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

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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):

"Industrial Fuel Switch by Gliricidia Branch Programmatic CDM in Sri Lanka"
Version 1
1 March 2010

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

The "Industrial Fuel Switch by Gliricidia Branch Programmatic CDM in Sri Lanka" (hereafter, the "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 assumed capacity of heat generation facilities to be installed by the 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 of this Project is the Bioenergy Association of Sri Lanka (hereafter, BEASL), which is a non-government organization promoting the use of indigenous resources for renewable energy generation and thus reduce the increasing dependence on imported fossil fuels throughout Sri Lanka. This PoA is a voluntary project implemented by the BEASL.

The owner of the biomass energy generating facility will be the owner of the CPA. There are two cases where companies using traditional fossil fuel at present become the owner of CPA. First case where biomass energy generating facilities own and operate and the second case where owner of CPA supply heat to companies currently using fossil fuel and hence replace the usage of fossil fuel. It is anticipated that the monitoring will be carried out by an operating partner formed from multiple CPA who wlll also be responsible for the maintenance of equipments. EX Corporation, as Japanese CDM consultants will provide technical support to BEASL for taking the role of the coordinating/managing entity.

2. Policy/measure or stated goal of the PoA

The goals of the PoA are to reduce the dependence on (imported) fossil fuels as an energy source and to generate additional income for the local farmers to enhance their quality of life.

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

By promoting the implementation of environmentally friendly biomass utilization technology under this PoA, emission of greenhouse gas (hereafter, GHGs) can be avoided by replacing industrial thermal energy generated from fossil fuel combustion with renewable energy.

Furthermore, the project activity will create a sustainable additional source of income for the local farmers to enhance their quality of life.

3. Confirmation that the proposed PoA is a voluntary action by the coordinating/managing entity.

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 to reduce greenhouse gas emissions, as well as the mitigation of local environmental problems including air pollution. In addition, effective utilization of biomass resources and creation of its market will contribute to generate additional income for the farmers in Sri Lanka. 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 and 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 and if we assume that 50% of the energy demand of the country is supplied from this source, then it is expected to result in a saving of LKR 600 million/y worth of foreign currency. This will lead to the socioeconomic development of agricultural communities throughout Sri Lanka.
- Enhancement of rural economy: In the remote areas of Sri Lanka where the poor population is concentrated, apart from the income from the cultivation and usage of Gliricidia wood the economic impacts on rural economy is expected to be significant, which will contribute to tackle the problem of poverty.

- 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: New jobs may be created by this Project in the areas of operation and supply of biomass resources and maintenance of biomass energy generation facilities.

Environmental Benefits
- Reduction of greenhouse gas emissions
- Emissions Reduction of air pollutants (SOx, Nox): SOx, NOx emission will be reduced through replacing 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. Coordinating or managing entity of the PoA as the entity which communicates with the Board

   Bioenergy 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 Corporation	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.

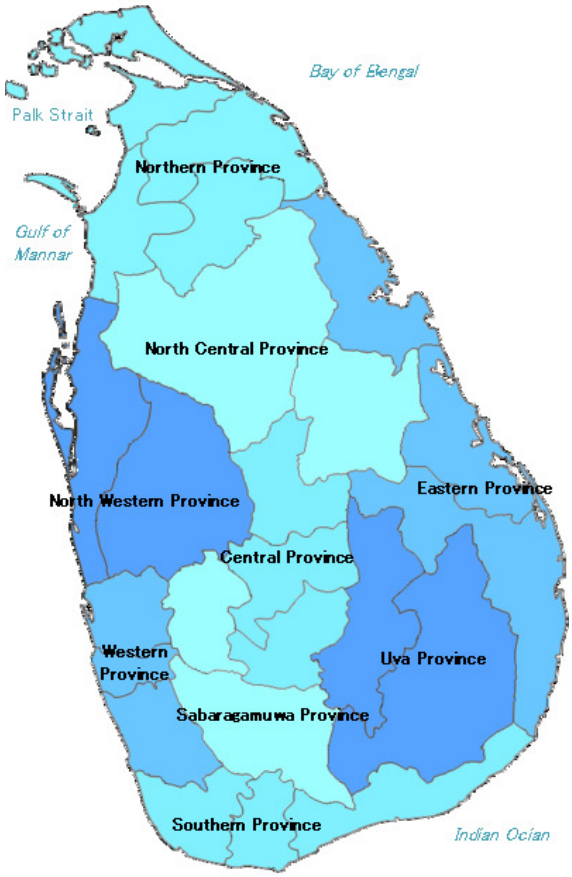

Figure 1. Map of Sri Lanka

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:

Technologies applied in the CPAs under this PoA are the ones to generate thermal energy from biomass resources for replacing industrial fossil fuel based thermal energy including gasification technology and direct combustion technology (boiler).

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

The PoA will consist of installing biomass based thermal energy generation systems to replace fossil fuels with biomass fuel. There are two types of systems applicable to this PoA, Gasification system and Direct Combustion System.

The outlines of the applicable systems are described as follows:

(i) Gasification system

Gasification is a technology to convert biomass fuel to a synthetic mass containing 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.

In this PoA, we are expecting to use the biomass gasification furnace for timber , which is a technology based on Indian Expertise and converted by EnerFab (Pvt) Ltd,.Currently, 10 of these furnaces are operating under the assistance of foreign governments. The system is shown in the following diagram. 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 parame

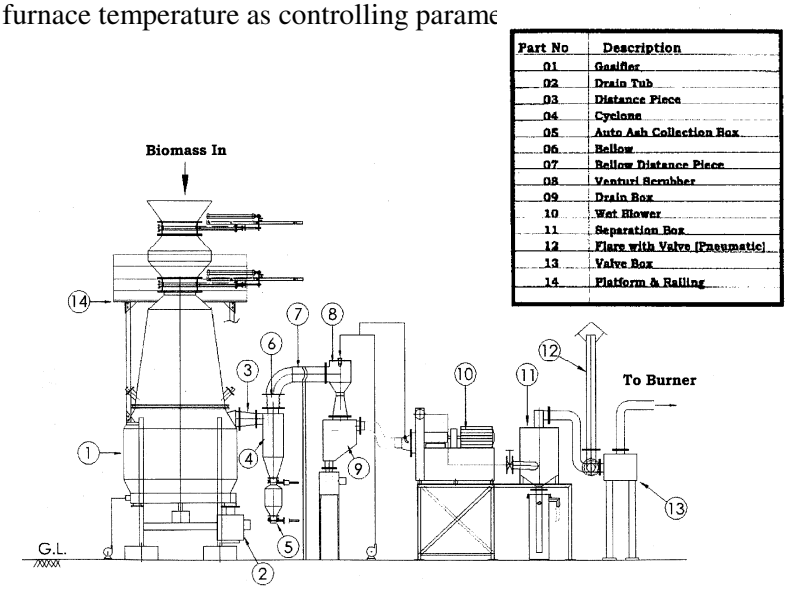

Figure2. Gasification System

(ii) Direct combustion system

Among heat using technologies using biomass fuel, the system that directly combusts and uses wood based boilers is the most common system and is also used widely in Sri Lanka. In the most common systems, heat obtained from combustion of fuel is transmitted to water and converted to steam and hot water which is utilized by the boiler. The wood based boiler that directly combusts wood based biomass to generate energy has simpler equipment and can be controlled easily as compared to gasification furnaces that have 2 processes of gasification and gas combustion to generate energy.

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

- Located within Sri Lanka
- A project to implement baseline and monitoring methodology AMS-I.C. “Thermal energy production with or without electricity (Version 16)”

- A project to generate thermal energy from biomass resources which replaces fossil fuel origin industrial thermal energy
- The technology to be applied must be the thermal energy conversion technology from biomass resources Maximum thermal energy generation volume less than or equal to 45MWth
- Monitors and collects appropriate data on the parameters listed in A.4.4.2
- 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.） No CDM projects or CPA should be registered within the project area or the same physical area.
- The project must be approved by the coordinating entity and DOE prior to its incorporation into the PoA.
- The entity responsible for the monitoring work must be reported to the coordinating entity prior to its incorporation into the PoA..
- 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”.
- Biomass resources used by a project activity must comply to the “Definition of renewable biomass (EB23, Annex18)”.
- 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 are biomass from dedicated plantation, the following criteria must be satisfied

- When CPAs use biomass fuel procured from newly cultivated land, CPAs need a written clarification between the cultivator and coordinating managing entity 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
- 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).

(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.

- Any national or regional forestry, agriculture and nature conservation regulations are complied with,
- The dedicated plantation will be planted by direct planting and/or seeding,
- The biomass to be used in this project are to be short rotation crops[1] that naturally regenerate in a short time after harvesting,
- Grazing will not occur within the plantation, and
- 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
- enhancing rural economy by utilizing and creating market of 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 regarding industrial thermal energy utilization. In this policy, significant focus is placed on the promotion of biomass resources especially 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 2006 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 even since before, a number of biomass utilizing facilities for fuel purpose 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 and supply areas or biomass are located nearby and hence there are no issues regarding procurement of biomass. Cases where biomass fuel is used in relatively large industrial heat using facilities are very limited. However, due to factors like the distance between supply and demand areas of Gliricidia , uncertainty in the stable procurement of Gliricidia and also due to the fact that taking actions to solve these problems will have adverse impacts on the main business, efforts to utilize Gliricidia have been extremely rare, mainly due to the barriers indicated in E.5.1. In case of Gliricidia, the supply areas are distributed 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):

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

A.4.4.1. Operational and management plan:

The following operational and management arrangements will be implemented by the coordinating/managing entity for the implementation of the PoA:

(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.

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

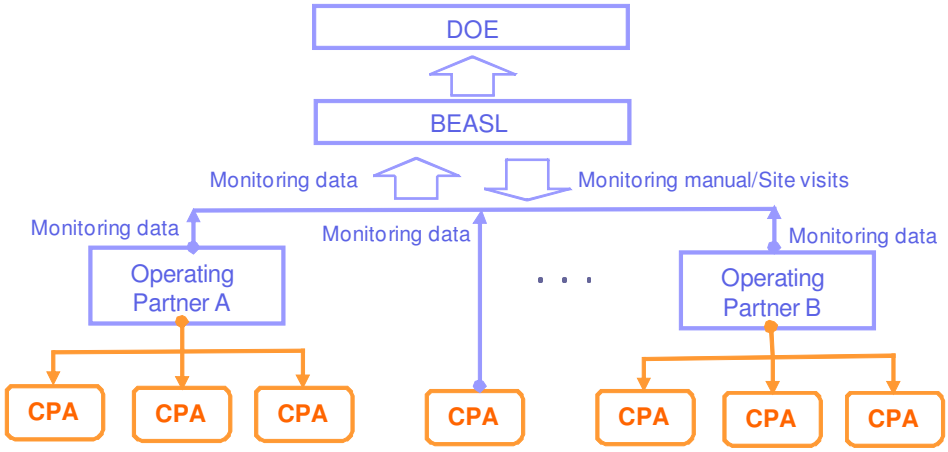

Figure3. Layout of Record Keeping System

(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 C of the Simplified Modalities and Procedures for Small-Scale CDM project activities defines that a registered SSC-CPA shall be deemed to be a debundled component of a large project activity if there is a registered small-scale CDM project activity or an application to register another small-scale CDM project activity:

- With the same project participants;
- In the same project category and technology/measure;
- Registered within the previous 2 years; and
- Whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point.

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[2])" 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 reductions of anthropogenic emissions of greenhouse gases due to CPAs under the PoA.

Table 2. Monitored Parameters

Monitoring Item	Unit	Monitoring Method	Monitoring Frequency	Monitoring Body
Option1 Boiler and Gasifier more than 45kW capacity				
Energy production flow	M3/y, t/y	Flow meter	Continuous	
Energy production temperature	℃	Thermometer	Continuous	
Energy production pressure (only in the case of steam)	Bar	Pressure gauge	Continuous	
Amount of biomass feed (type wise)	t/y	Bills	Daily	
Fossil fuel used (only when used)	t/y	Bills	Daily	
Option2 Gasification below than 45kW capacity				
Biomass feed amount (type wise)	t/y	Bills	Daily	
Fossil fuel used (only when used)	t/y	Bills	Daily	

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 managing entity will assist the monitoring process at the CPA level by distributing monitoring manuals

[2] $45MW_{th}$ for thermal energy project.

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 and 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):

This PoA does not include any public fund.

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

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

1st of March 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 ☒

In Sri Lanka, the Environmental Impact Statement (EIS) process is stated in the National Environmental Act No.56. Projects that will be required to go through the Environmental Impact Assessment Process are listed in the Gazette no 772/22 of 24th June. 1993 and 859/14 of 23rd February 1995. The projects are prescribed according to two categories;

1. By type and magnitude
2. By location

The project Approving Agency is the government agency responsible for administering the EIA Process. The Ceylon Tourist Board, The Ministry of Agriculture, Coast Conservation Department, Central Environmental Authorities are examples. If the project is located in the North-Western Province, the North-Western Provincial Environmental Authority should be contacted. If the project is located within one mile from the boundary of a National Reserve the Dept. of Wild Life Conservation should be contacted.

According to the Guideline for Implementing the Environmental Impact Assessment (EIA) Process the process in Sri Lanka is as follows.

Determine the need for EIA
Project proponent need to verify with the Central Environmental Authority, or refer to the Government Gazette No.772/22 of 24th June 1993 and No.859/14 of 23rd February 1995 to determine if the project proposal will be required to go through the EIA process.

1. Submission of Preliminary Information（if applicable）
As soon as the project concept is developed and the location of the project is decided (not after the full feasibility stage), the project proponent needs to submit some **Preliminary Information** about the project to the Project Approving Agency.

2. Preparation of Terms of Reference (ToR)
Based on the Preliminary information the Project Approving Agency will prepare Terms of Reference (ToR) for the EIA report by conducting one or more "scoping" meetings. If the project is very large in extent and magnitude, the Project Approving Agency may ask for more details about the project.

According to the type of the project, an Initial Environmental Examination might be sufficient with no need to carry out a full EIA. The preparation of ToR and the implementation of the EIA is approved within 116 days from the submission of major information. The Initial Environmental Examination is approved in an even shorter time span.
The EIA is carried out by a consultant appointed by the project proponent. The EIA report is presented to the project approving agent. The EIA generally takes from 3 months to a year although there is no legal requirement on time span.

3. Review of Terms of Reference (ToR)
Submitted ToR will be revised by a Technical Evaluation Committee appointed by the Project Approving Agency. Then the project Approving Agency will decide on whether to give permission or not and the Central Environmental Authority will ensure the effectiveness of the permission.

4. Project implementation (project implementation timing)
The permission shall remain in force for a period of one year from the Effective Date, therefore if the project is not initiated within a year, the project proponent have to reapply to the Project Approving Agency.

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 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 in case of using biomass from 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). 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). This project is excluded from the EIA requirements of the Host Country and EIA at the CPA level is not required and the EIA analysis 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. Further stakeholders' comments, especially at the CPA levels must be collected through interviews with local agencies and citizens who are specifically related to the CPAs.

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

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

- 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 Corporation as a Japanese CDM consultancy and Mahatma Gandhi Centre as a 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 specifically 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 a positive opportunity for Sri Lanka to gain financial support from foreign countries such as Japan in order to shift its energy supply to renewable sources which results in reduction of dependence on imported fossil fuel, as well as to create opportunities to provide positive impacts to rural agricultural communities. Moreover, no direct objections to the implementation of the Project were 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 16)"* was applied to the baseline and monitoring methodologies in the PoA. Methodological Tool in Annex 12 of the EB 35 meeting Report: *"Tool to calculate the emission factor for an electricity system (Version 02)*" was 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.16). 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.16)

Justifications of the choice of SSC AMS-I.C (ver.16) are described in Table 3.

Table 3. Applicability Criteria and Justification

Applicability Criteria of SSC AMS-I.C (ver.16)	Justification of Applicability
1. This category comprises renewable energy technologies that supply users[3] 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. Regarding "renewable energy", more details and elaboration is provided in "(2) Applicability to the definition of renewable biomass".
2. Biomass-based co-generating systems that produce heat and electricity are included in this category. For the purpose of this methodology "Cogeneration" shall mean the simultaneous generation of thermal energy and electrical and/or mechanical energy in one process. Cogeneration system may supply one of the following (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

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

3. The total installed/rated thermal energy generation capacity of the project equipment is equal to or less than 45 MW[4] thermal	All CPAs under the PoA will apply biomass energy generation facilities producing less than, or equal to, 45 MW of thermal energy
4. For co-fired[5] 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	N/A (None of the CPAs will employ co-fired systems)
5. 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.	N/A (None of the CPAs will employ co-generation systems)
6. 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.	It this is the case, 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.
7. 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.
8. The capacity limits specified in the above paragraphs apply to	All CPAs under the PoA will

[4] 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.

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

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 not exceed 45 MW_{th} and should be physically distinct[6] from the existing units.	apply the biomass energy generation facilities producing less than, or equal to, 45 MW of thermal energy

(2) Applicability conditions of AM0042 for Biomass

In I.C.（Ver 16）in addition to Table 3, 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 4. 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. More details and elaboration is provided in "(2) 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 consisting of chipping and drying without any chemical treatment. Hence this condition is applicable
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 "(2) 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)

[6] 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".

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 fact 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	Included in the eligibility criteria of this PoA and hence this condition will be applicable to all CPAs under the PoA
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.	Included in the eligibility criteria of this PoA and hence this condition will be applicable to all CPAs under the PoA
(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	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

used as feedstock in the absence of the project activity can be clearly identified throughout the crediting periods; and (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-piled7 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)	the branches are not used immediately but are left to decay in backyards of farms which ultimately degrade over time. Cinnamon, which is 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 5. Applicability Criteria and Justification

The biomass is originating from land areas that are **forests**	(a) The land area remains a forest8; 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

[7] 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.

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

	(c) Any national or regional forestry and nature conservation regulations are complied with
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 (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
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	
5. The biomass is the non-fossil fraction of an **industrial** or **municipal waste**.	

[Applicability to the proposed project activity]

Usage of new cultivation and biomass residue, adopted in this project apply to 2 and 4 of Table5 . Hence, biomass used in this project is renewable.

- New cultivation:

New cultivation to be adopted by this project assumes the following conditions and as it satisfies the three conditions specified in 2 in Table5, 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 that is to be planted, fast growing trees that have branches separating from trunks which grow to 2-3m in a few months and branches of which are cultivated periodically are used and hence here 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.

- Biomass residue:

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 fence or as 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 currently not-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 and includes the physical and geographic location of each biomass thermal energy generating facility. Significant amounts of GHG emissions are to be reduced within the project boundary of the PoA because small amount of grid electricity may be used for operating the facility and fossil fuel will also be used for transporting biomass resources after the project implementation.

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
iii) Carbon dioxide (CO2) emissions from increment of transportation 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 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 industry.

Apart from cases where a substantial amount of biomass is being generated at the factory itself as by-product of its process or when biomass is easily accessible from areas near to the factory, biomass fuel is not regarded as an option that is dependable. The 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,
- 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 estate, pepper cultivation land and coconuts plantations in some cases for shades, as live fence or as companion crop. As its growth rate is very high, it needs to be constantly pruned and as stated in E.4.1, as there is no system that connects the farms with the people with 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 course of the project activity, in case where plants like Gliricidia etc that can be harvested in short cycles is 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. The existence of the following factors act as barriers to prevent the implementation of a project activity (a typical CPA without CDM) and hence GHGs will continue to be emitted into the atmosphere through consumption of the current fossil fuel.

Determination of additionality will be established 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.

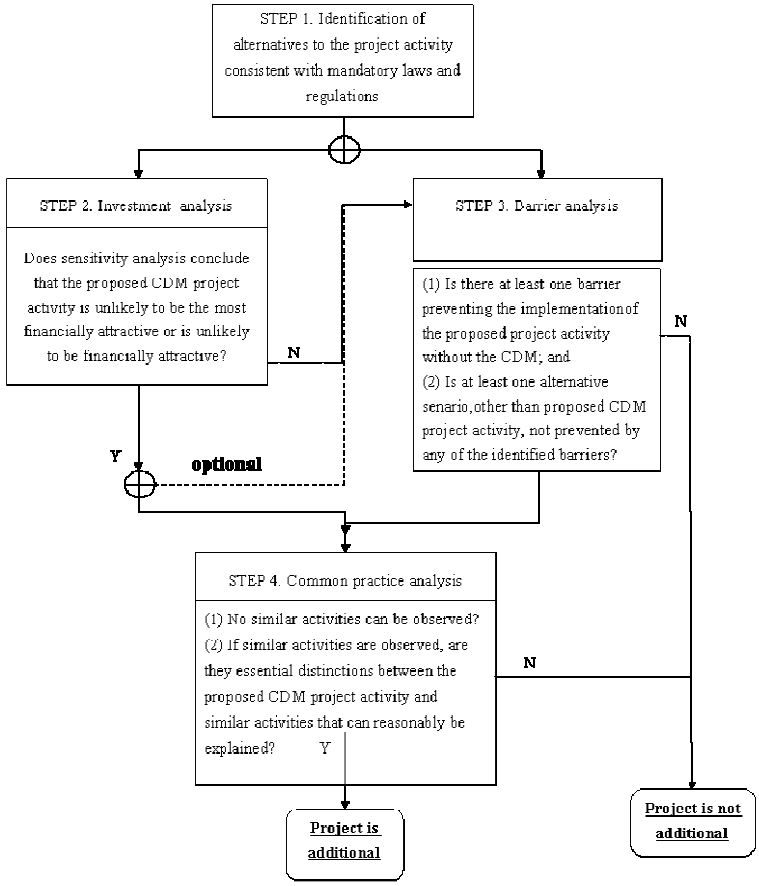

Figure4 Steps of establishment of additionality

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) Alternative2: 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 national and local and regulations. A typical CPA under this PoA is therefore not the only alternative amongst those considered that is in compliance with mandatory regulations.

TEP2. 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. The 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 although the private banks are expected to be affected, the interest rate is expected to be over 10%. However, the value of 8% is taken as benchmark here taking account of conservativeness.

a) Internal Rate of Return (IRR) Calculation
The Sri Lanka government provides subsidy to fuel oil from the viewpoint of preservation of industry and the price of the fuel is fixed as LKR32/L. For heat using facilities using fuel oil like gasification facilities using wood based biomass in this CDM , or business involving the transformation to boiler facilities, it is very hard to expect a business with value of over 8%.

To demonstrate benchmark analysis, each CPA must conduct the *ex ante* IRR (15years after tax) calculation and compare it with the determined benchmark (8%). 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 (20years)

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 smallscale 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 8 facilities in Sri Lanka that utilize gasification of Grilicidia all of which have received initial investment support from foreign governments and there are no facilities 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 exists. Hence, as the ratio of medium to large scale heat using plants that uses biomass fuels based on Gliricidia is less than 1%, barrier due to prevailing practice is expected.

In addition, there are obvious risks in implementation of the proposed project described as follows:

- In case the price for crude oil becomes less than procurement cost for biomass based fuel such as Gliricidia due to a decrease in price of the crude oil, the cost will become larger than companies using fossil fuel and there is a chance that it will have a negative impact on profit of the company. (In two (2) sites amongst the eight (8) existing gasifiers using Gliricidia, due to the decrease in domestic price of fuel oil impacted by a decrease in price of the crude oil, the operation of the facilities has stopped and are continuing to use fossil fuel).
- The procuring price for renewable wood based biomass is expected to be impacted by the domestic supply and it is necessary to hedge the potential risks by enhancing the project profitability with CER sales and reliability by incorporating under the PoA framework.

Due to these reasons, it can be said that barrier 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 area to demand area, a lot of effort and investment will become necessary in areas that are not the main business in order to provide a stable supply of biomass demanded by the client. This will not only put other non-financial pressure on manufacturers but will also result in additional load such as negotiations with farms. This fact is becoming the major factor that is preventing investment on biomass using facilities.

One particular factory that had plans to replace diesel oil has put its plan on hold for 5 years. Even if they expect the project to be profitable, because they are suspicious about the stable supply of biomass fuel, in this program, it is necessary to prepare a system for stable supply of biomass within the CDM framework by matching suppliers with people with demand.

(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 that 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 large hindering factor for these ESCO companies.
Further, providing guarantees is necessary when borrowing is necessary and for ESCO companies who are not well off financially it is very difficult to reach the stage of project formation although the demand for energy supply exists.

During discussions with Sri Lanka Central Bank, it was understood that investment in businesses involving transformation of fuel from fossil fuel to biomass fuel was difficult because of the various uncertainties involved (especially if the company involved is a small to medium enterprises), but when the project becomes a CDM project and guarantee can be provided by a Japanese or other investors, the attitude toward the risk factors associated with the project was thought to improve and hence the chances

of investment in the project improved too. 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 a financial institution. 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", eight (8) facilities using Gliricidia as fuel exist in Sri Lanka, but all of these facilities are invested by foreign governments and no facility based solely on private investment exists. 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 of industry, rubber wood is sometimes used as fuel for boiler. However, rubber wood has established market and used as timber or fuel purpose. 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 main common 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 little and it can be supplied from plants grown on their own land or one or two supply sources nearby their own location, which makes biomass procurement very easy and cheap due to short transportation. Therefore, this option is obviously different from the proposed project where a significant amount of biomass resources must be procured from many distant suppliers.

Therefore, 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.

Key additionality criteria:

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 8%. If this criteria 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.

Each SSC-CPA-DD will include a discussion of additionality addressing each of these key criteria. CPA under PoA must meet at least one of criteria b) or c) to meet the additionality requirement.

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 16)"*.

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 in Annex 12 of the EB 35 Meeting Report: *"Tool to calculate the emission factor for an electricity system (Version 02)"* (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 16, 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 Meeting Report: *"Tool to calculate the emission factor for an electricity system (Version 02)"* (referring to E.6.2.)

I. BASELINE EMISSIONS

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

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

$BE_{thermal,CO2,y}$	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 (TJ)
$EF_{FF,CO2}$	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 / TJ)
$\eta_{BL,thermal}$	The efficiency of the plant using fossil fuel that would have been used in the absence of the project activity

For *ex-ante* calculation, $(EG_{thermal,y}/\eta_{BL,thermal})$ is derived by the equation (2).

$$EG_{thermal,y}/\eta_{BL,thermal} = FF_{BL,y} * NCV_{FF} \quad \ldots\ldots\ldots(2)$$

$FF_{BL,y}$	Amount of fossil fuel to be replaced by the biomass fuel(kt/y)
NCV_{FF}	Heat value of the fossil fuel to be replaced by biomass fuel (TJ/kt)

Therefore, equation (1) can be translated as equation (3) as follows:

$$BE_{thermal,CO2,y} = FF_{BL,y} * NCV_{FF}*EF_{FF,CO2} \quad \ldots\ldots\ldots(3)$$

$BE_{thermal,CO2,y}$	The baseline emissions from steam/heat displaced by the project activity during the year y (tCO2e)
$FF_{BL,y}$	Amount of fossil fuel to be replaced by the biomass fuel(kt/y)
NCV_{FF}	Heat value of the fossil fuel to be replaced by biomass fuel (TJ/kt)
$EF_{FF,CO2}$	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 / TJ)

II. PROJECT EMISSIONS

Project emissions are composed of the following two components:

a) Emissions from on-site consumption of fossil fuels due to the project activity

b) Emissions from electricity consumption by the project activity

$$BE_{ww,y} = \{PE_{on\text{-}site,y} + PE_{power,y}\} \quad \ldots\ldots\ldots(4)$$

where :

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

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

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

The emission amount when fossil fuel is consumed onsite during project an activity is obtained from the following equation.

$$PE_{on\text{-}site,y} = FF_{PJ,y} * NCV_{FF} * EF_{FF,CO2} \quad \text{.....(5)}$$

$PE_{on\text{-}site,y}$	Project emissions from fossil fuel consumption in year y ($tCO2_e$)
$FF_{PJ,y}$	Amount of fossil fuel used in the grid electricity (kt/y)
NCV_{FF}	Net calorific value of the fossil fuel to be replaced by biomass fuel (TJ/kt)
$EF_{FF,CO2}$	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 (tCO_2e /TJ)

B) Emissions from electricity consumption by the project activity ($PE_{grid,y}$)

STEP 1. Emission Factor Calculation

Step 1-1. Select an Emission Factor Option

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 open to public. 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. On the other hand, 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", 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 latest data, the OM calculation method to be applied to each grid system in Sri Lanka is determined as shown in Table 6.

Table 6. OM Calculation Method to Be Applied to the Grid Systems in Sri Lanka

Proportion of Electricity Supply by Low-cost/Must-run Power Plants (2001-2005)	Option applied
41.1% < 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 in 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 2004-2006.. The formula used is shown in based on data on fuel consumption and net electricity generation of each power plant / unit (Option A).

$$EF_{grid,OM,y} = \frac{\sum_{i,m} FC_{i,m,y} \cdot NCV_{i,y} \cdot EF_{CO2,iy}}{\sum_{m} EG_{m,y}} \quad \text{..... (6)}$$

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)
$NCV_{i,y}$	:	Net calorific value (energy content) of fossil fuel type *i* in year *y* (GJ/mass or volume unit)
$EF_{CO2,i,y}$	:	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, calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_{m} GEN_{m,y} \times EF_{EL,m,y}}{\sum_{m} GEN_{m,y}} \quad \ldots\ldots(7)$$

Where,

$EF_{grid,BM,y}$: Build margin CO2 emission factor in year y (tCO2/MWh)
$GEN_{m,y}$: 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:

$$CEF_y = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM} \quad \ldots\ldots(8)$$

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 7. CPAs under PoA can use these figures if new electricity generation statistic data is not available.

Table 7. Emission Factor of The System Power Supply (CEF_y)

OM ($tCO2_{eg}$ /MWh)	BM ($tCO2_{eg}$ /MWh)	CM ($tCO2_{eg}$ /MWh)
0.663	0.661	0.662

STEP 2. Calculation of Project Emissions

Project emission is calculated by equation (9).

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 7.

$$\underset{(tCO2_{eq}/y)}{PEy,_{grid}} = \underset{(MW)}{Electricity_y} \times \underset{(h/y)}{T_y} \times \underset{(tCO2_{eg}/MWh)}{CEF_y} \quad \ldots\ldots (9)$$

$PE_{y,grid}$: Annual project emissions from system power supply ($tCO2_{eq}$/year)
$Electricity_y$: Electricity requirement of installed plant (MW)
T_y: Operation hours of installed plant (h/y)
CEF_y: CO2 emission factor of system power supply ($tCO2_{eg}$ /MWh)

III. LEAKAGE EMISSIONS

A) Leakage emissions associated to biomass utilization

In the specific case of biomass project activities the determination of leakage shall be done following either:

- "General guidance for leakage in small-scale biomass project activities" (attachment C of appendix B14 of simplified modalities and procedures for small-scale CDM project activities; decision 4/CMP.1), or
- The procedures included in the leakage section of AM0042.

For the CPAs under this PoA, basically "General guidance for leakage in small-scale biomass project activities" but for detail discussions on assessment of biomass availability, procedures of AM0042 was referred.

STEP1: "the general guidance for leakage in small-scale biomass project activities"

For small-scale energy CDM project activities involving renewable biomass, there are three types of emission sources as shown in Table 8 that are potentially significant (>10% of emission reductions) and attributable to the project activities:

Table 8. Emission source per type of biomass

Biomass type	Activity/source	Shift of pre-project activities	Emissions from biomass generation / cultivation	Competing use of biomass
Biomass from forests	Existing forests	-	-	x
	New forests	x	x	-
Biomass from croplands or grasslands (woody or non-woody)	In the absence of the project the land would be used as cropland / wetland	x	x	-
	In the absence of the project the land would be abandoned ***[New cultivation]***	-	x	-
Biomass residues or wastes	Biomass residues or wastes are collected and used ***[Biomass residue]***	-	-	x

The biomass to be used in this project are new cultivation and biomass residue and correspond to the shaded areas in the table .Regarding the emission sources applicable to this project the method of investigation of the necessity of calculating the leakage emission (or project emission) is shown below. For forest biomass, farmland biomass, grass land biomass, the project boundary includes the area of biomass extraction and production.

Step1-1. Emissions from the production of the renewable biomass

Potentially significant emission sources from the production of renewable biomass can be:

(a) Emissions from application of fertilizer[1]; and

(b) Project emissions from clearance of lands.

These emissions sources should respectively be included in a simplified manner, not involving any significant transaction costs. All other emission sources are likely to be smaller than 10% (each) - including transportation of raw materials and biomass, fossil fuel consumption for the cultivation of plantations - and can therefore be neglected in the context of small scale project activities.

(a) Emissions from the application of synthetic fertilizer:

- Project participants should monitor the type and quantity of fertilizer applied to the land areas.
- N2O emissions from the use of synthetic and organic fertilizers should be estimated according to provisions outlined in the *"Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories (Chapter. 4.5)"*.

(b) Project emissions from clearance of lands:

- Significant case: Project emissions from clearance of lands can be significant in cases where an area is deforested to produce the biomass.
- Negligible case: the land area (e.g., abandoned land) can regenerate in the absence of production of the biomass resulting in increasing carbon stocks in carbon pools. As a consequence, carbon stocks in carbon pools could be higher in the baseline scenario than in the project scenario. However, as a simplification, it is suggested to neglect this latter case.
- Potential of deforestation due to the implementation of the CDM project activity: This must be addressed by considering the following applicability condition: Where the project activity involves the use of a type of renewable biomass that is not a biomass residues or waste, project participants should demonstrate that the area where the biomass is grown is not a forest (as per DNA forest definition) and has not been deforested, according to the forest definition by the national DNA, during the last 10 years prior to the implementation of the project activity. In the absence of forest definition from the DNA, definitions provided by relevant international organisations (e.g., FAO) shall be used.

[Application to the CPAs under the PoA]
In case where Gliricidia is newly cultivated in unused land inside coconut plantations, the considerations of the facts mentioned above is necessary. However, the cultivation of Gliricidia does not involve the usage of chemical fertilizers (on the contrary, they are usually cultivated to use the leaves as organic fertilizers).. Further, the plantation is done in unused land between coconut trees and there is no land disturbance and hence it can be said that there is no leakage. However, at the time of starting a new cultivation, the coordinating managing entity shall carry out an inspection and report to the DOE.
If the CPA includes biomass from dedicated plantations, this will be demonstrated at each CPA level and justification should be described in CDM-SSC-CPA-DD prior to incorporation to the PoA.

Step1-2. Competing uses for the biomass:[9]
In some cases, the biomass used in the project activity could be used for other purposes in the absence of the project. For example, biomass residues from existing forests could have been used as fuel wood or agricultural biomass residues could have been used as fertilizers or for energy generation. Competing uses for biomass are not relevant, where the biomass is generated as part of the project activity (new forests or cultivations).

The project participant shall evaluate ex ante if there is a surplus of the biomass in the region of the project activity, which is not utilised. If it is demonstrated (e.g., using published literature, official

[9]When the biomass produced is a part of biomass produced during project activity (new cultivation or cultivation) , it can be said that there is no competition of usage and hence leakage can be neglected.

reports, surveys etc.) at the beginning of each crediting period that the quantity of available biomass in the region (e.g., 50 km radius), is at least 25% larger than the quantity of biomass that is utilised including the project activity, then this source of leakage can be neglected otherwise this leakage shall be estimated and deducted from the emission reductions.

Approach 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, the scenario is B1 and the approach is a combination of L1 and L2.

[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.

- Where project participants wish to use approaches L2, L3 or L4 to assess leakage effects, they 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[10]. 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).

- Project participants shall apply a leakage penalty to the quantity of biomass residues, for which project participants cannot demonstrate with one of the approaches above that the use of the biomass residue does not result in leakage. The leakage penalty aims at adjusting emission reductions for leakage effects in a conservative manner, assuming that this quantity of biomass residues is substituted by the most carbon intensive fuel in the country.

- 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:

$$LE_y = EF_{CO2,LE} \cdot \sum_n BF_{LE,n,y} \cdot NCV_n \quad \ldots\ldots\ldots(10)$$

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

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 can not be ruled out using one of the approaches L1, L2, L3 or L4 (tons of dry matter or liter)7
NCVn	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 approaches 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 not public information to prove the fact stated above and hence publicly available data was used for the estimation of storage amount and a survey was carried out to understand the usage condition of biomass. The result showed that domestically in Sri Lanka, branches of Gliricida were hardly used and generally, after periodic pruning, the branches were left at back yards of farms. Annex 3 Table20 shows the known available amount of Gliricidia in Sri Lanka. This need to be assessed at each CPA level and justification should be described in CDM-SSC-CPA-DD.

However, when biomass other than Gliricidia is used, the approach 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 10 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 Greenhouse Gas

GHG emissions reduction is calculated as indicated in equation (11).

$$\underset{(tCO2_{eq}/y)}{ER_y} = \underset{(tCO2_{eq}/y)}{BE_y} - \left(\underset{(tCO2_{eq}/y)}{PE_y} + \underset{(tCO2_{eq}/y)}{Leakage_y} \right) \ldots\ldots (11)$$

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:

The detailed information on the data and parameters not requiring monitoring are described as follows. For 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:	
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:	

Data / Parameter:	$EF_{FF,CO2}$
Data unit:	tCO2/TJ
Description:	CO2 emission factor of the fossil fuel in the baseline
Source of data used:	2006 IPCC Guideline for National Greenhouse Gas inventories, Table 1.4
Value applied:	Gas/diesel: 74.1 Residual oil (residual oil): 77.4 Naptha: 73.3
Justification of the choice of data or description of measurement methods and procedures actually applied:	Standard value recommended by UNFCCC
Any comment:	

Data / Parameter:	Gravity of the fossil fuel oil that would have been used in the baseline
Data unit:	t/kL
Description:	Gravity of the fossil fuel in t/kL
Source of data used:	
Value applied:	Gas/diesel: 0.85 Furnace oil: 0.958 Naptha: 0.66
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:	$FF_{BL,y}$
Data unit:	kt/y
Description:	Amount of fossil fuel to be replaced by the biomass fuel to be replaced by the biomass fuel
Source of data to be used:	Data obtained from project site
Value of data applied for the purpose of calculating expected emission reductions in section B.5	On site specific data to be applied
Description of measurement methods and procedures to be applied:	
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	NCV_{FF}, $NCV_{i,y}$
Data unit:	TJ /kt
Description:	Net calorific value of the fossil fuel to be replaced by biomass fuel in TJ /kt
Source of data used:	2006 IPCC Guideline for National Greenhouse Gas inventories, Table1.2
Value applied:	Gas/diesel: 43.0 Furnace oil (residual oil): 40.4 Nahtha: 44.5
Justification of the choice of data or description of measurement methods and procedures actually applied:	Standard value recommended by UNFCCC
Any comment:	

Data / Parameter:	$F_{i,y}$
Data unit:	M3/y, t/y
Description:	Amount of fossil fuel type i consumed in the grid system in year y y
Source of data used:	Ceylon Electricity Board
Value applied:	Provided in 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 2004-2006)
Any comment:	Used for calculation of OM

Data / Parameter:	GEN_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:	Ceylon Electricity Board
Value applied:	Provided in 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 2004-2006)
Any comment:	Used for calculation of OM

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 national / regional data is unavailable.)
Any comment:	Used for calculation of OM

Data / Parameter:	$NCV_{biomass}$
Data unit:	TJ/t
Description:	The net calorific value of the biomass
Source of data to be	

used:	
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Official released statistic; publicly accessible and reliable data source
Description of measurement methods and procedures to be applied:	
QA/QC procedures to be applied:	
Any comment:	Applicable for gasifier with capacity more than 45kW and boiler.

Data / Parameter:	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
Data unit:	-
Description:	
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:	
Any comment:	

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:	$EG_{flow,y}$
Data unit:	M3/y, t/y
Description:	Flow of the energy produced in the year y
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	Depending on the scale of facilities which varies for each CPA
Description of	To be measured by automatic flow meter

measurement methods and procedures to be applied:	
QA/QC procedures to be applied:	
Any comment:	Data will be kept for 2years after the last issuance of CERs for this activity. Applicable for gasifier with capacity more than 45kW and boiler. Parameter used for calculation of $EG_{thermal,y}$

Data / Parameter:	Temp
Data unit:	℃
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	Depending on the specification of facilities which varies for each CPA
Description of measurement methods and procedures to be applied:	To be measured by thermometer
QA/QC procedures to be applied:	
Any comment:	Data will be kept for 2years after the last issuance of CERs for this activity. Applicable for gasifier with capacity more than 45kW and boiler. Parameter used for calculation of $EG_{thermal,y}$

Data / Parameter:	P
Data unit:	Bar
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	Depending on the specification of facilities which varies for each CPA
Description of measurement methods and procedures to be applied:	To be measured by pressure meter
QA/QC procedures to be applied:	
Any comment:	Data will be kept for 2years after the last issuance of CERs for this activity. Applicable for gasifier with capacity more than 45kW and boiler. Parameter used for calculation of $EG_{thermal,y}$

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
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:	To be recorded referring to the expense sheet daily
QA/QC procedures to be applied:	On-site inspection by a third-party
Any comment:	

Data / Parameter:	$FF_{PJ,y}$
Data unit:	kt/y
Description:	Amount of fossil fuel used at on-site in the project scenario
Source of data to be used:	Own 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:	To be recorded referring to the expense sheet daily
QA/QC procedures to be applied:	On-site inspection by a third-party
Any comment:	

Data / Parameter:	η_{PJ}
Data unit:	
Description:	Efficiency of the project equipment measured using representative sampling methods or based on referenced literature values.
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:	The efficiency tests shall be conducted following the guidance provided in the relevant national / international standards.
QA/QC procedures to be applied:	
Any comment:	Applicable for gasifier with capacity more than 45kW and boiler.

Data / Parameter:	$Electricity_y$
Data unit:	MW
Description:	Power generation capacity of installed plant
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:	
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	T_y
Data unit:	h/y
Description:	Operation hours of installed plant
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:	
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	Source of biomass used as fuel at project site
Data unit:	-
Description:	

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:	
Any comment:	

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)

1st March 2010

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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)
Street/P.O.Box:	465/1 Sunetradevi Road, Pepiliyana
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City:	Boralesgamuwa
State/Region:	
Postfix/ZIP:	
Country:	Sri Lanka
Telephone:	+94-11-2812584
FAX:	
E-Mail:	Bioenergy@sltnet.lk
URL:	www.bioenergysrilanka.org
Represented by:	
Title:	President
Salutation:	Mr.
Last Name:	Jayasinghe
Middle Name:	
First Name:	Parakrama
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Mobile:	+94-77-7269970
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Middle Name:	
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Mobile:	
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding is involved in this PoA and related CPAs.

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		
2001	3,045	3.4	64	3,112	1,896	1,058	0	471	3,424	6,537	47.6%
2002	2,589	3.6	103	2,695	1,953	1,243	0	939	4,136	6,831	39.5%
2003	3,190	3.4	120	3,313	2,193	1,711	1	394	4,299	7,613	43.5%
2004	2,755	2.7	206	2,964	2,507	2,064	1	509	5,081	8,045	36.8%
2005	3,173	2.4	280	3,455	2,162	3,152	-	-	5,314	8,769	39.4%
Total	14,751	15.5	773	15,540	10,710	9,228	3	2,313	22,255	37,795	41.1%

Source: Ceylon Electric Board

Table 10. Net Calorific Value (NCV)

Fuel Type	Net Calorific Value [NCV] (TJ/t)	Remarks
Fuel Oil	0.043	Gas/Diesel Oil
Auto Oil	0.043	Gas/Diesel Oil
Naptha	0.0445	Naptha
Heavy Oil	0.043	Gas/Diesel Oil

Source: 2006 IPCC Guideline for National Greenhouse Gas inventories, Table 1-2

Table 11. Effective CO2 Emission Factor (EF_i)

Fuel Type	Effective CO2 emission factor [EF_i] (tCO2e/TJ)	Remarks
Fuel Oil	74.1	Gas/Diesel Oil
Auto Oil	74.1	Gas/Diesel Oil
Naptha	73.3	Naptha
Heavy Oil	74.1	Gas/Diesel Oil

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)	
Fuel Oil	0.043	74.1	1.0	3.186	Gas/Diesel Oil
Auto Oil	0.043	74.1	1.0	3.186	Gas/Diesel Oil
Naptha	0.0445	73.3	1.0	3.262	Naptha
Heavy Oil	0.043	74.1	1.0	3.186	Gas/Diesel Oil

Table 14. OM Calculation Data (Simple OM, 2004)

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	374	0.985	3.186	1,173,691		
Auto Oil	577	0.850	3.186	1,562,276		
Naptha	138	0.660	3.262	297,103		
Heavy Oil	179	0.850	3.186	484,750		
Total	-	-	-	3,517,819	5,103	0.689
Source	CEB data	0.958:measured 0.85: assumption		(a)*(b)*(c)	CEB data	(d)/(e)

Table 15. 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)	Geid Emission Factor (kg_CO2/kWh)
	(a)	(b)	(c)	(d)	(e)	(f)
Fuel Oil	583	0.985	3.186	1,829,576		
Auto Oil	315	0.850	3.186	853,052		
Naptha	180	0.660	3.262	387,526		
Heavy Oil	189	0.850	3.186	511,831		
Total	-	-	-	3,581,984	5,310	0.675
Source	CEB data	0.958:measured 0.85: assumption		(a)*(b)*(c)	CEB data	(d)/(e)

Table 16. 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)	Geid Emission Factor (kg_CO2/kWh)
	(a)	(b)	(c)	(d)	(e)	(f)
Fuel Oil	539	0.985	3.186	1,691,495		
Auto Oil	276	0.850	3.186	747,436		
Naptha	91	0.660	3.262	195,916		
Heavy Oil	189	0.850	3.186	511,831		
Total	-	-	-	3,146,677	5,035	0.625
Source	CEB data	0.958:measured 0.85: assumption		(a)*(b)*(c)	CEB data	(d)/(e)

Table 17. OM Calculation

Fuel Type	2,004 (kg_CO2/kWh)	2,005 (kg_CO2/kWh)	2,006 (kg_CO2/kWh)	Average (kg_CO2/kWh)
Simple OM	0.689	0.675	0.625	0.663

Source: Calculated from Table 14-16

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

No.	Plant	Date of Commissioning	Fuel Type	Generation of The Unit in 2005 (million kWh)
1	ACE- Embilipiyiya	Jun-05	Furnace Oil	593
2	Aggreko - Chunnakam	Jul-05	Auto Oil	55
3	Heladhanavi	Dec-04	Furnace Oil	619
4	AES-Kelanitissa	Oct-03	Auto Oil	620
5	ACE-Horana	Dec-02	Furnace Oil	132
			Total of 1-5 (million kWh)	2,019
			Total grid generation (million kWh)	9,389
			Proportion within the grid	21.5%

Source: CEB data

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)	Geid Emission Factor (kg_CO2/kWh)
	(a)	(b)	(c)	(d)	(e)	(f)
Fuel Oil	300	0.985	3.186	941,463		
Auto Oil	145	0.850	3.186	392,675		
Naptha	0	0.660	3.262	0		
Heavy Oil	0	0.850	3.186	0		
Total	-	-	-	1,334,138	2,019	0.661
Source	CEB data	0.958:measured 0.85: assumption		(a)*(b)*(c)	CEB data	(d)/(e)

Table 20. Gliricidia Availability in Sri Lanka

District	Residential areas	Tea estate	Pepper
Colombo	14,311	889	432
Kalutara	13,735	1,130	42,526
Gampala	25,376	5,648	0
Galle	12,706	1,678	151,999
Ratnapura	14,021	11,210	227,441
Nuwara Eliya	9,600	3,330	298,099
Matale	6,206	21,672	30,420
Kandy	16,091	19,904	134,021
Kegalle	11,544	9,940	0
Kurunegala	22,422	11,056	0
Puttalam	9,740	0	0
Matara	9,866	0	0
Hambantota	7,409	0	0
Ampara	6,758	0	0
Anuradhapura	10,720	0	0
Polonnaruwa	5,503	0	0
Badulla	10,745	9,036	0
Moneragala	5,796	6,422	0
Sub-total	212,549	101,915	884,938
Total			1,199,402

Annex 4

MONITORING INFORMATION

Refer to Section D. for the Monitoring Information

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