CLEAN DEVELOPMENT MECHANISM
SMALL-SCALE PROGRAMME OF ACTIVITIES DESIGN DOCUMENT FORM
(CDM-SSC-PoA-DD) Version 01

CONTENTS

Annexes

NOTE:

(i) This form is for the submission of a CDM PoA whose CPAs apply a small-scale approved methodology.

(ii) At the time of requesting registration this form must be accompanied by a CDM-SSC-CPA-DD form that has been specified for the proposed PoA, as well as by one completed CDM-SSC-CPA-DD (using a real case).

SECTION A. General description of small-scale programme of activities (PoA)

A.1 Title of the small-scale programme of activities (PoA):

"Programmatic CDM of Industrial Thermal Energy Generation by Indigenous Renewable Fuel Wood in Sri Lanka"

Version 1
7th January 2011

A.2. Description of the small-scale programme of activities (PoA):

The "Programmatic CDM of Industrial Thermal Energy Generation by Indigenous Renewable Fuel Wood in Sri Lanka" (hereafter, "PoA") is designed to generate renewable energy using locally available biomass resources that are not currently utilized and mostly left to decay in farm lands or fields and to replace industrial heat generated by fossil fuels. The main biomass resource to be used is fast growing tree called Gliricidia (*Gliricidia Sepium*) which is one of the major short rotation crops[1] in Sri Lanka. The assumed capacity of heat generation facilities to be installed by the CDM Program Activities (hereafter, "CPAs") under this PoA is less than or equal to $45MW_{th}$. There are approximately 2,000 existing facilities which are identified in Sri Lanka as potential sites where renewable energy generation facilities are to be installed under this PoA.

1. General operating and implementing framework of PoA

The coordinating/managing entity (hereafter, "C/ME") of this Project is the Bio Energy Association of Sri Lanka (hereafter, "BEASL"), which is a non-government organization promoting the use of indigenous resources for renewable energy generation to reduce the increasing dependence on imported fossil fuels throughout Sri Lanka. This PoA is a voluntary project implemented by the BEASL.

There are two cases where companies using traditional fossil fuel become the participants of CPAs under this PoA. The first case is where a current fossil fuel user owns a biomass based renewable energy generating facility and the second case is where a current fossil fuel user purchases thermal energy from a new biomass based heat supplying company. In both cases owners of biomass energy generating facilities are the owners of CPAs. EX Research Institute for Environment and Urban Planning (Japan), as a CDM consultant will provide technical support to BEASL for taking the role of the C/ME.

2. Policy/measure or stated goal of the PoA

The goal of the PoA is to "co-benefit" both the global environmental aim to reduce greenhouse gas (hereafter, "GHG") emissions, as well as the local socio-economic needs through implementation of renewable biomass thermal energy generation. By promoting the replacement of industrial thermal energy generated from fossil fuel combustion with renewable energy under this PoA, the project activities will contribute to reduce the dependence on (imported) fossil fuels in Sri Lanka and to generate additional income for the local farmers helping to enhance their quality of life.

[1] "Short Rotation Crops" means woody crops such as willows, poplars, Robinia and Eucalyptus with coppicing abilities (International Energy Agency: http://www.shortrotationcrops.org/)

In Sri Lanka, where agriculture plays a dominant role in its economy, biomass energy has been a major source of industrial thermal energy. However, areas where biomass is located are different from areas with energy demand. This hinders the sustainable supply of the biomass resources. For industries located in remote areas (in terms of biomass generating areas) or those not familiar with handling biomass resources, the usage of biomass resources is a risky option. For these industries, additional work that is required for handling biomass resources is regarded as an unnecessary burden and a big risk that may affect the stable operation of their core business. Therefore, biomass resources utilization has not materialized for these industries.

3. Confirmation that the proposed PoA is a voluntary action by the C/ME.

The implementation of renewable energy generation projects under this PoA is a voluntary action that is not required by law in Sri Lanka. There are some policies and incentives announced by the Government as follows:

The Ministry of Power and Energy declared the policy to promote indigenous energy resources including the following components in the National Energy Policy and Strategies of Sri Lanka (October, 2006):

- The use of economically viable, environment friendly, non-conventional renewable energy resources
- Encouragement and promotion of initiatives of related sectors and institutions to enhance biomass supplies, convert biomass

However neither the National Government nor the Provincial Governments mandate any quantitative targets for the installation of renewable energy generation facilities under this Act.

4. Contribution to Sustainable Development

The Project is designed to "co-benefit" both the global environmental aim of reduction of GHG emissions, as well as the mitigation of local environmental problems including air pollution. Promoting the implementation of this Project will contribute to sustainable development in Sri Lanka by bringing about the following economic, social and environmental benefits:

Economic/Social Benefits

- Enhancement of energy security of Sri Lanka (Sustainable alternative energy source development): The domestic energy demand in Sri Lanka is on the rise following economic development. Hydroelectricity, which used to be the main source of energy, has peaked and the country is relying more on the import of fossil fuel. With the increase in the price of fossil fuel, the country is facing a major drain of foreign currency. According to an estimate by BEASL, the domestic energy supply potential from Gliricidia, which is a sustainable indigenous biomass resource, is 4,000 MW. If it is assumed that 50% of the energy demand of the country is supplied from Gliricidia, then it is expected to result in a saving of LKR 600 million/y worth of foreign currency. This saving can contribute to the socioeconomic development of agricultural communities throughout Sri Lanka.
- Enhancement of rural economy: In the remote areas of Sri Lanka where the low income population is concentrated, apart from the income from the cultivation and usage of Gliricidia wood, the economic impacts on rural economy (such as soil enhancement, replacement of chemical fertilizer by leaves as a by-product) are expected to be significant. This can contribute to tackle the problem of poverty in the rural area.

- Investments from foreign countries to the local economy: Investment from foreign countries such as Japan will be expected for the implementation of the Project.
- Creation of job opportunities: Through implementation of this CPA, new jobs will be created in operation and maintenance of the gasifier facility and also in the area of handling biomass resources (collection and transportation).

Environmental Benefits

- Reduction of GHGs
- Emissions Reduction of air pollutants (SOx, Nox): SOx, NOx emission will be reduced through the replacement of conventional fossil fuel based thermal energy with biomass based energy. Especially where fuel oil is used, a lot of air pollutants are currently emitted to the air.

A.3. Coordinating/managing entity and participants of SSC-POA:

1. C/ME of the PoA as the entity which communicates with the Board

   Bio Energy Association of Sri Lanka (BEASL)

2. Project participants being registered in relation to the PoA

Table 1. Project Participants

Name of Party Involved (*) ((host) indicates a host party)	Private and/or public entity(ies) project participants (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Government of Sri Lanka	BEASL	No
Government of Japan	EX Research Institute for Environment and Urban Planning	No

A.4. Technical description of the small-scale programme of activities:

A.4.1. Location of the programme of activities:

A.4.1.1. Host Party(ies):

Democratic Socialist Republic of Sri Lanka (Sri Lanka)

A.4.1.2. Physical/ Geographical boundary:

The boundary of the PoA is defined within Sri Lanka, which is an island country in South Asia located to the south of India. Its total land area is 65,607 km^2 with Sri Jayawardenepura Kotte as its capital. Sri Lanka is divided into 9 provinces and 25 districts. Each province is administered by a directly elected provincial council.

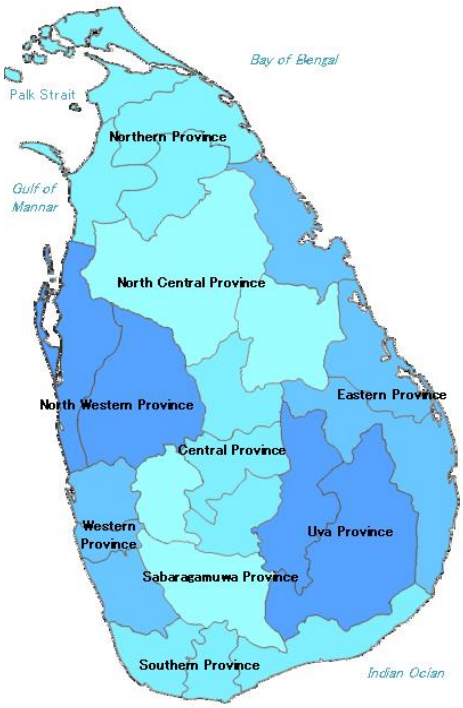

Figure 1. Map of Sri Lanka

A.4.2. Description of a typical small-scale CDM programme activity (CPA):

A.4.2.1. Technology or measures to be employed by the SSC-CPA:

Technology applied in the CPAs under this PoA is gasification technology to generate thermal energy from biomass resources for replacing industrial fossil fuel based thermal energy. Biomass co-generation system applying gasifier is also included under this PoA.

As described below in A.4.2.2, the maximum thermal energy generation volume is less than or equal to $45MW_{th}$.

Gasification is a technology to convert biomass fuel to a synthetic gas containing mainly carbon monoxide and hydrogen. This gas is also called Producer Gas, Town Gas and Wood Gas. Gaseous fuels are preferred to solid fuels due to its ease in handling and controlling flow and also better combustion performance. Biomass gasification is a globally accepted technology and a locally established technology for generation of thermal energy.

Figure 2 shows the diagram of the only gasification system installed for thermal purpose in Sri Lanka which is based on Indian technology and converted by EnerFab (Pvt) Ltd,. Currently 7 gasifier facilities are in operation mostly under the financial assistance of foreign governments. This system is composed of a flue gas treatment apparatus connected to a down-draft type gasification furnace. The down-draft type gasification furnace can control the amount of tar produced and can contribute to the alleviation of environmental load. The flue gas treatment apparatus consists of cyclone and scrubber and has the capability to extract dust etc from the flue gas. The system is controlled by using gas flow rate and furnace temperature as controlling parameters.

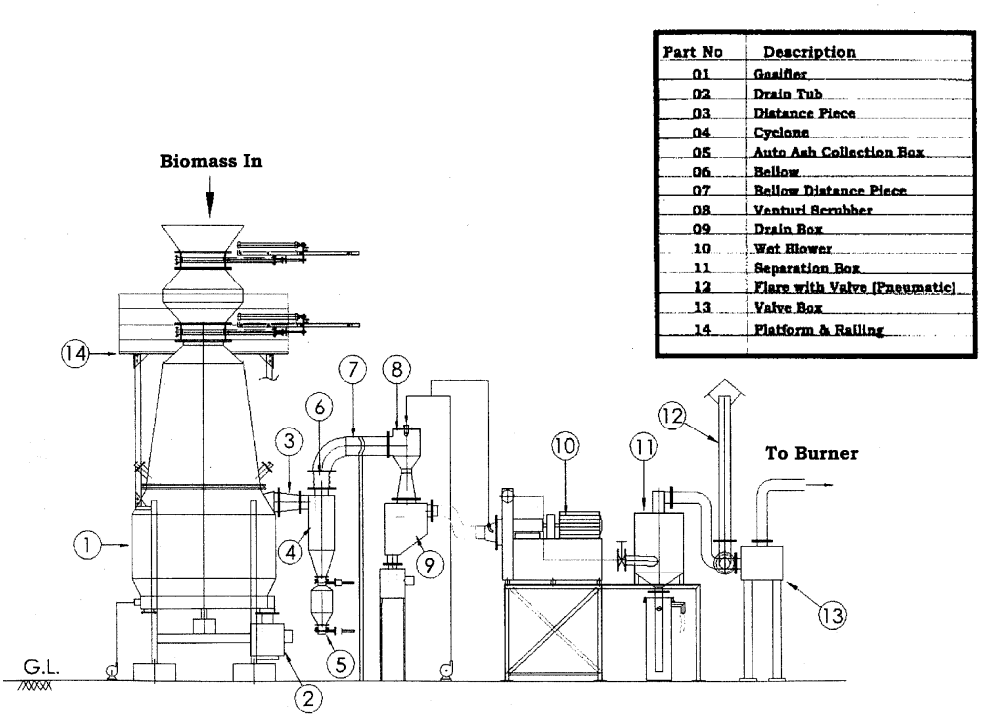

Figure2. An Example of Gasification System

A.4.2.2. Eligibility criteria for inclusion of a SSC-CPA in the PoA:

The Project defines the following criteria for inclusion of a project activity as a CPA under the PoA.

(1) Generic Eligibility Criteria

a) Located within Sri Lanka
b) A project to implement baseline and monitoring methodology AMS-I.C. "Thermal energy production with or without electricity (Version 18)"
c) A project to generate thermal energy from renewable biomass resources which replaces fossil fuel origin industrial thermal energy
d) The technology to be applied is gasification technology
e) The maximum thermal energy generation volume is less than or equal to 45MWth
f) Monitors and collects appropriate data on the parameters listed in A.4.4.2
g) When selling energy produced from biomass fuel to other businesses within the project boundary, an understanding should be reached between the supplier and the buyer that only the entity producing energy is entitled to the emission credits.In case electricity and/or steam/heat produced by the project activity is delivered to another facility or facilities within the project boundary, a contract between the supplier and consumer(s) of the energy will have to be entered into specifying that only the facility generating the energy can claim emission reductions from the energy displaced.
h) No CDM project or CPA should be registered within the project area of the same physical area.
i) The project must be approved by the C/ME prior to its incorporation into the PoA.
j) Biomass resources used by a project activity are biomass residues only or biomass from dedicated plantations complying with the applicability conditions of AM0042 "Grid-connected electricity generation using biomass from newly developed dedicated plantations".

k) Biomass used by the project facility is not stored for more than one year

(2) Eligibility criteria for new biomass cultivation

If the biomass resources used by a project activity is biomass from dedicated plantation, the following criteria must be satisfied

a) When CPAs use biomass fuel procured from newly cultivated land, CPAs need a written clarification between the cultivator and C/ME describing that the biomass resources are procured from the cultivation land which was developed for supplying biomass fuel to CPA(s) implemented under the PoA. The clarification must be done prior to the CPA being incorporated into the PoA

b) The land area where the dedicated plantation will be established, prior to project implementation, is 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 (unutilized area within coconut plantation is included in the criteria).

i) Vegetation degradation, e.g.,

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

ii) Soil degradation, e.g.,

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

iii) 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.

c) Any national or regional forestry, agriculture and nature conservation regulations are complied with,

d) The dedicated plantation will be planted by direct planting and/or seeding,

e) The biomass to be used in this project are to be short rotation crops[2] that naturally regenerate in a short time after harvesting,

f) Grazing will not occur within the plantation, and

g) No irrigation is carried out for the biomass plantations.

A.4.3. Description of how the anthropogenic emissions of GHG by sources are reduced by a SSC-CPA below those that would have occurred in the absence of the registered PoA (assessment and demonstration of additionality):

The proposed PoA is a voluntary coordinated action as explained in A.2 (section 3).
The Government of Sri Lanka has been promoting alternative energy development mainly for:

- Enhancing national energy security by reduction of dependence on the imported fossil fuels, and

[2] "Short Rotation Crops" means woody crops such as willows, poplars, Robinia and Eucalyptus with coppicing abilities(International Energy Agency: http://www.shortrotationcrops.org/)

- Enhancing rural economy by utilizing and creating market for the indigenous biomass resources that have not been effectively utilized.

The Government has set a target to increase the renewable component in the grid electricity. However, no target has been set on industrial thermal energy utilization. In this policy, significant focus is placed on the promotion of biomass resources with especially emphasis on plants called *Gliricidia speium,* which is a fast growing legume crop widely naturalized in the tropical areas all over the world including Sri Lanka. It was decided by the Cabinet in 2005 to promote the production and utilization of *Gliricidia speium* in the country as its contribution for sustainable development in the country is very significant.

As a result of the renewable energy policies mentioned above and other existing policies, a number of facilities utilizing biomass for fuel are in operation today in Sri Lanka. These facilities are utilizing biomass either in cases where the market for the biomass is already established or in cases where the demand can be satisfied from surrounding areas because of its small quantity of requirement and hence there are no issues regarding procurement of biomass. Efforts to utilize biomass fuel including Gliricidia are very limited and extremely rare especially in large industries due to the barriers indicated in E.5.1. However, the biggest obstacle is uncertainties in stable material procurement which can have an adverse impact on the core business of the company utilizing these materials. In Sri Lanka, supply areas of Gliricidia are dispersed all over the country, which further adds to other barriers mentioned above. Furthermore, legislations in Sri Lanka do not mandate production of renewable energy by biomass resources therefore providing no legal incentives to overcome the economic and technological challenges that are present. Due to these reasons, renewable thermal energy generation by utilizing biomass resources is unlikely to occur in the absence of a registered PoA.

A.4.4. Operational, management and monitoring plan for the programme of activities(PoA):

A.4.4.1. Operational and management plan:

The following operational and management arrangements will be implemented by the C/ME for the implementation of the PoA:

Table 2. Operational and Management Items and Responsible Entities

No	Item	Responsible entity	Remarks
1	Operation of the facilities	CPA	· C/ME will provide technical support
2	Maintenance of Equipments	CPA	· C/ME will provide technical support
3	Monitoring	CPA, C/ME (As described in Table3)	· C/ME will provide technical support
4	Data record	CPA, C/ME	· CPA and C/ME will record the necessary monitoring items specified in the monitoring plan
5	Data archive	C/ME	· All data is stored digitally and kept by record keeping system.
6	Identification of each CPA	C/ME	· Identification number is issued for each CPA. · In order to avoid double-counting and manipulation each CPA will be identical based on: a) the issued number b) CPA name, and c) geographic data.

(i) A record keeping system for each CPA under PoA

Regular monitoring and recording of specific parameters are carried out by an operating partner or an owner of the factory where emission reduction is in place. Data will be recorded digitally. The BEASL is responsible for collecting, storing and analyzing data from all CPAs where they will closely monitor the progress of each CPAs as well as provide necessary assistance.

All the data will be digitally recorded and properly managed under the Record keeping system to ensure double-counting and manipulation does not occur. The system keeps all the monitoring data described in A.4.4.2 and the project proponents have access to the data of their facility for their reference.

The following figure describes the general layout of the record keeping system.

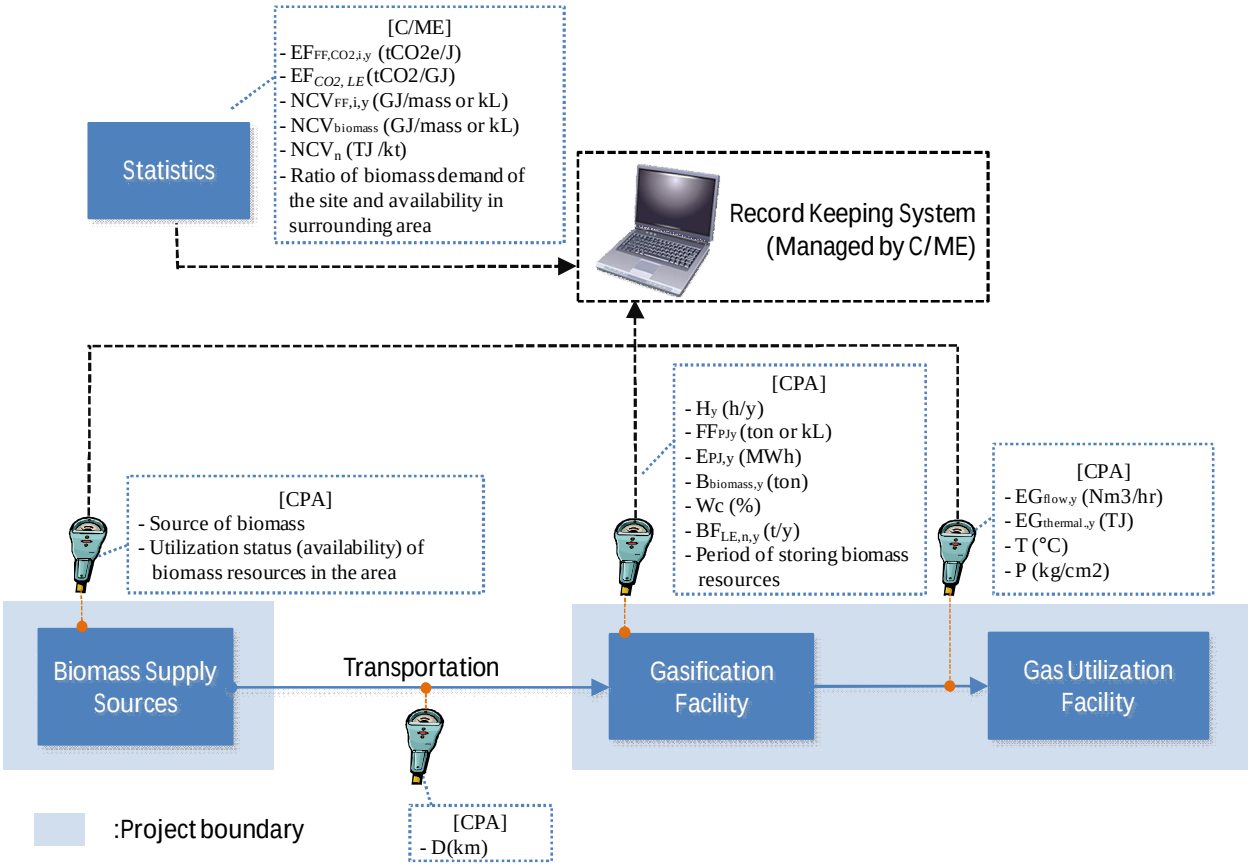

Figure3. Layout of Record Keeping System

(ii) A system/procedure to avoid double counting

An identification system is implemented under the management of BEASL who will be responsible for keeping all the data including monitoring data of each CPA. These CPA identification numbers are managed by the BEASL to prevent double counting.

(iii) Verification that SSC-CPA is not a debundled component of another CPA

Appendix 13 of EB 54 report "Guidelines on Assessment on Debundling for SSC Project Activities" defines that a registered SSC-CPA shall be deemed to be a debundled component of a large project activity if there is already an activity, which satisfies both conditions (a) and (b) below:

(a) Has the same activity implementer as the proposed small scale CPA or has a C/ME, which also manages a large scale PoA of the same technology/measure, and;
(b) The boundary is within 1 km of the project boundary of the proposed small-scale CPA, at the closest point.

If the CPA is managed by project participants that are only taking part in one CPA, it can be inferred that the CPA does not have the same project participants with any other CPAs (first criteria), thus verifying that the CPA is not a debundled component of another CPA.

If the CPA is managed by project participants that are taking part in more than one CPAs, the CPA will verify within their CDM-SSC-CPA-DD that one or more of the above criteria for debundling are not met.

Finally, if the CPA meets all four of the criteria for debundling, it will indicate within their CDM-SSC-CPA-DD that the small-scale project activity "Renewable energy project activities with a maximum output capacity equivalent to up to 15 Megawatts (or an appropriate equivalent[3])" as stated in paragraph 6 (c) of the decision 17/CP.7. This is in concurrence with Appendix C of the Simplified Modalities and Procedures for Small-Scale CDM project activities, which states that, "if a proposed small-scale project activity is deemed to be a debundled component, but the total size of such an activity combined with the previous registered small-scale CDM project activity does not exceed the limits for small-scale CDM project activities as set in paragraph 6 (c) of the decision 17/CP.7, the project activity can qualify to use simplified modalities and procedures for small-scale CDM project activities."

(iv) Assurance that CPA operations/operators are being subscribed to the PoA
All CPA operations/operators will be assured to be subscribed to the PoA and the subscribed electric data will be managed by BEASL.

A.4.4.2. Monitoring plan:

The following parameters are monitored to verify the amount of reduction of anthropogenic emissions of GHGs due to CPAs under the PoA.

Table 3. Monitored Parameters

No	Monitoring Item	Parameter	Unit	Monitoring Body
1	Continuous operation of the equipment/ system	H_y	-	CPA
2	CO2 emission factor of fossil fuel type i	$EF_{FF,CO2,i,y}$	tCO2e/GJ	C/ME
3	Quantity of hot air or steam	$EG_{flow,y}$	Nm^3 /hr	CPA
4	Net quantity of thermal energy supplied by the project activity during the year y	$EG_{thermal,y}$	GJ	CPA
5	Quantity of fossil fuel type i combusted in year y (if applicable)	$FF_{PJ,i,y}$	Mass or volume unit	CPA
6	Quantity of electricity consumed in year y	E_{PJy}	MWh	CPA
7	Net quantity of biomass consumed in year y (type wise)	$B_{biomass,PJ,y}$	Ton	CPA
8	Moisture content of the biomass residues	Wc	% water	CPA
9	Temperature (energy production temperature)	T	° C	CPA
10	Pressure	P	kg/cm^2	CPA

[3] $45MW_{th}$ for thermal energy project.

11	Net calorific value of fossil fuel type i	$NCV_{FF,i,y}$	GJ/mass or volume unit	C/ME
12	Net calorific value of biomass residue type k	$NCV_{biomass}$	GJ/mass or volume unit	CPA
13	Distance of biomass transportation	D	km	CPA
14	Ratio of required amount of biomass type i by the project site to the amount of biomass of the same kind in the boundary of procurement	-	-	C/ME
15	Source of biomass resources	-	-	CPA
16	Duration of storing biomass resources (not exceeding 1 year)	-	-	CPA
17	Utilization status (availability) of biomass resources in the area	-	-	CPA
18	CO2 emission factor of the most carbon intensive fuel used in the country	$EF_{CO2,LE}$	tCO2/GJ	C/ME
19	Quantity of biomass residue type *n* used for heat generation as a result of the project activity during the year *y* and for which leakage cannot be ruled out using one of the approaches L1, L2, L3 or L4	$BF_{LE,n,y}$	t/y	CPA
20	Net calorific value of the biomass residue type *n*	NCV_n	GJ /t	C/ME

The overview of the data recording system is described in A.4.4.1. The managing entity, in this case the BEASL, will closely manage the collected data regarding the above parameters. Monitoring will be done by an operating partner or an owner of the factory where emission reduction is in place. In addition, the C/ME will assist the monitoring process at the CPA level by distributing monitoring manuals and necessary forms for data recording to CPAs, as well as making regular site visits to provide any necessary assistance and advice to the CPAs to solve any issues.

BEASL will manage all the data in digital format, which will assure transparency through enabling easy access to the status of CPAs at anytime, as well as preventing double counting.

Further information on the monitoring items will be described in Section E.

A.4.5. Public funding of the programme of activities (PoA):

No public funding is involved in this PoA and related CPAs and also this PoA does not include any diversion of ODA funds.

SECTION B. Duration of the programme of activities (PoA)

B.1. Starting date of the programme of activities (PoA):

1st of May 2011

B.2. Length of the programme of activities (PoA):

28 years

SECTION C. Environmental Analysis

C.1. Please indicate the level at which environmental analysis as per requirements of the CDM modalities and procedures is undertaken. Justify the choice of level at which the environmental analysis is undertaken:

1. Environmental Analysis is done at PoA level ☒
2. Environmental Analysis is done at SSC-CPA level ☒

The level of conducting environmental analysis is determined as shown in Table 4. The justification is described in C.3.

Table 4. The level of Conducting Environmental Analysis

Item to be analysed	PoA level	CPA level
a) Procurement of biomass resources		✓ (analysis is required when new cultivation is involved)
b) Utilization of biomass resources (new thermal energy generation facility)	✓	

C.2. Documentation on the analysis of the environmental impacts, including transboundary impacts:

The environmental impacts of the biomass thermal energy generation facilities are expected to be very small because of the following reasons:

- CPAs under this PoA are not subject to the EIA under the regulations set forth by the Central Environmental Authority.
- The PoA installs biomass energy generating facilities in most cases within the compound of the existing factory only. Therefore it will not cause any additional destruction of forests, watersheds and other natural resources that have high ecosystem values and services.
- Through the replacement of the fossil fuel originated energy by biomass originated thermal energy, there are positive environmental effects, while there are no known negative effects to the environment (air pollutants will be reduced by the implementation of the project activity).

Furthermore, there are no transboundary environmental impacts predicted to be caused by the implementation of the biomass utilization facilities because the technology to be used in this project, as compared to the currently used fossil fuel, can efficiently decrease the emission of NOx, SOx and dust and does not lead to an increase in the emission of atmospheric pollutants. Therefore, there are no transboundary impacts expected from this Project.

Biomass will also be monitored in an adequate manner to ensure that they are renewable biomass.

C.3. Please state whether in accordance with the host Party laws/regulations, an environmental impact assessment is required for a typical CPA, included in the programme of activities (PoA),:

In Sri Lanka, projects that require Environmental Impact Assessment (EIA) are composed of 31 items and listed in the Gazette on 772/22 of 24th June, 1993 and 859/14 of 23rd February 1995. Regarding the EIA for this project, it is necessary to determine the need of EIA for both of a) Procurement of biomass resources and b) Utilization of biomass resources (building and operating biomass based thermal energy generating facilities).

a) Procurement of biomass resources

Regarding the procurement of biomass resources, this project will require EIA when using biomass from new plantations under the following conditions:

[Project items for EIA]

- Reclamation of Land, wetland area exceeding 4 hectares. (No.2)
- Extraction of timber covering land area exceeding 5 hectares. (No.3)
- Conversion of forests covering an area exceeding 1 hectare into non-forest uses. (No.4)
- Clearing of land areas exceeding 50 hectares. (No.5)

b) Utilization of biomass resources (building and operating biomass based thermal energy generating facilities)

All the CPAs under this PoA are projects that replace heat source and these projects are exempt from the list of projects requiring EIA in Sri Lanka (Gazette Extraordinary No. 722/22 of June 24, 1993)[4]. This project is excluded from the EIA requirements of the Host Country and EIA at the CPA level is not required. EIA for the construction and operation of the biomass based thermal energy generating facilities will be carried out at the PoA level.

SECTION D. Stakeholders' comments

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D.1. Please indicate the level at which local stakeholder comments are invited. Justify the choice:

1. Local stakeholder consultation is done at PoA level ☒
2. Local stakeholder consultation is done at SSC-CPA level ☒

Prior to the implementation of this Project, interviews were held for the purpose of explaining the objectives, processes, implications and benefits for sustainable development of the PoA to relevant stakeholders, including the representatives from the National Agencies, Financial Institution, environmental NGOs, etc. Additional stakeholders' comments, especially at the CPA levels must be collected through interviews with local agencies and citizens who are elated to the CPAs.

D.2. Brief description on how comments by local stakeholders have been invited and compiled:

Public comments were collected through individual interviews from the following organizations during the period between August 2009 and February 2010.

[4] This fact has been confirmed during the visit to the central Environmental Authority on January 13, 2010 with Mr P.V.S Shantha (deputy commissioner) and Mr Ajith Ethugala (Senior Environmental Officer).

- National Agencies:
  - Ministry of Environment and Natural Resources, Climate Change Division [Designated National Authority, DNA]
  - Ministry of Science and Technology, Alternative Energy Authority
  - Ministry of Power and Energy, Sustainable Energy Authority
  - Ministry of Finance and Planning, Department of Public Enterprises
- Environmental NGO:
  - BEASL
  - Mahatma Gandhi Centre
  - University of Peradeniya
- Financial Institution:
  - National Development Bank

In addition, public comments were also collected during a public seminar on 23 February 2010 organized by BEASL together with EX Research Institute for Environment and Urban Planning (Japanese CDM consultancy firm) and Mahatma Gandhi Centre (Voluntary organization for rural poverty alleviation) to explain the outline and framework of the proposed programmatic CDM.

As described in D.1., comments from responsible persons of local agencies and citizens who are directly related to the Project will be gathered at a later date through interviews at the CPA level.

D.3. Summary of the comments received:

Interviewees were generally very supportive towards the implementation of the PoA, viewing it as an opportunity for Sri Lanka to gain financial support from foreign countries such as Japan in order to shift its energy supply to renewable sources. This shift is expected to contribute to reduce dependence on imported fossil fuel, as well as to create opportunities to provide positive impacts to rural agricultural communities. Moreover, no direct objection to the implementation of the Project was expressed during or after the interviews and public comments.

D.4. Report on how due account was taken of any comments received:

All clarifications requested by local attending stakeholders were addressed during the discussion.

SECTION E Application of a baseline and monitoring methodology

E.1. Title and reference of the approved SSC baseline and monitoring methodology applied to a SSC-CPA included in the PoA:

SSC AMS-I.C. *"Thermal energy production with or without electricity (Version 18)"* was applied to the baseline and monitoring methodologies in the PoA. Methodological Tool: *"Tool to calculate the emission factor for an electricity system (Version 02)[EB35 Annex12]"* and *"Tool to calculate baseline, project and /or leakage emissions from electricity consumption [EB39 Annex18]"* were also applied to calculate project emission associated to the use of grid electricity.

In regards to calculation of leakage emission associated to biomass utilization, Approved Methodology AM0042 *"Grid-connected electricity generation using biomass from newly developed dedicated plantations (Version 02)"* and *"General guidance on leakage in biomass project activities (Attachment C to Appendix B of 4/CMP.1 Annex II)"* were referred to.

E.2. Justification of the choice of the methodology and why it is applicable to a SSC-CPA:

This PoA applies SSC AMS-I.C (ver.18). Applicability conditions of projects where this method will be applied and the suitability to the project is described in the table below.

(1) Applicability conditions for SSC AMS-I.C (ver.18)

Justifications of the choice of SSC AMS-I.C (ver.18) are described in Table 5.

Table 5. Applicability Criteria and Justification

Applicability Criteria of SSC AMS-I.C (ver.18)	Justification of Applicability
1. This category comprises renewable energy technologies that supply users[5] with thermal energy that displaces fossil fuel use. These units include technologies such as solar thermal water heaters and dryers, solar cookers, energy derived from renewable biomass and other technologies that provide thermal energy that displaces fossil fuel.	All CPAs under the PoA comprises renewable biomass energy generation facilities that supply thermal energy for industrial users. More details and elaborations regarding "renewable energy" is provided in "E.2. (3) Applicability to the definition of renewable biomass".
2. Biomass-based cogeneration systems consisting of steam generator(s) and steam turbine(s) are included in this category. For the purpose of this methodology "cogeneration" shall mean the simultaneous generation of thermal energy and electrical energy in one process. Project activities that produce heat and power in separate element processes (for example, heat from a boiler and electricity from biogas engine) do not fit under the definition of cogeneration project.	Cogeneration system included under this PoA is combination of gas engine and heat utilization facility that obtain energy from gas generated by gasifier. However, details are to be confirmed at CPA level.
3. Emission reductions from a biomass cogeneration system can accrue from one of the following activities (a) Electricity to a grid; (b) Electricity and/or thermal energy (steam or heat) for on-site consumption or for consumption by other facilities; (c) Combination of (a) and (b).	All CPAs under the PoA comprises thermal energy (steam or heat) for on-site consumption or for consumption by other facilities. In the case of co-generation, electricity can accrue from (a) electricity to a grid, or (b) electricity for on-site consumption or for consumption by other facilities.
4. The total installed/rated thermal energy generation capacity of the project equipment is equal to or less than 45 MW thermal[6].	All CPAs under the PoA will apply biomass energy generation facilities producing less than, or equal to, 45 MW of thermal

[5] E.g., residential, industrial or commercial facilities.

[6] Thermal energy generation capacity shall be manufacturers rated thermal energy output, or if that rating is not available the capacity shall be determined by taking the difference between enthalpy of total output (for example steam or hot air in kcal/kg or kcal/m3) leaving the project equipment and the total enthalpy of input (for example feed water or air in kcal/kg or kcal/m3) entering the project equipment. For boilers, condensate return (if any) must be incorporated into enthalpy of the feed.

	energy. However, details are to be confirmed at CPA level.
5. For co-fired[7] systems, the total installed thermal energy generation capacity of the project equipment, when using both fossil and renewable fuel shall not exceed 45 MW thermal	To be confirmed at CPA level.
6. The following capacity limits apply for biomass cogeneration units: (a)If the project activity includes emission reductions from both the thermal and electrical energy components, the total installed energy generation capacity (thermal and electrical) of the project equipment shall not exceed 45 MW thermal. For the purpose of calculating this capacity limit the conversion factor of 1:3 shall be used for converting electrical energy to thermal energy (i.e. for renewable project activities, the maximal limit of 15 MW(e) is equivalent to 45 MW thermal output of the equipment or the plant); (b)If the emission reductions of the cogeneration project activity are solely on account of thermal energy production (i.e. no emission reductions accrue from electricity component), the total installed thermal energy production capacity of the project equipment of the cogeneration unit shall not exceed 45 MW thermal; (c)If the emission reductions of the cogeneration project activity are solely on account of electrical energy production (i.e. no emission reductions accrue from thermal energy component), the total installed electrical energy generation capacity of the project equipment of the cogeneration unit shall not exceed 15 MW.	To be confirmed at CPA level.
7. In case electricity and/or steam/heat produced by the project activity is delivered to another facility or facilities within the project boundary, a contract between the supplier and consumer(s) of the energy will have to be entered into specifying that only the facility generating the energy can claim emission reductions from the energy displaced.	If this is the case, it will be confirmed at CPA level that a contract between the supplier and consumer(s) of the energy will be entered specifying that only the facility generating the energy can claim emission reductions from the energy displaced..
8. Project activities that seek to retrofit or modify an existing facility for renewable energy generation are included in this category	All CPAs under the PoA that will retrofit or modify existing thermal power generation facilities are applicable.
9. The capacity limits specified in the above paragraphs apply to both new facilities and retrofit projects. In the case of project activities that involve the addition of renewable energy units at an existing renewable energy facility, the total capacity of the units added by the project should comply with capacity limits in paragraphs 4 to 6 and should be physically distinct[8] from the existing units.	All CPAs under the PoA will apply the biomass energy generation facilities producing less than, or equal to, 45 MW of thermal energy

[7] Co-fired system uses both fossil and renewable fuels.

[8] Physically distinct units are those that are capable of producing thermal/electrical energy without the operation of existing units, and that do not directly affect the mechanical, thermal, or electrical characteristics of the existing facility. For example, the addition of a steam turbine to an existing combustion turbine to create a combined cycle unit would not be considered "physically distinct".

10. Charcoal based biomass energy generation project activities are eligible to apply the methodology only if the charcoal is produced from renewable biomass sources[9] provided: (a) Charcoal is produced in kilns equipped with methane recovery and destruction facility; or (b) If charcoal is produced in kilns not equipped with a methane recovery and destruction facility, methane emissions from the production of charcoal shall be considered. These emissions shall be calculated as per the procedures defined in the approved methodology AMS-III.K. Alternatively, conservative emission factor values from peer reviewed literature or from a registered CDM project activity can be used, provided that it can be demonstrated that the parameters from these are comparable e.g. source of biomass, characteristics of biomass such as moisture, carbon content, type of kiln, operating conditions such as ambient temperature.	N/A (Even in the case where charcoal that is generated as a by-product of gasification is used for switching fossil fuel, the emission reduction amount will not be included in CER calculation for the purpose of conservativeness.)
11. If solid biomass fuel (e.g. briquette) is used, it shall be demonstrated that it has been produced using solely renewable biomass and all project or leakage emissions associated with its production shall be taken into account in emissions reduction calculation.	N/A (Solid biomass fuel will not be used as fuel)

(2) Applicability conditions of AM0042 for Biomass

In SSC AMS-I.C. (Ver 18) in addition to Table 5, for biomass projects under PoA, the applicability of the methodology is limited to either project activities that use biomass residues only or biomass from dedicated plantations complying with the applicability conditions of AM0042.

Table 6. Applicability Criteria and Justification for Biomass (AM0042)

Applicability Criteria of AM0042 (Ver02)	Justification of Applicability
(1) Criteria for biomass from dedicated plantation	
The project activity involves the installation of a new grid-connected power plant that is mainly fired with renewable biomass from a dedicated plantation (fossil fuels or other types of biomass may be co-fired);	Grid connected electricity is not applicable. However, biomass resources that will be used at all the CPAs under the PoA will be renewable biomass. Additional details and elaboration is provided in "E.2.(3) Applicability to the definition of renewable biomass".
Biomass used by the project facility is not stored for more than one year	Included in the eligibility criteria of this PoA and hence will be applicable to all CPAs under the PoA.
The dedicated plantation must be newly established as part of the project activity for the purpose of supplying biomass exclusively to the project	For farms carrying out new cultivations, it is stated as a eligibility criteria for the PoA that a memorandum of understanding be signed stating that "the farms carrying out the cultivation supply the produce solely to the PoAs under the CPA" and hence all CPAs under the PoA will be applicable
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 Pre-treatment of chips to be used in this project only consist of chipping and drying without any chemical treatment. Hence this condition is applicable

[9] Refer to EB 23, Annex 18 for the definition of renewable biomass.

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	As described in "E.2. (3) Applicability to the definition of renewable biomass", biomass used by the CPAs under the PoA is applicable. (the biomass that satisfies the "definition of renewable biomass" is only eligible for being used at a CPA under the PoA)
The land area of the dedicated plantation will be planted by direct planting and/or seeding	Included in the eligibility criteria of this PoA and hence this condition will be applicable to all CPAs under the PoA (For Gliricidia whose cultivation is promoted in this project, the planting method involves the insertion of clipped branches)
After harvest, regeneration will occur either by direct planting or natural sprouting	The requirement that biomass to be used in this project be short rotation crops is included in the eligibility criteria and hence this condition will be applicable to all CPAs under the PoA
Grazing will not occur within the plantation	Included in the eligibility criteria of this PoA and hence this condition will be applicable to all CPAs under the PoA
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.	
(2) Criteria for biomass residue	
For the use of biomass residues, If biomass residues are co-fired in the project plant case B1, B2, B3, B4 and/or B5. If case B5 is the most plausible scenario, the methodology is only applicable if: (a) The plant where the biomass residues would be used as feedstock in the absence of the project activity can be clearly identified throughout the crediting periods; and	The biomass fuel to be used in this project is mainly branches of Gliricidia which presently are cultivated in parts of tea estates, pepper cultivation farms and coconut farms for providing shades, as companion crops or as tiny hedges. The plants are periodically pruned but the branches are not used immediately but are left to decay in backyards of farms which ultimately degrade over time. Cinnamon, which is

(b) The fuels used as substitutes for the biomass residues at the plant, referred in (a) above, can be monitored by project participants. B1 The biomass residues are dumped or left to decay under mainly aerobic conditions. This applies, for example, to dumping and decay of biomass residues on fields. B2 The biomass residues are dumped or left to decay under clearly anaerobic conditions. This applies, for example, to deep landfills with more than 5 meters. This does not apply to biomass residues that are stock-piled[10] or left to decay on fields. B3 The biomass residues are burnt in an uncontrolled manner without utilizing them for energy purposes. B4 The biomass residues are sold to other consumers in the market and the predominant use of the biomass residues in the region/country is for energy purposes (heat and/or power generation) B5 The biomass residues are used as feedstock in a process (e.g. in the pulp and paper industry)	used in parts is also expected to be meeting the same fate. Hence, it satisfies the B1 criteria.

(3) Applicability to " Definition of Renewable Biomass "

The "Definition of Renewable Biomass (EB23,Annex18)" defines Renewable biomass as shown below and when it satisfies the conditions, the biomass is regarded as a renewable and if the conditions are not satisfied it is regarded as non renewable.

Table 7. Applicability Criteria and Justification

Biomass category	Applicability criteria	Justification of Applicability
1.The biomass is originating from land areas that are **forests**	(a) The land area remains a forest[11]; and (b) Sustainable management practices are undertaken on these land areas to ensure in particular, that the level of carbon stocks on these land areas does not systematically decrease over time (carbon stocks may temporarily decrease due to harvesting); and (c) Any national or regional forestry and nature conservation regulations are complied with	N/A (No biomass from forests are utilized under this PoA)
2.The biomass is **woody biomass** and originates from **croplands and/or grasslands**	(a) The land area remains cropland and/or grasslands or is reverted to forest; and (b) Sustainable management practices are undertaken on these land areas to ensure in particular that the level of carbon stocks on these land areas does not systematically decrease over time	Please see "a) Applicability for new cultivation" in Page.20.

[10] Further work is undertaken to investigate to which extent and in which cases methane emissions may occur from stock-piling biomass residues. Subject to further insights on this issue, the methodology may be revised.

[11] The forest definitions as established by the country in accordance with the decisions 11/CP.7 and 19/CP.9 should apply.

	(carbon stocks may temporarily decrease due to harvesting); and (c) Any national or regional forestry, agriculture and nature conservation regulations are complied with	
3. The biomass is **non-woody** biomass and originates from **croplands and/or grasslands**	(a) The land area remains cropland and/or grasslands or is reverted to forest; and (b) Sustainable management practices are undertaken on these land areas to ensure in particular that the level of carbon stocks on these land areas does not systematically decrease over time (carbon stocks may temporarily decrease due to harvesting); and (c) Any national or regional forestry, agriculture and nature conservation regulations are complied with	N/A (Non-woody biomass and originates from croplands and/or grasslands. However, details are to be confirmed at CPA level.)
4. The biomass is a **biomass residue** and the use of that biomass residue in the project activity does not involve a decrease of carbon pools, in particular dead wood, litter or soil organic carbon, on the land areas where the biomass residues are originating from. For example, if bagasse from sugar production would in the absence of the CDM be dumped or left to decay and is used for energy generation under the CDM, it can be assumed that the use of the bagasse does not affect the sugar cane cultivation practices and hence the carbon pools of the respective soils. In contrast, where a CDM project involves the collection of dead wood from a forest which would not be collected in the absence of the CDM, the extracted biomass cannot be regarded as renewable, since it would result in a decrease of carbon stocks		Please see "b) Applicability for biomass residue" in Page.20. The primary biomass to be used under this PoA is Gliricidia wood which has been left to decay in farm lands or home gardens. However, for the purpose of conservativeness, details are to be confirmed at CPA level.
5. The biomass is the non-fossil fraction of an **industrial** or **municipal waste**.		To be confirmed at CPA level

Usage of new cultivations and biomass residues satisfies the criteria 2 and 4 of Table 7 as explained below. Hence, biomass used in this project is renewable.

a) New cultivation (corresponding to criteria 2 of Table 7):

New cultivation to be adopted by this project assumes the following conditions and as it satisfies the three conditions specified in 2 in Table 7, it can be concluded to be renewable biomass.

- Land where biomass is to be newly cultivated includes unused land in coconut farms between trees, non-cultivable land (dry land, non arable land) etc and hence satisfies the criteria.
- For biomass to be planted is fast growing trees that have branches separating from trunks which grow to 2-3 m in a few months and branches of which are cultivated periodically are used and hence there is no change in "Carbon accumulation level of the land"
- Land to be used are expected to be located either in non-used land inside coconut plantations or land classified for usage as forests or agriculture but that have not been used.

b) Biomass residue (corresponding to criteria 4 of Table 7):

The biomass fuel to be used in this project is mainly pruned Gliricidia branch and at present is cultivated in tea plantations, pepper cultivation land and coconuts plantations in some cases for shades, as live fences or as a companion plant. The branches are pruned periodically but are not used and are left to decay in farm lands. For biomass residue other than Gliricidia, similarly, biomass that are not currently used are utilised. Hence, the biomass to be used in this project is renewable biomass because the biomass satisfies the condition that states - "biomass residue and the usage of biomass residue in the project activity does not

result in the carbon pool of the area (especially dead tree, fallen leaves and branches or soil organic carbon)".

E.3. Description of the sources and gases included in the SSC-CPA boundary

The boundary applies to each CPA under the PoA includes:

- the physical and geographic location of each biomass thermal energy generating facility, and
- the area where the biomass is extracted or produced (only for the case where new cultivation are involved)[12].

Significant amounts of GHG emissions is expected to be reduced within the project boundary of the PoA because grid electricity to be used for operating the facility and fossil fuel to be used for transporting biomass resources after the project implementation are not large compared to the amount of fossil fuel currently used at thermal energy generating facility.

The project activity emissions included within the project boundary of CPAs under the PoA are emissions that occurred due to the project activity and are shown below:

i) Carbon dioxide (CO2) emissions from on-site consumption of fossil fuels due to the project activity,
ii) Carbon dioxide (CO2) emissions from electricity consumption by the project activity,

The baseline emissions included in the project boundary are as follows:

i) Carbon dioxide (CO2) emissions from steam/heat displaced by the project activity

E.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

The baseline scenario was identified using relevant methodology SSC AMS-I.C. and AM0042 for biomass part.

E.4.1. Baseline determination for fuel used at project site

Usage of fossil fuels such as furnace oil and diesel oil are the most common and regarded as the most economic and the easiest choice for industries in Sri Lanka.

Besides cases where a substantial amount of biomass is being generated at the factory itself as a by-product of its process or when biomass is easily accessible from areas near to the factory, biomass fuel is not regarded as a dependable option. Reasons that are preventing businesses being pro-active in changing fuel from fossil fuel to biomass fuel are listed below.

- A lot of uncertainty exists in the procurement of biomass fuel because the production and supply is impacted by factors such as the weather and climate changes,

[12]Indicative Simplified Baseline and Monitoring Methodologies for Selected Small-scale CDM Project Activity Categories: "General guidance on leakage in biomass project activities (Ver.03)" Para.2, and AM0042 "Grid-connected electricity generation using biomass from newly developed dedicated plantations (Ver.2.1)" P.3. Project boundary.

- It is required to secure space inside the premises and transportation cost is also required, and
- In order to carry out a stable and sustained procurement of the required quantity of biomass from multiple suppliers, it is perceived that a lot of effort is required

In addition, there are no laws or regulations in Sri Lanka that enforce thermal energy users to switch the fuel from fossil fuel into biomass resources or any other renewable energy resources.

Therefore, the baseline for the fuel at project site is fossil fuel utilization.

E.4.2. Baseline determination for biomass

The main biomass fuel to be used in this project is pruned Gliricidia branch and at present is cultivated in tea estates, pepper cultivation land and coconut plantations in some cases as shades, live fences or as a companion crop. As its growth rate is very high, it needs to be constantly pruned. As stated in E.4.1, as there is no system that connects the farms with areas of high energy demands, the biomass is not sold and is left at backyards of farms or farmlands to decay.

The biomass to be used in the project is a biomass residue not involving a decrease of carbon pools, in particular dead wood, litter or soil organic carbon on the land areas where the biomass residues are originating from and hence can be said to be a renewable biomass.

In the course of the project activity, in case where plants like Gliricidia etc that can be harvested in short cycles are cultivated on unused land for the purpose of supplying fuel to the project, the baseline scenario consists of the progress of aged deterioration of the land that is left unused.

E.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the SSC-CPA being included as registered PoA (assessment and demonstration of additionality of SSC-CPA):

E.5.1. Assessment and demonstration of additionality for a typical SSC-CPA:

In the absence of the PoA, thermal energy generation for industrial purpose will not be carried out. Thermal energy in these cases will be supplied from existing thermal energy generation facilities whose energy sources are almost exclusively fossil fuels.

1) For project activities up to 15 MW_{th}

The CPAs equal or below 15 MW thermal energy can establish additionality using "Guidelines for Demonstrating Additionality of Renewable Energy Projects =< 5 MW[13] and Energy Efficiency Projects with Energy Saving <= 20GWH Per Year". According to the guideline, project activities employ specific renewable energy technologies/measures recommended by the host country DNA and approved by the Board to be additional in the host country (conditions apply: The total installed capacity of technology/measure contributes less than or equal to 5% to national annual electricity generation) is regarded as additional.

Currently the recommendation letter for gasifier technology using renewable biomass resources by the DNA of the host country is under preparation in order to be approved by the Board. At present, the

[13] 15 MW for thermal energy equivalent

biomass based gasifier technology provides thermal energy installation capacity equivalent to 10MW of fossil fuel consumption which is less than 1.0 % of the industrial thermal energy generation.

2) For project activities beyond $15MW_{th}$

The CPAs beyond $15MW_{th}$ shall establish additionality in line with Attachment A of Appendix B of the Simplified Modalities and Procedures for Small-Scale CDM project activities and Methodological tool; *"Tool for the demonstration and assessment of additionality (Version 05.2)"(EB39, Annex10)*. The project participants will provide an explanation to show that the project activity would not have occurred without the PoA, according to the following steps.

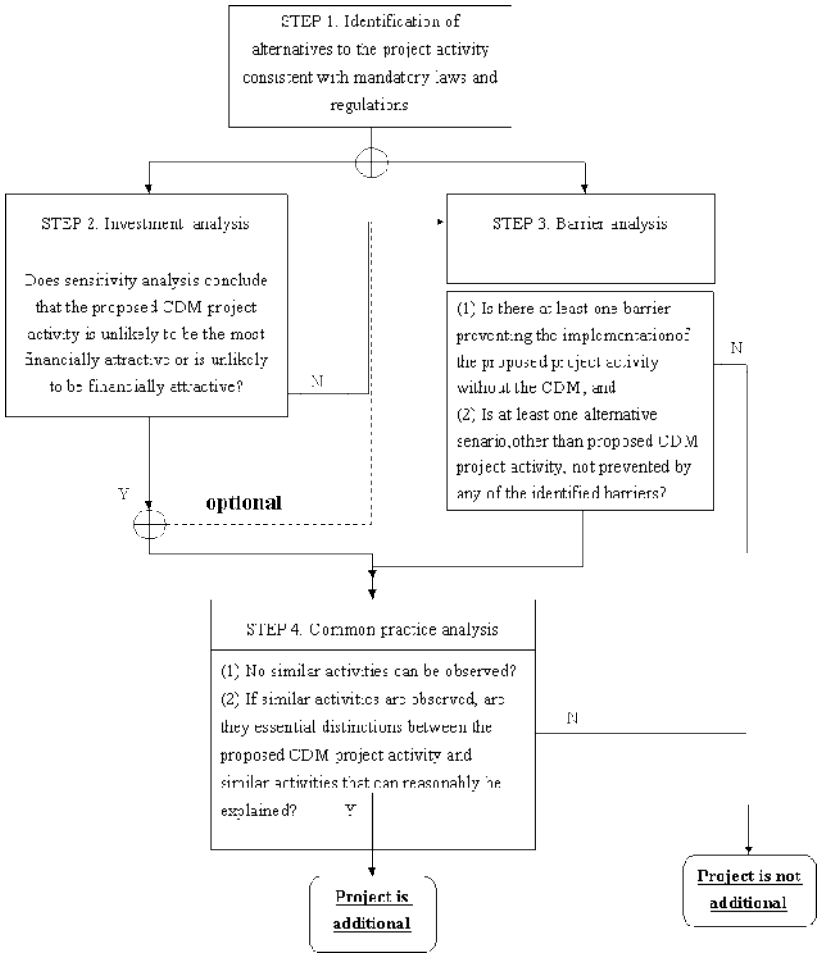

Figure 4 Steps of establishment of additionality

STEP1. Identification of alternatives to the project activity consistent with current laws and regulation

[Sub-Step 1a] Define alternatives to the project activity

The alternative baseline scenarios to a typical CPA under this PoA are identified as follows:

1) Alternative 1: The proposed project activity is not undertaken as a CDM project activity;
2) Alternative 2: An equivalent amount of thermal energy is generated by the existing facilities (Continuation of the current scenario. The proposed project activity will not be undertaken).

[Sub-step 1b] Consistency with mandatory laws and regulations
All the alternative scenarios to the project described above are consistent with laws of Sri Lanka and her national and local regulations. A typical CPA under this PoA is therefore not the only alternative amongst those considered that is in compliance with mandatory regulations.

STEP2. Investment Analysis
[Sub-step 2a] Determine appropriate analysis method
In this case, the benchmark analysis (Option III) is applied.

[Sub-step 2b]Option III. Apply benchmark analysis
In Sri Lanka, no national benchmark regarding investments conditions by banks have been set. Further, data regarding ROE (return of equity) which acts as a factor in judging investments has not been made public by the stock exchange and hence cannot be used as a benchmark. Interest rate on loans of the Sri Lanka central bank can be thought of as data available in public domain that can act as a benchmark for judgement of investments. This rate, which was 19% in December 2009, was decreased to up to 8% in January 2010 by the decision of the Government. However, only the National banks are subject to this decrease of interest rate and the private banks have been affected. Therefore, in this PoA, the average weighted prime lending rate of commercial banks from January to December of 2010, which is 10.22%, is used as a Benchmark because the data of 2009 is no longer relevant after the drastic drop of the interest rate of the Central Bank.

a) Internal Rate of Return (IRR) Calculation
Sri Lankan government provides rebates to fuel oil from the viewpoint of preservation of industry. The price of the fuel is fixed as LKR40/L, which is much lower than international market fuel price. Therefore, it is very hard for thermal energy users to expect IRR over 10.22% through system conversion activity from fossil fuel use into sustainable fuel wood base use.

To demonstrate benchmark analysis, each CPA must conduct the *ex ante* IRR (15years after tax) calculation and compare it with the determined benchmark (10.22%). With this comparison, CPA may prove that, from an economic standpoint, the proposed project activity is additional.

b) Sensitivity Analysis
The sensitivity analysis is made by variation of the cost and income parameters i.e., the investment in equipment and construction of the new project facility, income from the electricity selling and project period. The range of variation for each parameter is set as plus or minus 10% from the basis assumption.

CPAs under the PoA need to conduct the sensitivity analysis for the following parameters:

- Initial facility investment equipment and construction
- Biomass fuel price
- Price of the fuel to be replaced by biomass fuel
- Factory operation ratio
- Project life time (20 years)

This benchmark analysis needs to be demonstrated at each CPA basis. If there is a case where the IRR is beyond benchmark, CPA needs to demonstrate the "STEP3 barrier analysis" in accordance with the *"Tool for the demonstration and assessment of additionality (Version 05.2)"*.

STEP3. Barrier Analysis

In accordance with Attachment A to Appendix B of the simplified modalities and procedures for small scale CDM project activities, a barrier analysis will be undertaken. This analysis will discuss credible barriers that would prevent the implementation of the proposed project activity from being carried out if the project activity was not registered as a CDM activity.

For a typical CPA under this PoA the following barriers will be applicable.

(a) Barrier due to prevailing practice

Currently there are only seven operating facilities in Sri Lanka that utilize gasification of Gliricidia mostly received initial investment support from foreign governments and very few of them are operating purely on investment solely from private investors. Further, although some medium to large plants that use waste rubber or forest biomass as fuel for boilers exist, not even a single plant that uses Gliricidia as a main biomass fuel is known. Hence, it can be said that barriers to prevailing practice exists for changing fuel from the traditional fossil fuel to the Gliricidia based fuel as proposed in this project.

(b) Barrier regarding procurement of biomass resources

In Sri Lanka, the areas with high demand of energy are located mainly along the western coast centred on Colombo. However, villages that can potentially act as supply regions for Glircidia are mostly located in other regions. When considering the usage of Gliricidia and other biomass fuel, in addition to transportation from supply to demand area, a lot of effort and investment will become necessary for industries in areas that is not their core-business in order to make sure a stable supply of biomass required to operate their facilities. This will not only put other non-financial pressure on manufacturers but will also result in additional load such as negotiations with farmers or biomass suppliers. This fact is becoming the major factor that is preventing investment on biomass using facilities.

One particular factory that had a plan to replace diesel oil has put its plan on hold for 5 years. The factory expects the project to be profitable. However, they have their doubts on the stable supply of biomass fuel. Due to the reasons described above, barriers regarding procurement of biomass resources were demonstrated.

(c) Access-to-finance barrier

In Sri Lanka, companies that have been registered as ESCO service are generally of small to medium scale. When large consumers of fossil fuel who want an alternative to their energy source want a supply of renewable energy based on contracts with these ESCO service, it is expected that securing the initial and O&M cost becomes a hindering factor for these small to medium ESCO companies.
Further, providing guarantees is necessary when borrowing. However for ESCO companies who are not well off financially, it is very difficult to reach to the stage of project formation even if the demand for energy supply exists.

For the banks, financing in businesses involving conversion of fuel from fossil fuel to biomass fuel is difficult because of the various uncertainties involved (especially if the company involved is a small to medium enterprise), however when the project becomes a CDM project and foreign companies are involved, the risk factors associated with the project was thought to improve and hence the chances of financing in the project also improved. This fact demonstrates the access-to-finance barrier and it can be concluded that making this project a CDM project drastically reduces the barrier.

Impact of CDM registration

CDM registration will enable CPAs to receive low-income loans from financial institutions. In addition, the approval and registration of the CDM project will alleviate the identified barriers through diversion of some risks in the project to the CDM partner. Moreover, additional revenue from CER sales, technology transfer and investment from countries such as Japan will allow the project owners to invest and implement new biomass energy generating projects.

STEP 4. Common Practice Analysis

[Sub-step 4a] Analyse other activities similar to the proposed activity

Other activities similar to the project activity are described as follows:

a) Existing gasifier facilities using biomass fuel mainly Gliricidia
b) Existing boiler facilities using fuel wood other than Gliricidia
c) Biomass utilization for thermal use at very small scale

[Sub-step 4b] Discuss any similar options that are occurring.

There are fundamental distinctions between these activities similar to the proposed activity and CPAs under this PoA. The distinctions are described as follows:

a) Existing gasifier facilities using biomass fuel mainly Gliricidia

As described in "Barrier due to prevailing practice", seven facilities are in operation using Gliricidia as fuel exist in Sri Lanka, but many of these facilities are invested by foreign governments and even few facilities based solely on private investment exist. Hence, this project that assumes a purely private investment will have different pre-conditions compared to these pre existing projects.

b) Existing boiler facilities using fuel wood other than Gliricidia

For medium to large scale industries, rubber wood is sometimes used as fuel for boilers. However, rubber wood has an established market and is used as timber or as fuel. The biomass resources assumed by the proposed project is mainly Gliricidia wood that has not been utilized or dealt at market, and thus left as residue, which is the most significant difference between the option and proposed project activity.

c) Biomass utilization for thermal use at very small scale

One of the most commonly used fuels at households and very small scale thermal utilization units in rural area of Sri Lanka is biomass resources. It is very easy to procure biomass resources to meet their demand as the amount of required biomass is very low and it can be supplied from either plants grown on their own land or one or two supply sources nearby their own location. This makes biomass procurement very easy and cheap due to a minimal transportation requirement. Therefore, this option is obviously different from the proposed project where a significant amount of biomass resources must be procured from many distant suppliers.

Additionality of all the CPAs under this PoA is demonstrated as described above.

E.5.2. Key criteria and data for assessing additionality of a SSC-CPA:

Below are the key criteria for assessing the additionality of the CPA when proposed to be included in the registered PoA. Each CPA shall justify the choice of criteria based on analysis in E.5.1 above. It shall be

demonstrated how these criteria would be applied to assess the additionality of a typical CPA at the time of inclusion. Each SSC-CPA-DD will include a discussion of additionality addressing each of these key criteria.

[Key additionality criteria]

1) For project activities up to 15 MW_{th}
   If CPA employs gasifier technology for biomass utilization, CPA satisfies the additionality criteria

2) For project activities up to 15 MW_{th}
   CPA under PoA must meet at least one of criteria b) or c) to meet the additionality requirement:

   a) Identify alternatives to the project activity ensuring that the proposed project activity is not the only alternative amongst those considered that is in compliance with mandatory regulations.
   b) Demonstrate the IRR of the proposed project activity is below than determined benchmark which is 10.22%. If this criterion cannot be satisfied, the criteria c) needs to be demonstrated.
   c) Conduct barrier analysis to demonstrate that the proposed project faces significant barriers that are overcome if being implemented with CDM
   d) Conduct common practice analysis through identifying other activities similar to the proposed activity and demonstrating there are essential distinctions between these activities and the proposed project activity.

E.6. Estimation of emission reductions of a CPA:

E.6.1. Explanation of methodological choices, provided in the approved baseline and monitoring methodology applied, selected for a typical SSC-CPA:

Baseline emissions and project emissions are calculated by the equations defined by SSC AMS-I.C. *"Thermal energy production with or without electricity (Version 18)"*.

Based on Option A1 in *"Tool to calculate baseline, project and /or leakage emissions from electricity consumption [EB39 Annex18]"*, the emission factor from Grid Power in Sri Lanka was used to estimate the emission factor from electricity usage. The grid emission factor was calculated referring to Methodological Tool: *"Tool to calculate the emission factor for an electricity system (Version 02) [EB35 Annex12]"* (referring to E.6.2.).

The parameters used for calculation are locally obtained values and default values determined by IPCC Guidelines for National Greenhouse Gas Inventories (2006).

E.6.2. Equations, including fixed parametric values, to be used for calculation of emission reductions of a SSC-CPA:

This PoA applies the following methodologies for each component below:

(1) Applied methodology:
AMS-I.C small scale methodology for *"Thermal Energy Production With or Without Electricity"*, Version 18, Scope 16, in effect from 18th Dec. 2009.
(2) Methodological tool applied for project emission associated to electricity consumption:
- [Annex 12 of the EB 35] *"Tool to calculate the emission factor for an electricity system (Version 02)"* (referring to E.6.2.)
- [Annex 18 of the EB 39] *"Tool to calculate baseline, project and /or leakage emissions from electricity consumption (EB39 Annex18)"*,

I. BASELINE EMISSIONS

Based on SSC AMS-I.C., the baseline emissions for steam/heat produced using fossil fuels are calculated as follows:

$$BE_{thermal,CO2,y} = (EG_{thermal,y} / \eta_{BL,thermal}) * EF_{FF,CO2} \quad \ldots\ldots\ldots(1)$$

Where ,

$BE_{thermal,CO2,y}$: The baseline emissions from steam/heat displaced by the project activity during the year y (tCO2e)

$EG_{thermal,y}$: The net quantity of steam/heat supplied by the project activity during the year y (GJ)

$EF_{FF,CO2}$: The CO2 emission factor of the fossil fuel that would have been used in the baseline plant, obtained from reliable local or national data if available, otherwise, IPCC default emission factors are used (tCO2 / GJ)

$\eta_{BL,thermal}$: The efficiency of the plant using fossil fuel that would have been used in the absence of the project activity

II. PROJECT EMISSIONS

Project emissions are composed of the following two components:

A) CO2 emissions from on-site consumption of fossil fuels due to the project activity

B) CO2 emissions from electricity consumption by the project activity

$$PE_y = \{PE_{on\text{-}site,y} + PE_{EC,y}\} \ldots\ldots\ldots(2)$$

Where ,

$PE_{on\text{-}site,y}$: Project CO2 emissions from on-site consumption of fossil fuels in year *y* (tCO_2e/y)

$PE_{EC,y}$: Project CO2 emissions from electricity consumption in year *y* (tCO_2e/y)

A) CO2 emissions from on-site consumption of fossil fuels due to the project activity ($PE_{on-site,y}$)

The emission amount when fossil fuel is consumed onsite during project an activity is obtained from the following equation based on the "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion (ver.02)". Due to the lack of data required for option A, option B is applied for calculation.

$$PE_{on-site,y} = FF_{PJ,i,y} * NCV_{FF,i,y} * EF_{FF,CO2,i,y} \quad \ldots\ldots\ldots(3)$$

Where,

$PE_{on-site,y}$	:	Project emissions from fossil fuel consumption in year y ($tCO2_e$)
$FF_{PJ,i,y}$	:	Quantity of fuel type i combusted in process j during the year y (t/y)
$NCV_{FF,i,y}$	:	Net calorific value of the fossil fuel to be replaced by biomass fuel (GJ/t)
$EF_{FF,CO2,i,y}$	:	The CO2 emission factor of the fossil fuel that would have been used in the baseline plant, obtained from reliable local or national data if available, otherwise, IPCC default emission factors are used (tCO_2e /GJ)

B) CO2 emissions from electricity consumption by the project activity ($PE_{EC,y}$)

STEP 1. Emission Factor Calculation

Step 1-1. Select an Emission Factor Option

According to the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption (ver.01)", Option A1 of Scenario A is applied for this PoA.

Scenario A:
Electricity consumption from the grid

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 (ver.02)" .

The emission is the electricity generation (MWh) produced by the renewable generating unit multiplied by an emission factor (tCO2e/MWh) calculated in a transparent and conservative manner as:

(a) A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the 'Tool to calculate the emission factor for an electricity system'.

OR

(b) The weighted average emissions (in kg CO2e/kWh) of the current generation mix. The data of the year in which project generation occurs must be used.

This PoA applied option (a) for calculation of the emission factor.

Step 1-2. Determination of OM Emission Factor Calculation Method

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

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

The annual load duration curve and grid system dispatch data is necessary for Method (b) and (c) respectively. However, these data are not publicly available. Therefore, Methods (b) and (c) cannot be applied to this PoA.

Renewable energy (hydro, geothermal, wind, biomass, solar) and nuclear power are considered as sources of low-cost/must-run power generation. Therefore, Method (a) is obtained by the weighted average of the unit electricity generation volume of power plants excluding renewable energy and nuclear power plants. Method (d) is the average emission factor of all power plants connecting to the grid.

Method (a) can be used only 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.

Based on "Tool to calculate the emission factor for an electricity system(ver.02)", this PoA will utilize Method (a) if the 5-year generation-weighted average data indicates that the percentage of electricity generated from low-cost/must-run power plants is less than/equal to 50% of the total electricity generated within the grid. If this percentage is above 50%, Method (d) will be applied.

Based on the above, with the currently available data, the OM calculation method to be applied to each grid system in Sri Lanka is determined as shown in Table 8.

Table 8. OM Calculation Method to Be Applied to the Grid Systems in Sri Lanka

Proportion of Electricity Supply by Low-cost/Must-run Power Plants (2004-2008)	Option applied
41.8% < 50%	Simple OM

Step 1-3. Calculate The OM Emission Factor According to The Selected Method.

Calculation of Simple OM [Method (a)]

The Simple OM emission factor ($EF_{grid,OM,y}$) is calculated as the generation-weighted average emissions per electricity unit (tCO_2/MWh) of all generating sources serving the system, not including low-operating cost and must-run power plants. It can be calculated by using the following three options based on the obtained data.

- Based on data on fuel consumption and net electricity generation of each power plant / unit4 (Option A), or

- Based on data on net electricity generation, the average efficiency of each power unit and the fuel type(s) used in each power unit (Option B), or
- Based on data 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 C)

According to the data available in Sri Lanka, option A is considered as the most suitable method by using the Ex ante option. The calculation is a 3-year average based on most recent statistics available in the year 2006-2008. The formula used is shown in based on data on fuel consumption and net electricity generation of each power plant / unit (Option A).

$$EF_{grid,OM,y} = \frac{\sum_{i,m} FC_{i,m,y} \cdot NCV_{grid,i,y} \cdot EF_{grid,CO2,i,y}}{\sum_{m} EG_{m,y}} \quad \text{..... (4)}$$

Where,

$EF_{grid,OMsimple,y}$	:	Simple operating margin CO_2 emission factor in year *y* (tCO_2/MWh)
$FC_{i,m,y}$	:	Amount of fossil fuel type *i* consumed by power plant / unit m in year *y* (mass or volume unit)
$NCV_{grid,i,y}$	:	Net calorific value (energy content) of fossil fuel type *i* in year *y* (GJ/mass or volume unit)
$EF_{grid,CO2,i,y}$	:	CO_2 emission factor of fossil fuel type *i* in year *y* (tCO_2/GJ)
$EG_{m,y}$	:	Net electricity generated and delivered to the grid by power plant / unit m, not including low-cost / must-run power plants / units in year *y* (MWh)
M	:	All power plants / units serving the grid in year y except low-cost / must-run power plants / units
I	:	All fossil fuel types combusted in power plant / unit *m* in year *y*
Y	:	Three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option)

Step 1-4. Identify the Cohort of Power Units to Be Included in The Build Margin (BM) .

Sample Group of Power Units

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.

Capacity additions from retrofits of power plants should not be included in the calculation of the build margin emission factor.

Vintage of Data

In terms of vintage of data, project participants can choose between one of the following two options:

Option 1.

For the first crediting period, calculate the build margin emission factor ex-ante based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the Designated Operational Entity for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the Designated Operational Entity. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

Option 2.

For the first crediting period, the build margin emission factor shall be updated annually, ex-post, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin emissions factor shall be calculated ex-ante, as described in option 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

For this PoA, Option 1 is applied.

Step 1-5. Calculate The Build Margin Emission Factor.

The build margin emissions factor is the generation-weighted average emission factor (tCO2/MWh) of all power units m during the most recent year y for which power generation data is available, and is calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_{m} EG_{m,y} \times EF_{EL,m,y}}{\sum_{m} EG_{m,y}} \qquad \ldots\ldots(5)$$

Where,

$EF_{grid,BM,y}$	:	Build margin CO2 emission factor in year y (tCO2/MWh)
$EG_{,m,y}$	:	Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
$EF_{EL,m,y}$	:	CO2 emission factor of power unit m in year y (tCO2/MWh)
m	:	Power units included in the build margin
y	:	Most recent historical year for which power generation data is available

The CO2 emission factor of each power unit m ($EF_{EL,m,y}$) will be determined as per Step1-3. Method (a) for the simple OM using "y" for the most recent historical year for which power generation data is available, and using "m" for the power units included in the build margin.

Step 1-6. Calculate The Combined Margin (CM) Emissions Factor.

According to the above equations, the emission factor of the system power supply (combined margin, CM) is determined by the CO2 emission factor of system power supply (CEF_y). CEF is average of OM and BM as described below:

$$CEF_y = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM} \quad \ldots\ldots(6)$$

Where,

CEF_y	:	CO2 emission factor of system power supply ($tCO2_{eg}$ /MWh)
$EF_{grid,OM,y}$	:	Operating margin CO2 emission factor in year y ($tCO2_{eg}$ /MWh)
$EF_{grid,BM,y}$	:	Build margin CO2 emission factor in year y ($tCO2_{eg}$ /MWh)
w_{OM}	:	Weighting of operating margin emissions factor (%)
w_{BM}	:	Weighting of build margin emissions factor (%)

w_{OM} = 0.5 and w_{BM} = 0.5 for this crediting period.

According to the above equation, the latest emission factor of the system power supply (combined margin) for this PoA is determined as shown in the Table 9. CPAs under PoA can use these figures if new electricity generation statistic data is not available.

Table 9. Emission Factor of The System Power Supply (CEF_y)

OM ($tCO2_{eg}$ /MWh)	BM ($tCO2_{eg}$ /MWh)	CM ($tCO2_{eg}$ /MWh)
0.690	0.707	0.698

STEP 2. Calculation of Project Emissions

Project emission is calculated by using equation (7).

Renewable energy generation volume (MWh) for the project emission calculations was derived utilizing data with high transparency. Project emissions from system power supply are determined as follows with CEF_y shown in the Table 9.

$$\underset{(tCO2_{eq}/y)}{PE_{y,power}} = \underset{(MWh)}{E_{PJ,y}} \times \underset{(tCO2_{eg}/MWh)}{CEF_y} \quad \ldots\ldots (7)$$

Where,

$PE_{y,power}$	:	Annual project emissions from system power supply ($tCO2_{eq}$/year)
$E_{PJ,y}$	:	Electricity requirement of installed plant (MWh)
CEF_y	:	CO2 emission factor of system power supply ($tCO2_{eg}$ /MWh)

III. LEAKAGE EMISSIONS

A) Leakage emissions associated to biomass utilization

For the CPAs under this PoA, the determination of leakage shall be done following the procedures included in the leakage section of AM0042.

In AM0042, during the calculation of related leakage, the method used involves the setting of the most accurate baseline scenario according to the type of biomass and selecting the calculation approach .In this project, scenario B1 is applicable. Where scenario B1 appleis, approaches L1, L2 and/or L3 are to be used.

[Baseline scenario]

B1	The biomass residues are dumped or left to decay under mainly aerobic conditions. This applies, for example, to dumping and decay of biomass residues on fields.

[Approaches to rule out leakage]

L1	・Demonstrate that at the sites where the project activity is supplied from with biomass residues, the biomass residues have not been collected or utilized (e.g. as fuel, fertilizer or feedstock) but have been dumped and left to decay, land-filled or burnt without energy generation (e.g. field burning) prior to the implementation of the project activity. ・Demonstrate that this practice would continue in the absence of the CDM project activity, e.g. by showing that in the monitored period no market has emerged for the biomass residues considered or by showing that it would still not be feasible to utilize the biomass residues for any purposes (e.g. due to the remote location where the biomass residue is generated).
L2	・Demonstrate that there is an abundant surplus of the in the region of the project activity which is not utilized. For this purpose, demonstrate that the quantity of available biomass residues of type *k* in the region is at least 25% larger than the quantity of biomass residues of type *k* that are utilized (e.g. for energy generation or as feedstock), including the project plant.
L3	・Demonstrate that suppliers of the type of biomass residue in the region of the project activity are not able to sell all of their biomass residues. For this purpose, project participants shall demonstrate that the ultimate supplier of the biomass residue (who supplies the project) and a representative sample of suppliers of the same type of biomass residue in the region had a surplus of biomass residues (e.g. at the end of the period during which biomass residues are sold), which they could not sell and which are not utilized.

- In order to use approach L2 to assess leakage effects, project proponents shall clearly define the geographical boundary of the region and document it in the draft CDM-PDD. In defining the geographical boundary of the region, project participants should take the usual distances for biomass transports into account[14]. In any case, the region should cover a radius around the project activity of at least 20 km but not more than 200 km. Once defined, the region should not be changed during the crediting period(s).

- If for a certain biomass residue type k used in the project leakage effects cannot be ruled out with one of the approaches above, leakage effects for the year y shall be calculated as follows:

[14] i.e. if biomass residues are transported up to 50 km, the region may cover a radius of 50 km around the project activity

$$LE_y = EF_{CO2,LE} \cdot \Sigma_n BF_{LE,n,y} \cdot NCV_n \quad \ldots\ldots\ldots(8)$$

Where,

LE_y	:	Leakage emissions during the year *y* (tCO2/yr)
$EF_{CO2,LE}$	:	CO2 emission factor of the most carbon intensive fuel used in the country (tCO2/GJ)
$BF_{LE,n,y}$	:	Quantity of biomass residue type *n* used for heat generation as a result of the project activity during the year *y* and for which leakage cannot be ruled out using one of the approaches L1, L2, L3 or L4 (tons of dry matter or liter)
NCV_n	:	Net calorific value of the biomass residue type *n* (GJ/ton of dry matter or GJ/liter)
n	:	Biomass residue type *n* for which leakage can not be ruled out using one of the approaches L1, L2, L3 or L4

- In case of approach L1, $BF_{LE,n,y}$ corresponds to the quantity of biomass residue type n that is obtained from the relevant source or sources.
- In case of approaches L2 or L3, $BF_{LE,n,y}$ corresponds to the quantity of biomass residue type k used in the project plant as a result of the project activity during the year y ($BF_{LE,n,y} = BF_{PJ,k,y,}$ where n=k).

[Application to the CPAs under the PoA]
In Sri Lanka there is no publicly available information to prove the fact stated above (L1, L2 and L3) as Gliricidia has not been utilized and the market is very small. However, under this PoA a survey was carried out to estimate the generated amount and the utilization situation of Gliricidia wood. The result of the survey showed that domestically in Sri Lanka, branches of Gliricidia were hardly used and generally, after periodic pruning, the branches were left at back yards of farms (L1) . Hence, it can be said that suppliers of Gliricidia fuel wood in Sri Lanka have a surplus of biomass residues, which they cannot sell and which are not utilized (L3). In addition to this detailed survey, a separate simple survey for at least one of L1, L2 and L3 need to be carried out at each CPA level and justification should be described in CDM-SSC-CPA-DD.

When biomass other than Gliricidia is used , at least one of the approaches taken above should be repeated for all the biomass and when it cannot be demonstrated that leakage does not occur, then penalty based on equation (8) should apply.

b) Other leakage emissions
According to AMS-I.C., other leakage emissions are composed of the following three components:

- If the energy generating equipment currently being utilised is transferred from outside the boundary to the project activity, leakage is to be considered.
- If biomass residues are transported over a distance of more than 200 km due to the implementation of the project activity then this leakage source attributed to transportation shall be considered, otherwise it can be neglected.
- In processing of biomass residues, electricity will be used, however, this can be neglected because this is negligibly small.

For CPAs under the PoA, all the above three leakage can be neglected since there is no leakage effect from equipment transferred from another unit to other units in the project boundary and any CPA will transport the biomass residue more than 200 km (it is also too costly to transport for that distance). Each CPA will determine the boundary of biomass residue procurement, which will not be beyond 200km. .

(iv) Emissions Reduction of GHG

GHG emissions reduction is calculated as indicated in equation (9).

$$\underset{(tCO2_{eq}/y)}{ER_y} = \underset{(tCO2_{eq}/y)}{BE_y} - \left(\underset{(tCO2_{eq}/y)}{PE_y} + \underset{(tCO2_{eq}/y)}{Leakage_y} \right) \ldots\ldots (9)$$

Where,

ER_y	:	Emissions reduction in year "y" ($tCO2_{eq}$ /y)
BE_y	:	Baseline emissions in year "y" ($tCO2_{eq}$ /y)
PE_y	:	Project emissions in year "y" ($tCO2_{eq}$ /y)
$Leakage_y$	:	Emissions due to leakage in year y ($tCO2_{eq}$ /y)

E.6.3. Data and parameters that are to be reported in CDM-SSC-CPA-DD form:

Detailed information on the data and parameters that do not require monitoring are described below. Data and parameters used for ex-ante calculation that need to be monitored after project implementation are shown in E.7.1.

Data / Parameter:	$\eta_{BL,thermal}$
Data unit:	-
Description:	The efficiency of the plant using fossil fuel that would have been used in the absence of the project activity
Source of data used:	Data reported by each CPA
Value applied:	-
Justification of the choice of data or description of measurement methods and procedures actually applied:	On site specific data or default value to be applied
Any comment:	According to SSC AMS I.C.(ver.18) determined by adopting one of the following criteria: a) Highest measured operational efficiency over the full range of operating conditions of a unit with similar specifications, using baseline fuel. The efficiency tests shall be conducted following the guidance provided in relevant national/international standards;

	b) Highest of the efficiency values provided by two or more manufacturers for units with similar specifications, using the baseline fuel; c) Default efficiency 100%

Data / Parameter:	Specific gravity of the fossil fuel oil that would have been used in the baseline
Data unit:	t/kL
Description:	Specifict gravity of the fossil fuel in t/kL
Source of data used:	Energy data 2007, Sustainable Energy Authority, Table "Conversion Factors and Coefficients"
Value applied:	Provided in Table 14-16, Annex 3: Baseline information
Justification of the choice of data or description of measurement methods and procedures actually applied:	Official released statistic; publicly accessible and reliable data source
Any comment:	

Data / Parameter:	$FC_{i,y}$
Data unit:	M3/y, t/y
Description:	Amount of fossil fuel type i consumed in the grid system in year y
Source of data used:	Sustainable Energy Authority, Energy Data 2007, Table “Summary”
Value applied:	Provided in Table 9, Annex 3: Baseline information
Justification of the choice of data or description of measurement methods and procedures actually applied:	Official released statistic; publicly accessible and reliable data source (data for 2006-2008)
Any comment:	Used for calculation of OM

Data / Parameter:	$NCV_{grid,i,y}$
Data unit:	GJ /t
Description:	Net calorific value of the fossil fuel type i in year y
Source of data used:	Sustainable Energy Authority, Energy Data 2007, Table "Conversion Factors and Coefficients" and IPCC default values provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories.
Value applied:	Provided in Table 10, Annex 3: Baseline information
Justification of the choice of data or description of measurement methods and procedures actually applied:	For the local data which is out of uncertainty range provided in IPCC default values in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories, the closest IPCC default value is applied..
Any comment:	Annual monitoring for this parameter is not required during this crediting period, as Vintage of Data is chosen as Option 1 under this PoA.

Data / Parameter:	$EF_{grid,CO2,i,y}$
Data unit:	tCO2/GJ
Description:	CO2 emission factor of fuel type i in year y
Source of data used:	IPCC default values provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value applied:	Provided in Table 11, Annex 3: Baseline information
Justification of the choice of data or description of measurement methods and procedures actually applied:	One of the options described in the "Tool to calculate the emission factor for an electricity system (ver.02)".
Any comment:	Annual monitoring for this parameter is not required during this crediting period, as Vintage of Data is chosen as Option 1 under this PoA.

Data / Parameter:	$EG_{m,y}$
Data unit:	MWh
Description:	Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost / must-run power pants / units, in year y
Source of data used:	Sustainable Energy Authority, Energy Data 2007
Value applied:	Provided in Table 14-16, Annex 3: Baseline information
Justification of the choice of data or description of measurement methods and procedures actually applied:	Official released statistic; publicly accessible and reliable data source (data for 2005-2007)
Any comment:	Used for calculation of OM. Annual monitoring for this parameter is not required during this crediting period, as Vintage of Data is chosen as Option 1 under this PoA.

Data / Parameter:	$OXID_i$
Data unit:	-
Description:	Oxidation factor for fossil fuels
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 2: Energy, Table 1.4, pg 1.23-1.24
Value applied:	1.00
Justification of the choice of data or description of measurement methods and procedures actually applied:	Standard value recommended by UNFCCC (Neither the plant specific data nor the national / regional data is available.)

Any comment:	Used for calculation of OM. Annual monitoring for this parameter is not required during this crediting period, as Vintage of Data is chosen as Option 1 under this PoA.

E.7. Application of the monitoring methodology and description of the monitoring plan:

E.7.1. Data and parameters to be monitored by each SSC-CPA:

Data / Parameter:	H_y
Data unit:	h/y
Description:	Operation hours of installed plant (Continuous operation of the equipment/ system)
Source of data to be used:	On-site measurement at CPA level
Value of data applied for the purpose of calculating expected emission reductions in section B.5	-
Description of measurement methods and procedures to be applied:	Estimating the annual hours of operation of a system. Annual hours of operation can be estimated from total output (e.g. tonnes of grain dried) and output per hour if an accurate value of output per hour is available. If the project site has more than one system, record annually the number of systems operating (evidence of continuing operation, such as on-going rental/lease payments could be a substitute), if necessary using survey methods.
QA/QC procedures to be applied:	-
Any comment:	Data will be archived electronically and be kept at least for 2 years after the end of the last issuance of CERs for this activity. In the case the project site has more than one system, annual check of all appliances or a representative sample thereof to ensure that they are still operating or are replaced by an equivalent in service appliance.

Data / Parameter:	$EF_{FF,CO2,i,y}$
Data unit:	tCO2/GJ
Description:	CO2 emission factor of the fossil fuel in the baseline

<table>
<tr><td>Source of data to be used:</td><td>2006 IPCC Guideline for National Greenhouse Gas inventories, Table 1.4

<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 provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories</td><td>If a) is not available

<table>
<tr><td>Natural gas liquids</td><td>0.642</td></tr>
<tr><td>Other kerosene</td><td>0.719</td></tr>
<tr><td>Gas/diesel</td><td>0.741</td></tr>
<tr><td>Furnace oil (residual oil)</td><td>0.774</td></tr>
<tr><td>Naphtha:</td><td>0.733</td></tr>
<tr><td>Natural gas</td><td>0.561</td></tr>
</table>
</td></tr>
</table>
</td></tr>
<tr><td>Value of data applied for the purpose of calculating expected emission reductions in section B.5</td><td>-</td></tr>
<tr><td>Description of measurement methods and procedures to be applied:</td><td>Any future revision of the IPCC Guidelines should be taken into account</td></tr>
<tr><td>QA/QC procedures to be applied:</td><td>-</td></tr>
<tr><td>Any comment:</td><td>-</td></tr>
</table>

Data / Parameter:	$EG_{flow,y}$
Data unit:	NM3/hr
Description:	Quantity of hot air or steam
Source of data to be used:	Measurements undertaken by the facility operator of each CPA
Value of data applied for the purpose of calculating expected emission reductions in section B.5	-
Description of measurement methods and procedures to be applied:	Continuous monitoring by automatic flow meter. integrated hourly and at least monthly recording For measuring hot air, where it is not feasible (e.g. because of too high temperature), spot measurements can be used through sampling with a 90%

	confidence level and a 10% precision
QA/QC procedures to be applied:	Meters will be periodically calibrated according to manufacturer specifications. If applicable, measurement results shall be cross checked with records for sold/purchased electricity (e.g. invoices/receipts).
Any comment:	Data will be archived electronically and be kept at least for 2 years after the end of the last issuance of CERs for this activity. A parameter used to calculate $EG_{thermal,y}$

Data / Parameter:	$EG_{thermal}$
Data unit:	GJ
Description:	Net quantity of thermal energy supplied by the project activity during the year y
Source of data to be used:	Calculated by $EG_{flow,y}$ (t/y or m3/y)[15], T and P
Value of data applied for the purpose of calculating expected emission reductions in section B.5	-
Description of measurement methods and procedures to be applied:	Continuous monitoring, aggregated annually
QA/QC procedures to be applied:	-
Any comment:	Data will be archived electronically and be kept at least for 2 years after the end of the last issuance of CERs for this activity.

Data / Parameter:	$FF_{PJ,i,y}$
Data unit:	t/y
Description:	Quantity of fossil fuel type i combusted on-site in the project scenario in year y
Source of data to be used:	Onsite measurements at CPA level
Value of data applied for the purpose of calculating expected emission reductions in section B.5	-

15 Heat generation is determined as the difference of the enthalpy of the steam or hot fluid and/or gases generated by the heat generation equipment and the sum of the enthalpies of the feed-fluid and/or gases blow-down and any condensate returns. The respective enthalpies should be determined based on the mass (or volume) flows, the temperatures and, in case of superheated steam, the pressure. Steam tables or appropriate thermodynamic equations may be used to calculate the enthalpy as a function of temperature and pressure. In case of equipment that produces hot water/oil this is expressed as difference in the enthalpy between the hot water/oil supplied to and returned by the plant. In case of equipment that produces hot gases or combustion gases, this is expressed as difference in the enthalpy between the hot gas produced and all streams supplied to the plant. The enthalpy of all relevant streams shall be determined based on the monitored mass flow, temperature, pressure, density and specific heat of the gas. In case the project activity is exporting heat to other facilities, the metering shall be carried out at the recipients end and measurement results shall be cross checked with records for sold/purchased thermal energy (e.g. invoices/receipts). Metering the energy produced by a sample of the systems where the simplified baseline is based on the energy produced multiplied by an emission coefficient

Description of measurement methods and procedures to be applied:	· Use either mass or volume meters. In cases where fuel is supplied from small daily tanks, rulers can be used to determine mass or volume of the fuel consumed, with the following conditions: The ruler gauge must be part of the daily tank and calibrated at least once a year and have a book of control for recording the measurements (on a daily basis or per shift); · Accessories such as transducers, sonar and piezoelectronic devices are accepted if they are properly calibrated with the ruler gauge and receiving a reasonable maintenance; · In case of daily tanks with pre-heaters for heavy oil, the calibration will be made with the system at typical operational conditions.
QA/QC procedures to be applied:	· The consistency of metered fuel consumption quantities should be cross-checked by an annual energy balance that is based on purchased quantities and stock changes. · Where the purchased fuel invoices can be identified specifically for the CDM project, the metered fuel consumption quantities should also be cross-checked with available purchase invoices from the financial records.
Any comment:	Data will be archived electronically and be kept at least for 2 years after the end of the last issuance of CERs for this activity. Meters should be installed, maintained and calibrated according to equipment manufacturer instructions and be in line with national standards, or, if these are not available, international standards (e.g. IEC, ISO).

Data / Parameter:	$E_{PJ,y}$
Data unit:	MWh/y
Description:	Amount of grid electricity used at on-site in the project scenario
Source of data to be used:	On-site measurement at CPA level
Value of data applied for the purpose of calculating expected emission reductions in section B.5	-
Description of measurement methods and procedures to be applied:	Continuous monitoring by meter integrated hourly, at least monthly recording
QA/QC procedures to be applied:	Meters will be periodically calibrated according to manufacturer specifications.
Any comment:	Data will be archived electronically and be kept at least for 2 years after the end of the last issuance of CERs for this activity.

Data / Parameter:	$B_{biomass,PJ,y}$ (each type of fuel)
Data unit:	t/y
Description:	Biomass consumption during the year *y* in tons
Source of data to be used:	Own measurement at CPA level
Value of data applied	-

for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Use mass or volume based measurements. Adjust for the moisture content in order to determine the quantity of dry biomass. And/or perform an annual energy/mass balance that is based on purchased quantities and stock. If more than one type of biomass fuel is consumed, each shall be monitored separately
QA/QC procedures to be applied:	Measurement devices will be periodically calibrated according to manufacturer specifications. The amount will be double checked by the purchasing bills.
Any comment:	Data will be archived electronically and be kept at least for 2 years after the end of the last issuance of CERs for this activity.

Data / Parameter:	Wc
Data unit:	% water
Description:	Moisture content of the biomass residues
Source of data to be used:	Information provided by each biomass supplier (on site record) # In case of dry biomass, monitoring of this parameter is not necessary.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	-
Description of measurement methods and procedures to be applied:	The moisture content of biomass of homogeneous quality shall be monitored at least on a monthly basis. The weighted average should be calculated for each monitoring period and used in the calculations
QA/QC procedures to be applied:	Double checked by responsible persons of each CPA.
Any comment:	Data will be archived electronically and be kept at least for 2 years after the end of the last issuance of CERs for this activity.

Data / Parameter:	T
Data unit:	°C
Description:	Temperature of the energy produced
Source of data to be used:	Measurements undertaken by the facility operator of each CPA
Value of data applied for the purpose of calculating expected emission reductions in section B.5	-
Description of measurement methods and procedures to be applied:	Continuous monitoring by calibrated thermometer, integrated hourly and at least monthly recording
QA/QC procedures to	Meters will be periodically calibrated according to manufacturer specifications.

be applied:	
Any comment:	Data will be archived electronically and be kept at least for 2 years after the end of the last issuance of CERs for this activity. A parameter used to calculate $EG_{thermal,y}$

Data / Parameter:	P
Data unit:	kg/cm2
Description:	Pressure of the energy produced
Source of data to be used:	Measurements undertaken by the facility operator of each CPA
Value of data applied for the purpose of calculating expected emission reductions in section B.5	-
Description of measurement methods and procedures to be applied:	Continuous monitoring by calibrated meters, integrated hourly and at least monthly recording
QA/QC procedures to be applied:	Meters will be periodically calibrated according to manufacturer specifications.
Any comment:	Data will be archived electronically and be kept at least for 2 years after the end of the last issuance of CERs for this activity. A parameter used to calculate $EG_{thermal,y}$

Data / Parameter:	$NCV_{FF,i,y}$
Data unit:	GJ /t
Description:	Net calorific value of the fossil fuel type i in year y
Source of data to be used:	The following data sources may be used if the relevant conditions apply (Refer to Table 10 Annex 3):

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 provided in Table 1.2 of Chapter 1 of Vol.2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories	Applied if a) is not available

Natural gas liquids	44.2
Other kerosene	43.8
Gas/diesel	43.0
Furnace oil (residual oil)	40.4
Naphtha	44.5
Natural gas	48.0

<table>
<tr><td>Value of data applied for the purpose of calculating expected emission reductions in section B.5</td><td>-</td></tr>
<tr><td>Description of measurement methods and procedures to be applied:</td><td>For a) and b):
· Measurements should be undertaken in line with national or international fuel standards.
· 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</td></tr>
<tr><td>QA/QC procedures to be applied:</td><td>· 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.
<table>
<tr><th>Type of fuel</th><th>Lower</th><th>Upper</th></tr>
<tr><td>Natural gas liquids</td><td>40.9</td><td>46.9</td></tr>
<tr><td>Other kerosene</td><td>42.4</td><td>45.2</td></tr>
<tr><td>Gas/diesel</td><td>41.4</td><td>43.3</td></tr>
<tr><td>Residual fuel oil (Furnace oil)</td><td>39.8</td><td>41.7</td></tr>
<tr><td>Naphtha</td><td>41.8</td><td>46.5</td></tr>
<tr><td>Natural gas</td><td>46.5</td><td>50.4</td></tr>
</table>
· If the values fall below this range collect additional information from the testing laboratory to justify the outcome or conduct additional measurements., or apply the closest figure of the uncertainty range of IPCC 2006 is to be applied.
· The laboratories in a), b) or c) should have ISO17025 accreditation or justify that they can comply with similar quality standards.</td></tr>
<tr><td>Any comment:</td><td>Data will be archived electronically and be kept at least for 2 years after the end of the last issuance of CERs for this activity.
Meters should be installed, maintained and calibrated according to equipment manufacturer instructions and be in line with national standards, or, if these are not available, international standards (e.g. IEC, ISO).</td></tr>
</table>

Data / Parameter:	$NCV_{biomass}$
Data unit:	GJ/t, GJ/M3 (use a dry matter basis for biomass)
Description:	The net calorific value of the biomass
Source of data to be used:	Measurement by CM/E
Value of data applied for the purpose of calculating expected emission reductions in section B.5	-
Description of measurement methods and procedures to be	Measurement in laboratories according to relevant national/international standards. Measure the NCV based on dry biomass. Check the consistency of the measurements by comparing the measurement results with measurements

applied:	from previous years, relevant data sources (e.g. values in the literature, values used in the national GHG inventory) and default values provided in Table 1.2, Vol. 2 of the 2006 IPCC Guidelines (7.9~31.0 TJ/kt for wood/wood waste). If the measurement results differ significantly from previous measurements or other relevant data sources, conduct additional measurements
QA/QC procedures to be applied:	Meters will be periodically calibrated according to manufacturer specifications. Check the consistency of the measurements by comparing the measurement results with measurements from previous years, relevant data sources (e.g. values in the literature, values used in the national GHG inventory) and default values by the IPCC. If the measurement results differ significantly from previous measurements or other relevant data sources, conduct additional measurements.
Any comment:	Data will be archived electronically and be kept at least for 2 years after the end of the last issuance of CERs for this activity.

Data / Parameter:	D
Data unit:	km
Description:	Distance of biomass transportation
Source of data to be used:	Information provided by each biomass supplier (on site record)
Value of data applied for the purpose of calculating expected emission reductions in section B.5	-
Description of measurement methods and procedures to be applied:	Source of biomass to be reported by each supplier and recorded at each CPA level.
QA/QC procedures to be applied:	Double checked by responsible persons of each CPA.
Any comment:	Data will be archived electronically and be kept at least for 2 years after the end of the last issuance of CERs for this activity.

Data / Parameter:	-
Data unit:	-
Description:	Source of biomass used as fuel at project site
Source of data to be used:	Information provided by each biomass supplier (on site record)
Value of data applied for the purpose of calculating expected emission reductions in section B.5	-
Description of measurement methods and procedures to be	Source of biomass to be reported by each supplier and recorded at each CPA level.

applied:	
QA/QC procedures to be applied:	-
Any comment:	Data will be archived electronically and be kept at least for 2 years after the end of the last issuance of CERs for this activity.

Data / Parameter:	-
Data unit:	-
Description:	Duration of storing biomass resources (not exceeding 1 year)
Source of data to be used:	On-site measurement
Value of data applied for the purpose of calculating expected emission reductions in section B.5	-
Description of measurement methods and procedures to be applied:	When managing the storage period, make sure that the delivery date is written in the container of the biomass fuel.
QA/QC procedures to be applied:	-
Any comment:	Data will be archived electronically and be kept at least for 2 years after the end of the last issuance of CERs for this activity.

Data / Parameter:	-
Data unit:	-
Description:	Ratio of required amount of biomass type i by the project site to the amount of biomass of the same kind in the boundary of procurement
Source of data to be used:	
Value of data applied for the purpose of calculating expected emission reductions in section B.5	-
Description of measurement methods and procedures to be applied:	
QA/QC procedures to be applied:	Meters will be periodically calibrated according to manufacturer specifications.
Any comment:	Data will be archived electronically and be kept at least for 2 years after the end of the last issuance of CERs for this activity.

Data / Parameter:	$EF_{CO2,LE}$
Data unit:	tCO2/GJ

Description:	CO2 emission factor of the most carbon intensive fuel used in the country
Source of data to be used:	According to Table 12 of Annex 3: Furnace oil (residual oil)
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.774
Description of measurement methods and procedures to be applied:	Any future revision of the IPCC Guidelines should be taken into account
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	$BF_{LE,n,y}$
Data unit:	t/y
Description:	Quantity of biomass residue type *n* used for heat generation as a result of the project activity during the year *y* and for which leakage cannot be ruled out using one of the approaches L1, L2, L3 or L4 (tons of dry matter or liter)
Source of data to be used:	Own measurement at CPA level
Value of data applied for the purpose of calculating expected emission reductions in section B.5	-
Description of measurement methods and procedures to be applied:	Use mass or volume based measurements. Adjust for the moisture content in order to determine the quantity of dry biomass. And/or perform an annual energy/mass balance that is based on purchased quantities and stock. If more than one type of biomass fuel is consumed, each shall be monitored separately
QA/QC procedures to be applied:	Measurement devices will be periodically calibrated according to manufacturer specifications. The amount will be double checked by the purchasing bills.
Any comment:	Data will be archived electronically and be kept at least for 2 years after the end of the last issuance of CERs for this activity.

Data / Parameter:	NCV_n
Data unit:	GJ /t
Description:	Net calorific value of the biomass residue type *n*
Source of data to be used:	Measurement by CM/E

Value of data applied for the purpose of calculating expected emission reductions in section B.5	-
Description of measurement methods and procedures to be applied:	Measurement in laboratories according to relevant national/international standards. Measure the NCV based on dry biomass. Check the consistency of the measurements by comparing the measurement results with measurements from previous years, relevant data sources (e.g. values in the literature, values used in the national GHG inventory) and default values provided in Table 1.2, Vol. 2 of the 2006 IPCC Guidelines (7.9~31.0 TJ/kt for wood/wood waste). If the measurement results differ significantly from previous measurements or other relevant data sources, conduct additional measurements
QA/QC procedures to be applied:	Meters will be periodically calibrated according to manufacturer specifications. Check the consistency of the measurements by comparing the measurement results with measurements from previous years, relevant data sources (e.g. values in the literature, values used in the national GHG inventory) and default values by the IPCC. If the measurement results differ significantly from previous measurements or other relevant data sources, conduct additional measurements.
Any comment:	Data will be archived electronically and be kept at least for 2 years after the end of the last issuance of CERs for this activity.

E.7.2. Description of the monitoring plan for a SSC-CPA:

Monitoring and reporting framework is shown in Figure 3. The operation and management of each thermal energy generation facility is carried out by an operating partner or an owner of the factory where emission reduction is in place. Based on a project operation and monitoring manual, necessary monitoring data such as biomass data and thermal energy generation data will be collected, managed, and monitored by the entity responsible for operation and management of each facility. BEASL, which is the regulatory agency of the recorded data will undertake data checking and calculation of emission reduction. BEASL will also be responsible for communication with Designated Operational Entity for verification procedures (Refer to Figure4. Layout of Record Keeping System).

E.8 Date of completion of the application of the baseline study and monitoring methodology and the name of the responsible person(s)/entity(ies)

7th January 2011

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Annex 1

CONTACT INFORMATION ON COORDINATING/MANAGING ENTITY and PARTICIPANTS IN THE PROGRAMME of ACTIVITIES

Organization:	Bio Energy Association of Sri Lanka (BEASL)
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State/Region:	
Postfix/ZIP:	
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E-Mail:	Bioenergy @sltnet.lk
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Represented by:	
Title:	President
Salutation:	Mr.
Last Name:	Jayasinghe
First Name:	Parakrama
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Represented by:	
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First Name:	Ai
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Direct tel:	
Personal E-Mail:	Kawamura @exri.co.jp

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding is involved in this PoA and related CPAs and also this PoA does not include any diversion of ODA funds.

Annex 3

BASELINE INFORMATION

Baseline information is described in Section E.

Table 9. Electricity Statistical Data of Sri Lanka

Year	Low Cost / Must Run				Thermal Generation					Total Generation	% of low-cost / must run
	CEB Hydro	CEB Wind	SPP Hydro	Total	CEB	IPP	SPP	Hired	Total		
2003	3,190	3.39	121.0	3,314	2,248	1,746	1.2	394	4,389	7,704	43.0%
2004	2,755	2.70	207.0	2,965	2,507	2,087	1.5	509	5,105	8,069	36.7%
2005	3,223	2.44	280.0	3,505	2,162	3,177	2.3	-	5,341	8,847	39.6%
2006	4,290	2.31	346.4	4,638	1,669	3,136	1.7	-	4,807	9,445	49.1%
2007	3,603	2.27	345.0	3,950	2,336	3,559	1.1	-	5,896	9,846	40.1%
Total	17,060	13.11	1299.4	18,373	10,921	13,705	7.8	903	25,537	43,910	41.8%

Source: Sustainable Energy Authority, Energy Data 2007, Table Summary

Table 10. Net Calorific Value ($NCV_{grid,i,y}$, $NCV_{FF,i,y}$)

Energy Data 2007				2006 IPCC guideline, Vol2, Table 1,2			Applied Figure
Type of fuel	NCV (Mcal/t)	Conversion (TJ/MCal)	NCV (TJ/t)	Type of fuel	Lower (TJ/t)	Upper (TJ/t)	NCV (TJ/t)
Furnace Oil	9,800	4.186×10^{-6}	41.0	Residual fuel oil	0.398	0.417	0.410
Gas/Diesel Oil	10,500	4.186×10^{-6}	44.0	Gas/diesel	0.414	0.433	0.433
Naphtha	10,900	4.186×10^{-6}	45.6	Naphtha	0.418	0.465	0.456
Residual Oil	9,800	4.186×10^{-6}	41.0	Residual fuel oil	0.398	0.417	0.410

Source: Table" Conversion Factors and Coefficients" of Energy Data 2007 (Sustainable Energy Authority), and Table 1.2 of Chapter 1 of Vol.2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories

Table 11. Effective CO2 Emission Factor ($EF_{grid,CO2,i,y}$, $EF_{FF,CO2,i,y}$)

Fuel Type	Effective CO2 emission factor [EF_i] (tCO2e/TJ)	Remarks
Furnace Oil	77.4	Residual Fuel
Gas/Diesel Oil	74.1	Gas/Diesel Oil
Naphtha	73.3	Naphtha
Residual Oil	77.4	Residual Fuel

Source: 2006 IPCC Guideline for National Greenhouse Gas inventories, Table 1-4

Table 12. Combustion Efficiency ($OXID_i$)

Type of Fuel	Combustion Efficiency
For all types of fuel	1.00

Source: 2006 IPCC Guideline for National Greenhouse Gas inventories, Table 1-4

Table 13. CO2 Emission Coefficient ($COEF_i$)

Fuel Type	Net Calorific Value [NCV] (TJ/t)	Effective CO2 Emission Factor [EF_i] (tCO2e/TJ)	Oxidation Factor [$OXID_i$] -	CO2 Emission Coefficient [$COEF_i$] (tCO2/t)	Remarks
	(a)	(b)	(c)	(a)*(b)*(c)	
Furnace Oil	0.410	77.4	1.0	3.173	Residual Fuel
Gas/Diesel Oil	0.433	74.1	1.0	3.209	Gas/Diesel Oil
Naphtha	0.456	73.3	1.0	3.342	Naphtha
Residual Oil	0.410	77.4	1.0	3.173	Residual Fuel

Table 14. OM Calculation Data (Simple OM, 2005)

Fuel Type	Fuel Consumption 1000kL/y	Density of Fuel t/m3	COEF (tCO2/t_fuel)	Emission (tCO2/y)	Electricity Generation (GWh)	Grid Emission Factor (kg_CO2/kWh)
	(a)	(b)	(c)	(d)	(e)	(f)
Furnace Oil	500	0.972	3.173	1,542,554		
Gas/Diesel Oil	306	0.846	3.209	830,733		
Naphtha	180	0.690	3.342	415,076		
Residual Oil	270	0.972	3.173	832,979		
Total	-	-	-	3,621,343	5,341	0.678
Source	Energy Data 2007, Table "Fuel Consumption in Power Plants"	Energy Data 2007, Table "Conversion Factors and Coefficients"		(a)*(b)*(c)	Energy Data 2007, Table "Summary"	(d)/(e)

Table 15. OM Calculation Data (Simple OM 2006)

Fuel Type	Fuel Consumption 1000kL/y	Density of Fuel t/m3	COEF (tCO2/t_fuel)	Emission (tCO2/y)	Electricity Generation (GWh)	Grid Emission Factor (kg_CO2/kWh)
	(a)	(b)	(c)	(d)	(e)	(f)
Furnace Oil	469	0.972	3.173	1,446,916		
Gas/Diesel Oil	308	0.846	3.209	836,163		
Naphtha	91	0.690	3.342	209,844		
Residual Oil	266	0.972	3.173	820,639		
Total	-	-	-	3,313,561	4,807	0.689
Source	Energy Data 2007, Table "Fuel Consumption in Power Plants"	Energy Data 2007, Table "Conversion Factors and Coefficients"		(a)*(b)*(c)	Energy Data 2007, Table "Summary"	(d)/(e)

Table 16. OM Calculation Data (Simple OM 2007)

Fuel Type	Fuel Consumption 1000kL/y	Density of Fuel t/m3	COEF (tCO2/t_fuel)	Emission (tCO2/y)	Electricity Generation (GWh)	Grid Emission Factor (kg_CO2/kWh)
	(a)	(b)	(c)	(d)	(e)	(f)
Furnace Oil	513	0.972	3.173	1,582,660		
Gas/Diesel Oil	466	0.846	3.209	1,265,103		
Naphtha	138	0.690	3.342	317,303		
Residual Oil	296	0.972	3.173	913,809		
Total	-	-	-	4,078,875	5,896	0.692
Source	Energy Data 2007, Table "Fuel Consumption in Power Plants"	Energy Data 2007, Table "Conversion Factors and Coefficients"		(a)*(b)*(c)	Energy Data 2007, Table "Summary"	(d)/(e)

Table 17. OM Calculation

Fuel Type	2006 (kg_CO2/kWh)	2007 (kg_CO2/kWh)	2008 (kg_CO2/kWh)	Average (kg_CO2/kWh)
Simple OM	0.678	0.689	0.692	0.686

Source: Calculated from Table 14-16

Table 18. Most Recently Built Power Plant Data Used for BM

No.	Plant	Date of Commissioning	Fuel Type	Fuel Consumption (million Ltr)	Generation of the Unit in 2007 (million kWh)
1	ACE- Embilipiyiya	2004, Mar 2005	Furnace Oil	160	663
2	Heladhanavi	Oct 2003	Furnace Oil	158	748
3	AES-Kelanitissa	Mar 2003	Auto Oil	209	789
			Total of 1-3	528	2,200
			Total grid generation (million kWh)		9,814
			Proportion within the grid		22.4%

Source: Generation data is from "Generation Summary", System Control and Operations, Ceylon Electric Board (2008), Fuel consumption data is from the data provided by Sustainable Energy Authority

Table 19. BM Calculation Data

Fuel Type	Fuel Consumption 1000kL/y	Density of Fuel t/m3	COEF (tCO2/t_fuel)	Emission (tCO2/y)	Electricity Generation (GWh)	Grid Emission Factor (kg_CO2/kWh)
	(a)	(b)	(c)	(d)	(e)	(f)
Fuel Oil	318	0.972	3.173	981,681		
Auto Oil	209	0.846	3.209	568,482		
Naphtha	0	0.690	3.342	0		
Heavy Oil	0	0.972	3.173	0		
Total	-	-	-	1,550,163	2,200	0.705
Source	SEA Data	Energy Data 2007, Table "Conversion Factors and Coefficients"		(a)*(b)*(c)	CEB data	(d)/(e)

Annex 4

MONITORING INFORMATION

Refer to Section D. for the Monitoring Information

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