CLEAN DEVELOPMENT MECHANISM
SMALL-SCALE PROGRAM ACTIVITY DESIGN DOCUMENT FORM (CDM-SSC-CPA-DD)
Version 01

CONTENTS

Annexes

NOTE:

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

(ii) The coordinating/managing entity shall prepare a CDM Small Scale Programme Activity Design Document (CDM-SSC-CPA-DD)[1,2] that is specified to the proposed PoA by using the provisions stated in the SSC PoA DD. At the time of requesting registration the SSC PoA DD must be accompanied by a CDM-SSC CPA-DD form that has been specified for the proposed SSC PoA, as well as by one completed CDM-SSC CPA-DD (using a real case). After the first CPA, every CPA that is added over time to the SSC PoA must submit a completed CDM-SSC CPA-DD.

[1] The latest version of the template form CDM-CPA-DD is available on the UNFCCC CDM web site in the reference/document section.

[2] At the time of requesting validation/registration, the coordinating managing entity is required to submit a completed CDM-POA-DD, the PoA specific CDM-CPA-DD, as well as one of such CDM-CPA-DD completed (using a real case).

SECTION A. General description of small scale CDM programme activity (CPA)

A.1. Title of the small-scale CPA:

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

A.2. Description of the small-scale CPA:

Description of the CPA:
This CPA is implemented under the Programmatic of Activity (PoA), "Industrial Fuel Switch by Gliricidia Branch Programmatic CDM in Sri Lanka". The coordinating/managing entity of this PoA 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 reducing the increasing dependence on imported fossil fuels throughout Sri Lanka. This PoA is a voluntary project implemented by the BEASL.

The goals of the PoA are to reduce the dependence on fossil fuels in Sri Lanka and to both the global environmental aim to reduce GHG emissions, as well as the local socio-economic needs by promoting utilization and also cultivation of renewable indigenous biomass resources especially gliricidia (*Gliricidia Sepium*) which is one of the major short rotation crops[3] in Sri Lanka. By promoting the utilization of biomass that has not been utilized and left to decay in a field, greenhouse gas emissions (hereafter GHGs) will be avoided by replacing industrial thermal energy generated from fossil fuel combustion with renewable thermal energy using renewable biomass resources. Furthermore, the implementation of CPA will generate additional income for the local farmers whose income to enhance their quality of life and

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.

This CPA aims to generate biomass thermal energy at XXXX in XXXX, Sri Lanka. The generated thermal energy will replace the existing industrial thermal energy supply to the factory, which is generated by fossil fuels. Therefore the implementation of the CPA will reduce the overall GHG emissions. Estimated annual amount of energy supply to the factory is XXXX kL of [select one of: furnace oil/diesel oil/heavy oil/auto oil] annually. Annual emission reduction from the CPA is expected to be XXXX t CO_2 equivalent (a total of XXXX t CO_2 equivalent during the crediting period).

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

[Option1]Owner of the facility is responsible for both operation of the facility and monitoring works.
The implementer of the CPA is XXXX, who is the owner of the biomass energy generation facility and responsible for the collection and monitoring of data as well as the operation and management of the facility.

[Option2] Owner of the facility is responsible for operation and operating partner will be responsible for monitoring works.
The implementer of the CPA is XXXX, who is the owner of the biomass energy generation facility and responsible for operation and management of the facility. While, XXXX, as an operating partner, will be responsible for the collection and monitoring of data.

In this CPA, thermal energy from biomass resources is generated at XXXX factory in XXXX province, Sri Lanka. Installed facilities include, XXXX, XXXX, XXXX and XXXX.

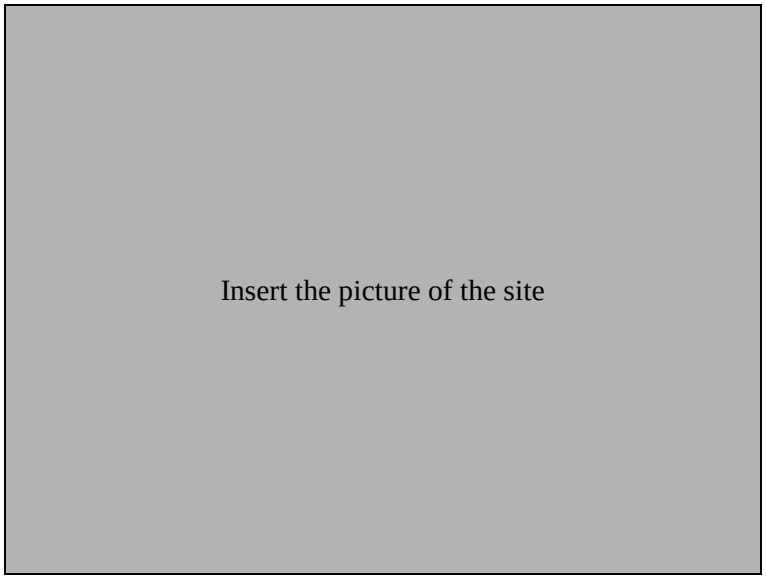

Figure1. Project site of the CPA

Purpose of the CPA:
The purpose of the CPA is to "co-benefit" both the global environmental aim to reduce GHG emissions, as well as the local socio-economic needs. Promoting the implementation of biomass thermal energy generation through this CPA contributes to the sustainable development of 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. Entity/individual responsible for the small-scale CPA:

The implementer of the CPA is XXXX.

A.4. Technical description of the small-scale CPA:

A.4.1. Identification of the small-scale CPA:

A.4.1.1. Host Party:

Democratic Socialist Republic of Sri Lanka (Sri Lanka)

A.4.1.2. Geographic reference or other means of identification allowing the unique identification of the small-scale CPA (maximum one page):

The project site (location of the biomass thermal energy generation facility) is located at XXXX. Latitude of the project site is N XX° XX′ XX″ , and longitude is E XX° XX′ XX″ .

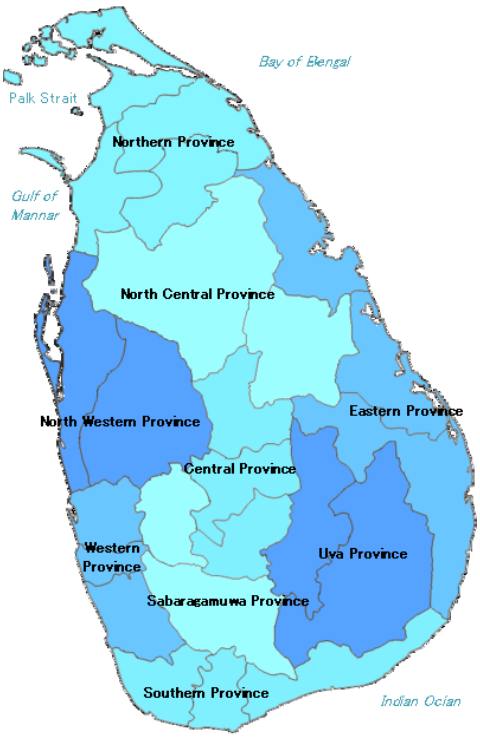

Figure2. Location of the Project Site

Insert the map of the site

Figure3. Location of the Project Site(2)

A.4.2. Duration of the small-scale CPA:

A.4.2.1. Starting date of the small-scale CPA:

This starting date of this CPA is 1st XXXX, which is the same date as the proposed PoA.

A.4.2.2. Expected operational lifetime of the small-scale CPA:

15years

A.4.3. Choice of the crediting period and related information:

Fixed Crediting period

A.4.3.1. Starting date of the crediting period:

>>
The starting date of the crediting period is the registration date.

A.4.3.2. Length of the crediting period, first crediting period if the choice is renewable CP:

10 years

A.4.4. Estimated amount of emission reductions over the chosen crediting period:

Table 1. Estimated amount of emission reductions

Years	**Estimation of annual emission reductions (tCO_2e)**
2011	XXXX
2012	XXXX
2013	XXXX
2014	XXXX
2015	XXXX
2016	XXXX
2017	XXXX
2018	XXXX
2019	XXXX
2020	XXXX
Total emission reductions (tCO_2e)	XXXX
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tCO_2e)	XXXX

A.4.5. Public funding of the CPA:

This CPA does not include any public fund.

[If any public fund is not involved for the CPA, please use the above expressions. If the CPA includes any public fund, it must be clarified that ODA is not diverted to the CPA such as *"Public funds for ODA will not be applied to this project."*.]

A.4.6. Information to confirm that the proposed small-scale CPA is not a de-bundled component

As highlighted in Appendix C of the Simplified Modalities and Procedures for Small-Scale CDM project activities, a proposed small-scale project activity shall be deemed to be a debundled component of a large project activity if there is a registered small-scale CDM or an application to register another small-scale CDM with the following characteristics:

- 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.

The project participant of the CPA is XXXX. This CPA is the first and only CPA that XXXX is part of. Therefore, 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.

A.4.7. Confirmation that small-scale CPA is neither registered as an individual CDM project activity or is part of another Registered PoA:

BEASL, who is the managing entity of the PoA in which this CPA is under, will periodically obtain and update information regarding CDM project activities and PoAs related to biomass thermal energy generation. Prior to the implementation of the CPA, BEASL will verify that the small-scale CPA is neither registered as an individual CDM project activity or is part of another Registered PoA by crosschecking the geographic location of the CPA with existing CDM project activities.

SECTION B. Eligibility of small-scale CPA and Estimation of emissions reductions

B.1. Title and reference of the Registered PoA to which small-scale CPA is added:

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

B.2. Justification of why the small-scale CPA is eligible to be included in the Registered PoA :

This CPA is eligible to be included in the registered PoA since it satisfies the criteria defined in A.4.2.2. in CDM-SSC-PoA-DD of the registered PoA as described below.

- Located within Sri Lanka
  → Applicable
  (The location of this CPA is described in A.4.1.2. of CDM-SSC-PoA-DD of the registered PoA)

- A project to implement baseline and monitoring methodology AMS-I.C. "Thermal energy production with or without electricity (Version 16)"

→Applicable
(CDM-SSC-PoA-DD was developed based on AMS-I.C.)

- 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
→Applicable
(The technology to be applied is [select one of: Gasifier or Boiler] to generate thermal energy and the maximum thermal energy generation capacity is XXXX kW as shown in A.2.)

- Monitors and collects appropriate data on the parameters listed in A.4.4.2
→ Applicable.
('Monitoring items in A.4.4.2. of CDM-SSC-PoA-DD of the registered PoA will be applied)

- 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.
[Select one of the options below]
→ Applicable.
(A contract between the supplier and consumer of the energy has entered into the contract specifying that only the facility generating the energy can claim emission reductions from the energy displaced)
→ Not applicable.
(In this proposed project, the supplier and the recipient of the generated energy is the same entity.)

- The project must be approved by the coordinating entity and DOE prior to its incorporation into the PoA.
→ Applicable.
(This project was approved by coordinating managing entity and DOE on dd/mm/yy.)

- A project to generate thermal energy from biomass resources which replaces fossil fuel origin industrial thermal energy
→Applicable
(The activity of this CPA is described in A.2 of CDM-SSC-PoA-DD of the registered PoA)

- The entity responsible for the monitoring work must be reported to the coordinating entity prior to its incorporation into the PoA.
→Applicable
(For this CPA, XXXX was designated as implementer of monitoring work on dd/mm/yy.)

- 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".
  →Applicable
  (Gliricidia is the main biomass resources to be supplied for the project activity and it is elaborated in B.5.2 that gliricidia branch is biomass residue, while this CPA does not involve new cultivation of biomass resources.)

- Biomass resources used by a project activity must comply to the "Definition of renewable biomass (EB23, Annex18)".
  →Applicable
  (This is elaborated in B.5.2)

- Biomass used by the project facility is not stored for more than one yea
  →Applicable
  (This factor is included in the monitoring items of this CPA)

B.3. Assessment and demonstration of additionality of the small-scale CPA , as per eligibility criteria listed in the Registered PoA:

In the absence of the PoA, thermal energy generation for industrial purpose will not be carried out at XXXX. Thermal energy for XXXX will be supplied from existing thermal energy generation facilities whose energy sources is [select one of: furnace oil/diesel oil/heavy oil/auto oil]. The existence of the following factors act as barriers to prevent the implementation of the proposed project activity without CDM and hence GHGs will continue to be emitted into the atmosphere through consumption of the current fossil fuel, which is [select one of: furnace oil/diesel oil/heavy oil/auto oil].

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 explanation to show that the project activity would not have occurred without the PoA is described according to the following steps.

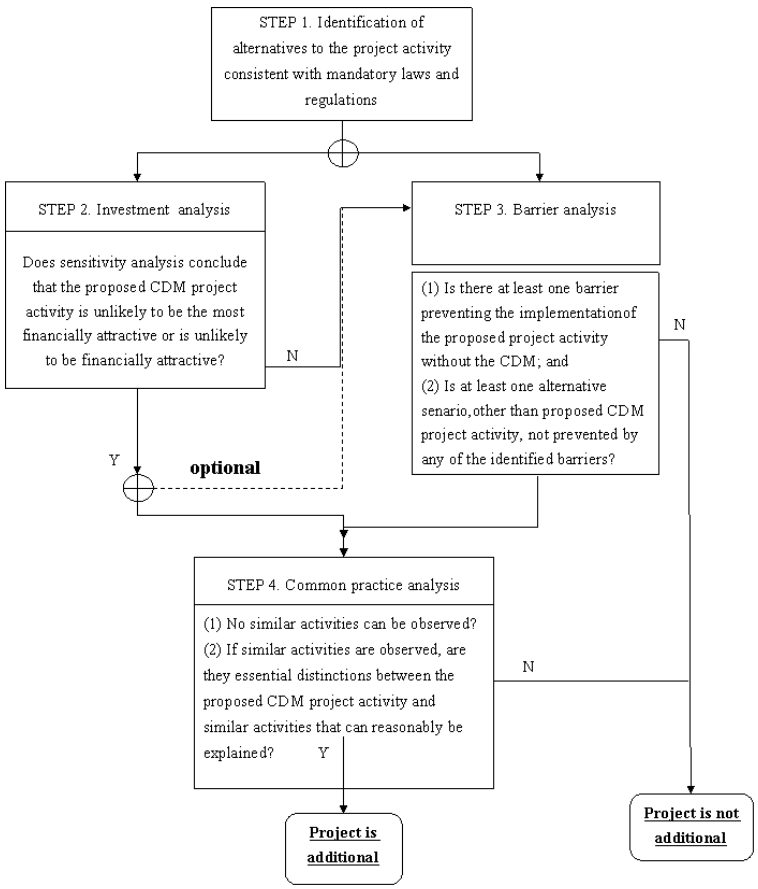

Figure4 Steps of establishment of additionality

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 *ex ante* IRR(15 years after tax) calculation is based on the conditions and assumption of this project is calculated on the conditions shown in Table 2.

Table 2 Precondition and parameter of Internal Rate of Return (IRR) calculation

Items	Value	Unit	Remarks
1) Initial investment cost	XXXX	'000 USD	-
2) O&M cost	XXXX	'000 USD	
Biomass procurement cost	XXXX	'000 USD	
Electricity cost	XXXX	'000 USD	
Manpower cost	XXXX	'000 USD	
Maintenance cost	XXXX	'000 USD	
Consumable etc	XXXX	'000 USD	
3)Other parameters			
Interest rate	12	%	Assumed
Gliricidia procurement price	XXXX	USD/kg	
Price of fossil fuel to be replaced		USD/L	
Electric purchasing price	0.078	USD/kWh	CEB data
Amount of gliricidia required to replace 1L of fossil fuel	3.8	Kg/L	
Operating hours of installed plant	XXXX	h/y	
Electricity requirement at installed plant	XXXX	kW	
Total amount of fossil fuel to be replaced	XXXX	kL/y	
Project operational lifetime and crediting period	15	Years	
Corporation tax	35	%	
Depreciation taxable	XXXX	'000 USD	
Depreciation period	15	Years	
Repayment period	10	Years	
Depreciation method and rate	fixed instalment method	-	
Salvage value	0	%	
Price inflation rate	0	%	
Exchange rate (LKR⇔USD)	115	Sri Lankan LKR/USD	

In this CPA, the benchmark for this project is determined as 8.0%. The calculation results of the IRR without CER revenue of this project activity is XX% and is not economically viable and far below than the Benchmark as shown in the Table 3.

Table 3. Project IRR and Benchmark

IRR without CER(15years, after tax)	Benchmark
XX%	8%

b) Sensitivity Analysis
The sensitivity analysis is made by variation of the cost and income parameters i.e., initial facility investment equipment and construction, biomass fuel price, price of the fuel to be replaced by biomass fuel, factory operation ratio and project life time (20years). The range of variation for each parameter is set as plus or minus 10% from the basis assumption. The results of IRR calculation from such variations are summarized in Table 4.

Table 4. Sensitivity Analysis

Variables		IRR		
	Range:	-10%	0%	10%
a)	Initial facility investment equipment and construction	XX%	XX%	XX%
b)	Biomass procurement cost	XX%	XX%	XX%
c)	Price of fossil fuel to be replaced	XX%	XX%	XX%
d)	Operation ratio (Operating days)	XX%	XX%	XX%
e)	With CER Revenue(@USD16/tCO2)	XX%	XX%	XX%
	Project life time:	-	15yers	20years
f)	Project life time	-	XX%	XX%

[Option1: When all the IRR is below than Benchmark]
According to the analysis, the IRR without CER sales are very low and all the IRRs except for the IRR with CER sales do not reach the Benchmark defined in Table 3. This analysis also includes the economic effect of the project period. If the project period is longer than the currently assumed period which is 15 years, IRR improves, however, even the period is 20 years, IRR is still below than the benchmark, thus, it is obvious that this project activity is not financially viable without the revenue from CER sales.

Thus, it is concluded that the project cannot proceed on a business-as-usual basis, has been tested by subjecting critical assumptions to reasonable variation. As required by Annex 45 of EB 41.

[Option2: When any of the IRR is above than Benchmark: CPA must describe analysis result of Sensitivity analysis]

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 this CPA, 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
While the project site is located in [i.e, the western coast nearby Colombo city], villages that can potentially act as supply regions for Glircidia are mostly located in remote area from the project site. When considering the usage of Gliricidia and other biomass fuel, in addition to transportation from supply area to the project site, a lot of effort and investment will become necessary in areas that is not the main business in order to provide a stable supply of biomass necessary for the factory operation. 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 one of the major factors that has been preventing investment on biomass using facilities at XXXX. It is truly difficult for XXXX to identify and negotiate with the supply source of gliricidia for stable procurement, thus, a system for stable supply of biomass within the CDM framework by matching suppliers with demand side is essential for the project activity being implemented.

(c) Access-to-finance barrier
[For ESCO type project, the following description can be applied]
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.

Because of the various uncertainties involved (especially if the company involved is a small to medium enterprises) in the project it is extremely difficult to procure funds from the financing banks unless the project is implemented as a CDM project. Implementing this project under the CDM scheme becomes a crucial component of the bank's investment criteria. Therefore, there is an access-to-finance barrier where access to capital will be limited in the absence of the CDM

Impact of CDM registration

CDM registration will enable the CPA 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 the proposed project activity. 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. In addition, it is impossible for this CPA to identify the adequate amount of rubber wood for supplying to the factory as its fuel because there is no known market for such resources. 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 the CPA is demonstrated as described above.

B.4. Description of the sources and gases included in the project boundary and proof that the small-scale CPA is located within the geographical boundary of the registered PoA.

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 the CPA 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

B.5. Emission reductions:

B.5.1. Data and parameters that are available at validation:

Detailed information on the data and parameters that do not require monitoring are described as follows. Data and parameters used for ex-ante calculation but which need to be monitored after project implementation are shown in B.6.1.

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	On site specific data or default value to be applied

actually 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:	

B.5.2. Ex-ante calculation of emission reductions:

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

Where, $(EG_{thermal,y}/\eta_{BL,thermal})$ 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}	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 (tCO2 / TJ)

Where:

Parameter	Figure	Unit	Data Source
$BE_{thermal,CO2,y}$	XXXX	t $CO2_{eq}$/year	
$FF_{BL,y}$	XXXX	kt/y	Factory specific data
NCV_{FF}	XXXX	TJ/kt	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2: Energy, Table 1.2
$EF_{FF,CO2}$	XXXX	tCO2 / TJ	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2: Energy, Table 1.4

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.

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

$PE_{on\text{-}site,y}$	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}	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 (tCO_2e /TJ)

Where:

Parameter	Figure	Unit	Data Source
$FF_{PJ,y}$	XXXX	kt/y	Site specific data
NCV_{FF}	XXXX	TJ/kt	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2: Energy, Table 1.2
$EF_{FF,CO2}$	XXXX	tCO2 / TJ	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2: Energy, Table 1.4

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 5.

Table 5. 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 6. CPAs under PoA can use these figures if new electricity generation statistic data is not available.

Table 6. 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 6.

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

$PE_{y,grid}$: Annual project emissions from system power supply ($tCO2_{eq}/y$)
$Electricity_y$: 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)

Where:

Parameter	Figure	Unit	Data Source
$Electricity_y$	XXXX	MW	Site specific data
T_y	XXXX	t/y	Site specific data
CEF_y	0.662	$tCO2_{eg}$ /MWh	Calculated in Step1-6

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 7 that are potentially significant (>10% of emission reductions) and attributable to the project activities:

Table 7. 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.

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.

[If the CPA includes biomass from dedicated plantations, this will be demonstrated here**]**

Step1-2. Competing uses for the biomass:[4]
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 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.

[4]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.

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[5]. 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:

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

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)

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

$BF_{LE,n,y}$	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 CPA]
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 was hardly used and generally, after periodic pruning, the branches were left at back yards of farms to dacay. Annex 3 Table 20 shows the known available amount of Gliricidia in procurement boundary of the CPA (30km from the site). This procurement boundary cannot be changed during the crediting period.

[Elaboration regarding the biomass availability should be analysed here]

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).

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

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)

B.5.3. Summary of the ex-ante estimation of emission reductions:

Table 8. Summary of Ex-ante Estimation of Emission Reduction

Year	Estimation of project activity emissions (tCO_2 e)	Estimation of baseline emissions (tCO_2 e)	Estimation of leakage (tCO_2 e)	Estimation of overall emission reductions (tCO_2 e)
2011	XXXX	XXXX	XXXX	XXXX
2012	XXXX	XXXX	XXXX	XXXX
2013	XXXX	XXXX	XXXX	XXXX
2014	XXXX	XXXX	XXXX	XXXX
2015	XXXX	XXXX	XXXX	XXXX
2016	XXXX	XXXX	XXXX	XXXX
2017	XXXX	XXXX	XXXX	XXXX
2018	XXXX	XXXX	XXXX	XXXX
2019	XXXX	XXXX	XXXX	XXXX
2020	XXXX	XXXX	XXXX	XXXX
Total (tCO_2e)	XXXX	XXXX	XXXX	XXXX

B.6. Application of the monitoring methodology and description of the monitoring plan:

B.6.1. Description of the monitoring plan:

(i) Monitoring and reporting framework

Monitoring and reporting framework is shown in Figure 5 below. The operation and management of biomass thermal energy generation facility is carried out by XXXX. Based on monitoring manual that is provided by the BEASL, XXXX will monitor the monitoring items specified below and will report to BEASL, who will then undertake data checking, calculation of emission reduction, site visits and provision of advice to the CPAs. BEASL will also be responsible for communication with Designated Operational Entity for verification procedures.

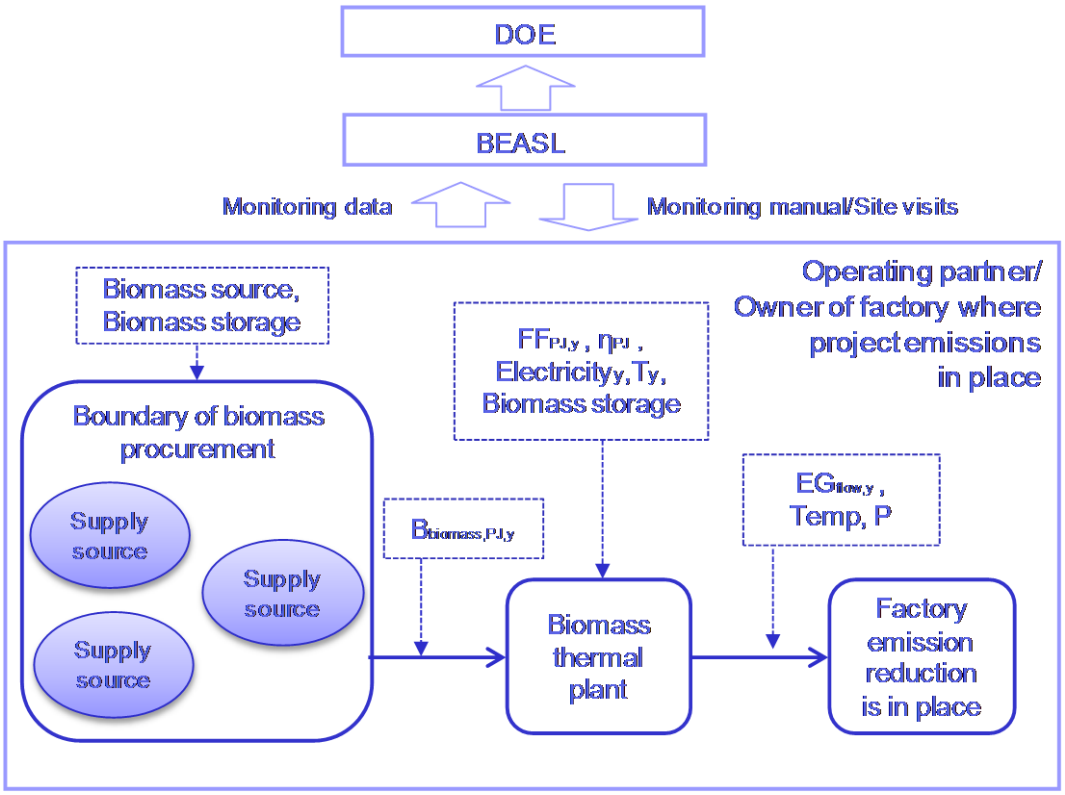

Figure 5. Layout of Record Keeping System

(ii) Monitoring method

The detailed information of the monitoring items and their monitoring methods are described below.

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 measurement methods and procedures to be applied:	To be measured by automatic flow 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:	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:	

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:

☐ Please tick if this information is provided at the PoA level. In this case sections C.2. and C.3. need not be completed in this form.

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 only. Therefore it does not cause any additional destruction of watersheds and other natural resources that have high ecosystem values and services.
- Through the replacement of the fossil fuel based energy by biomass based thermal energy, there are positive environmental effects, while there are no known negative effects to the environment (air pollutants will be reduced).

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.

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

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 of this project, we have to determine the need 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, according to the Gazette on 772/22 of 24th June, 1993 and 859/14 of 23rd February 1995, the project proponent must conduct EIA in case of using biomass from plantations under the following conditions:

[Project items for EIA]
- Reclamation of 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)

[For CPAs using biomass from dedicated plantation need to address the applicability of the above items in the PDD. If EIA applicable, proper conduction of EIA needs to be checked and report to Designated Operational Entity for validity of the CPA.]

[For CPAs not using biomass from dedicated plantation can describe as follows]
The above items are not applicable, and hence, EIA is not necessary for this CPA since the biomass resources to be procured for the CPA are biomass residue that are currently abandoned and not utilized effectively. The sources of biomass resources for the CPA will be monitored to make sure those are not procured from dedicated plantation of wood biomass resources.

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

This project is excluded from the EIA requirements of the Host Country and EIA at the CPA level is not required. The EIA analysis for the construction and operation of the biomass based thermal energy generating facilities were carried out at the PoA level.

SECTION D. Stakeholders' comments

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

☒ Please tick if this information is provided at the PoA level. In this case sections D.2. to D.4. need not be completed in this form.

As indicated in the proposed PoA, interviews with the stakeholders at the PoA level were conducted. They were given the opportunity to discuss and provide comments to the PoA.

In addition to the interviews at the PoA level, comments from responsible persons of local agencies and citizens who are specifically related to the Project will be collected at a later date through interviews at the CPA level.

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

Local citizens and agencies were/will be invited to participate in interviews where they will receive information on the objectives, process, implications and benefits for sustainable development of the CPA. Representatives from the XXXX may also be present at the consultation. Comments from local citizens will be invited and compiled during this time.

D.3.	Summary of the comments received:

Comments from local citizens and related agencies are summarized here.

Summary of the comments received from the interviewees.

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

The report on how the comments are received will be described here.

Annex 1

CONTACT INFORMATION ON ENTITY/INDIVIDUAL RESPONSIBLE FOR THE SMALL-SCALE CPA

Organization:	
Street/P.O.Box:	
Building:	
City:	
State/Region:	
Postfix/ZIP:	
Country:	
Telephone:	
FAX:	
E-Mail:	
URL:	
Represented by:	
Title:	
Salutation:	
Last Name:	
Middle Name:	
First Name:	
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

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

Annex 3

BASELINE INFORMATION

Detail baseline information is described in Section E.

Table 9. Electricity Statistical Data of Sri Lanka

Year	Low Cost / Must Run				Thermal Generation					Total	% of low-cost /
	CEB Hydro	CEB Wind	SPP Hydro	Total	CEB	IPP	SPP	Hired	Total	Generation	must run
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 type 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)	Geid 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. Amount of Gliricidia Available within the Procurement Boundary (30km from the site)

Table to be attached

Annex 4

MONITORING INFORMATION

Refer to Section B.6.1 for the Monitoring Information.

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