20 ☐20-40 ☐41-60 ☐above 61
2. Gender
☐Female ☐Male
3. Occupation/Means of livelihood: _____

4. Number of family members living with you: _____

Section 2 Respondent's opinion toward electricity

1. Are you using electricity now?
☐Yes ☐No
2. Do you think electricity is useful for your life?
☐Yes ☐No
3. What benefits do you think electricity can bring?
_____
4. Are you willing to pay for the use of electricity?
☐Yes ☐No

Section 3 Respondent's attitude toward the proposed project

1. What benefits, besides providing electricity, do you think the proposed project would bring? (Multiple options)
☐Employment ☐Biomass collection and supply business
☐Others: _____

2. What concerns do you have over the proposed project? (Multiple options)
☐Pollution and operation safety
☐Additional financial burden on residents due to the proposed project
☐High price of electricity
☐Others: _____

資料３　新規方法論

NM0xxx Version ## (to be completed by UNFCCC)

CLEAN DEVELOPMENT MECHANISM
PROPOSED NEW BASELINE AND MONITORING METHODOLOGIES
(CDM-NM)
(Version 03.1)

CONTENTS

Section A. Recommendation by the Methodological Panel (to be completed by the Meth Panel)

Section B. Summary and applicability of the baseline and monitoring methodology

Section C. Proposed new baseline and monitoring methodology

Section D. Explanations / justifications to the proposed new baseline and monitoring methodology

Section A. Recommendation by the Methodological Panel (to be completed by the Meth Panel)

Recommendation (preliminary or final / approval or rejection / consolidation)

>>

2. Major changes required

>>

3. Minor changes required

>>

Section B. Summary and applicability of the baseline and monitoring methodology

1. Methodology title (for baseline and monitoring), submission date and version number

>>Electricity generation using biomass from dedicated plantation in isolated grids in Cambodia

2. If this methodology is based on a previous submission or an approved methodology, please state the reference numbers (NMXXXX/AMXXXX/ACMXXXX) here. Explain briefly the main differences and their rationale.

>>AM0042, AM00XX (Meth Panel Meeting 51, Annex 6)

3. Summary description of the methodology, including major baseline and monitoring methodological steps

This methodology is developed based on AM0042 and AM00XX that is developed under Meth Panel for using proposed standardized baseline. According to the "Report on Power Sector for the Year 2010" by EAC (Electricite de Cambodia), there are three distinct grid systems operating in Cambodia and two grid systems from neighbouring countries, one connected to the system in Thailand and the other connected to the system in Vietnam, which supply to about 400,000 consumers with electricity. The rest of electricity supply systems are isolated grid systems consisting of its own generators and distribution lines. They are operated by rural electricity enterprises (REEs) and supply electricity to only a small area (EAC 2010). In rural areas of Cambodia, more than 700 REEs play a dominant role for electricity supply in the private sector by generating electricity through diesel generators (UNDP 2007). Therefore, baseline should be set under 200KW. Since a generator with larger installed capacity tends to consume less fuel per unit of electricity generation, baseline is set as 200KW of diesel generator.

Section C. Proposed new baseline and monitoring methodology

Draft baseline and monitoring methodology AMXXXX

"Electricity generation using biomass from dedicated plantation in isolated grids in Cambodia"

I. SOURCE, DEFINITIONS AND APPLICABILITY

Sources

This consolidated baseline and monitoring methodology is based on the following approved baseline and monitoring methodologies and proposed new methodologies:

- AM0042 "Grid-connected electricity generation using biomass from newly developed dedicated plantations";
- AM00XX "Renewable energy power generation in isolated grids" prepared by UNFCCC Meth Panel.

This methodology also refers to the latest approved versions of the following tools (please delete those not applicable):

- Proposed standardized baseline "Standardized baseline for off-grid biomass electricity generation in Cambodia".

Selected approach from paragraph 48 of the CDM modalities and procedures

"Existing actual or historical emissions, as applicable"

Definitions: Please provide definitions of key terms that are used in this proposed new methodology

For the purpose of this methodology, the following definitions apply:

- **Biomass.** Biomass is non-fossil and biodegradable organic material originating from plants, animals and microorganisms. This shall also include products, by-products, residues and waste from agriculture, forestry and related industries as well as the non-fossilized and biodegradable organic fractions of industrial and municipal wastes. Biomass also includes gases and liquids recovered from the decomposition of non-fossilized and biodegradable organic material.

- **Isolated grid.**
  (1) An isolated grid is an electrical network that is independent and is not connected to the national grid;
  (2) The electricity dispatched in an isolated grid is not managed by one grid operator;

(3) The installed capacity of the grid is less than 100 MW;
(4) The distance from the closest point of the national or main grid is at least 50 km;
(5) An isolated grid:
- Consists of predominantly diesel generators and some renewable energy generation;
- Has at least 80% of its installed capacity based on diesel generators.

- **Installed power generation capacity (or installed capacity or nameplate capacity).** The installed power generation capacity of a power unit is the capacity, expressed in Watts or one of its multiples, for which the power unit has been designed to operate at nominal conditions. The installed power generation capacity of a power plant is the sum of the installed power generation capacities of its power units.

- **Capacity addition.** An increase in the installed power generation capacity of an existing power plant through: (i) the installation of a new power plant beside the existing power plant/units, or (ii) the installation of new power units, additional to the existing power plant/units. The existing power plant/units continue to operate after the implementation of the project activity.

- **Replacement.** Investment in a new power plant or unit that replaces one or several existing unit(s) at the existing power plant. The new power plant or unit has the same or a higher power generation capacity than the plant or unit that was replaced.

Applicability conditions

This methodology is applicable under the following conditions:

- Project activities is installation of a greenfield renewable energy power plant and/or the establishment of an isolated grid and/or additions of renewable energy capacity;

- Biomass used by the project facility is not stored for more than one year;

- The dedicated plantation must be newly established as part of the project activity for the purpose of supplying biomass exclusively to the project;

- The biomass from the plantation is not chemically processed (e.g. esterification to produce biodiesel, production of alcohols from biomass, etc) prior to combustion in the project plant but it may be processed mechanically or be dried;

- The site preparation does not cause longer-term net emissions from soil carbon. Carbon stocks in soil organic matter, litter and deadwood can be expected to decrease more due to soil erosion and human intervention or increase less in the absence of the project activity;

- The land area of the dedicated plantation will be planted by direct planting and/or seeding;

- After harvest, regeneration will occur either by direct planting or natural sprouting;

- Grazing will not occur within the plantation;

- No irrigation is undertaken for the biomass plantations;

- The land area where the dedicated plantation will be established is, prior to project implementation, severely degraded and in absence of the project activity would have not been

used for any other agricultural or forestry activity. The land degradation can be demonstrated using one or more of the following indicators:

(a) Vegetation degradation, e.g.

- Crown cover of pre-existing trees has decreased in the recent past for reasons other than sustainable harvesting activities;

(b) Soil degradation, e.g.

- Soil erosion has increased in the recent past;
- Soil organic matter content has decreased in the recent past.

(c) Anthropogenic influences, e.g.

- There is a recent history of loss of soil and vegetation due to anthropogenic actions; and
- Demonstration that there exist anthropogenic actions/activities that prevent possible occurrence of natural regeneration.

Furthermore, this methodology is only applicable if the most plausible baseline scenarios meet the proposed standardized baseline "Standardized baseline for off-grid biomass electricity generation in Cambodia".

II. BASELINE METHODOLOGY PROCEDURE

Project boundary

The physical delineation of the project boundary is the physical extent of the project site, where electricity generating activity occurs and the place generates biomass resources like the geographic boundaries of the dedicated plantation. In addition, the project boundary is extended to include emissions from the biomass transportation to the power generation site.

The greenhouse gases included in or excluded from the project boundary are shown in Table 1.

Table 1: Emissions sources included in or excluded from the project boundary

Source		Gas	Included ?	Justification / Explanation
Baseline	CO2 emissions from electricity generation in 200KW diesel oil power generator (in accordance with standardized baseline)	CO_2	Yes	
		CH_4	No	Excluded for simplification. This emission source is assumed to be small
		N_2O	No	Excluded for simplification. This emission source is assumed to be small
Project activity	Off-site fossil fuel combustion for transportation of biomass to the project plant	CO_2	Yes	
		CH_4	No	Excluded for simplification. This emission source is assumed to be small
		N_2O	No	Excluded for simplification. This emission source is assumed to be small

Identification of the baseline scenario

Project participants shall apply the baseline scenario to the latest version of the "Standardized baseline for off-grid biomass electricity generation in Cambodia".

Additionality: Please describe the procedure for demonstrating additionality

This methodology uses the latest version of the "Standardized baseline for off-grid biomass electricity generation in Cambodia".

Baseline emissions

Baseline emissions are in compliance with the latest version of the "Standardized baseline for off-grid biomass electricity generation in Cambodia"; CO2 emissions from electricity generation by internal combustion engines from diesel oil fuel with 200KW capacity that are displaced due to the project activity.

Project emissions

Project emissions include only emission from fossil fuel combustion for transportation of biomass to the project plant.

"Project emissions are calculated as follows:

$$PE_y = PE_{FC,y} \quad \textbf{(1)}$$

Where:

PE_y = Project emissions in year *y* (t CO_2/yr)
$PE_{FC,y}$ = Project emissions from fossil fuel combustion in year *y* (t CO_2/yr)

Leakage

No leakage emissions are considered. The emissions potentially giving rise to leakage in the context of the projects where this methodology can apply are mainly arising from activities such as power plant construction. These emissions sources are neglected.

Emission reductions

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y \quad \textbf{(2)}$$

Where:

ER_y = Emission reductions in year *y* (t CO_2e/yr)
BE_y = Baseline emissions in year *y* (t CO_2e/yr)
PE_y = Project emissions in year *y* (t CO_2/yr)
LE_y = Leakage emissions in year *y* (t CO_2/yr)

Changes required for methodology implementation in 2nd and 3rd crediting periods

Consistent with guidance by the Executive Board, project participants shall check the relevant EB updates with regard to the status of the Standardized Baseline and, if it is still valid, apply the latest-updated version.

The following data, used in Standardized Baseline calculation, shall be updated at the renewal of the crediting period, based on any future revision or amendment of the source documents such as 2006 IPCC Guideline.

Data and parameters not monitored

In addition to the parameters listed in the tables below, the provisions on data and parameters not monitored in the tools referred to in this methodology apply.

Data / parameter:	DST_{DO}
Data unit:	kg/L (In source document: API gravity)
Description:	Density of diesel fuel
Source of data:	EIA documentation for Emissions of GHG in the USA 2006, Table 6-5
Value to be applied:	0.847 (In source document: API gravity 35.5)
Any comment:	

Data / parameter:	E_INT_{DO}
Data unit:	GJ/kg
Description:	Calorific value of diesel
Source of data:	2006 IPCC Guideline, Table 1.2
Value to be applied:	0.043
Any comment:	

Data / parameter:	C_INT_{DO}
Data unit:	kg/GJ
Description:	Default Carbon Content
Source of data:	2006 IPCC Guideline Vol.2 Table 2.2
Value to be applied:	20.2
Any comment:	

III. MONITORING METHODOLOGY

All data collected as part of monitoring should be archived electronically and be kept at least for 2 years after the end of the last crediting period. 100% of the data should be monitored if not indicated otherwise in the tables below. All measurements should be conducted with calibrated measurement equipment according to relevant industry standards.

In addition, the monitoring provisions in the tools referred to in this methodology apply.

Data and parameters monitored

Data / parameter:	EG_y
Data unit:	kWh/y
Description:	Annual Net Electricity Generation
Source of data:	Project Site
Measurement procedures (if any):	Electricity Meters
Any comment:	

Data / parameter:	FC_y
Data unit:	L/kWh
Description:	Standardized Baseline Electricity Generation Fuel Consumption Rate
Source of data:	Standardized Baseline
Measurement procedures (if any):	Check the Latest Standardized Baseline Update Information
Any comment:	Standardized Baseline is expected to be updated every 3 years.

IV. REFERENCES AND ANY OTHER INFORMATION

Section D. Explanations / justifications to the proposed new baseline and monitoring methodology

Selected approach from paragraph 48 of the CDM modalities and procedures

Definitions

Applicability conditions

Project boundary

Identification of the baseline scenario

Additionality

Baseline emissions

Project emissions

Leakage

Emission reductions

Changes required for methodology implementation in 2nd and 3rd crediting periods

Monitoring methodology, including data and parameters not monitored

- - - - -

History of the document

Version	Date	Nature of revision(s)
1	11 Jan 2012	• Initial adoption