Reports of CDM/JI Feasibility Studies: FY2010
Summary

Title

Programmatic CDM Feasibility Study for Biomass (Gliricidia) Utilisation for Thermal Energy to Be Used at Industrial Facilities

Organization

EX Corporation

1. Project outline

Sri Lanka is a fossil fuel importing country whose energy demand is on the rise in recent times resulting in a large pressure to the financial state of the country. This project aims to use collected wood chips of Gliricidia (*Gliricidia sepium*), a fast growing tree, and use it as a source of industrial heat under the framework of Programmatic CDM as an alternate to fossil fuel (furnace oil, diesel). Utilization of Gliricidia in the way described results not only in the reduction of GHGs, but also helps in prevention of atmospheric pollution and also contributes to self reliance in terms of energy usage and development of rural areas in Sri Lanka.

Taking into account the results of a study conducted in 2009, this study focused on conducting validation and formulating the implementation framework of the proposed Programme of Activity (hereafter referred as PoA). This was done in order to achieve an early registration of the PoA and the CDM Programme Activities (hereafter referred as CPA) whose responsible and implementing entity is Lion Brewery Ceylon Limited (hereafter referred as Lion Brewery). The amount of reduction of CO2 from Lion Brewery was estimated to be 6,468 tCO2/y. The total reduction potential from CPA sites that have showed their interest in participation in this PoA was estimated to be 4,400 tCO2/y. Hence, the total GHG emission reduction by implementation of the potential CPAs identified up to now was estimated to be 10,868 tCO2/y.

After second phase onwards, in sites with annual usage of furnace oil of about 300kL, the reduction is expected to be about 800-900tCO2/y per site. As about 2,000 heat using companies, both of large and small scales, are expected within the country, the applicability of the project is expected to be high.

The coordinating managing entity (hereafter referred as C/ME) is Bio Energy Association of Sri Lanka. Justification of the fact that this PoA is a voluntary action taken by C/ME and outline of the proposed CPA are described as follows:

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

The implementation of renewable energy generation projects under this PoA is a voluntary action that is not required by law in Sri Lanka. There are some policies and incentives announced by the Government. However neither the National Government nor the Provincial Governments mandate any quantitative targets for the installation of renewable energy generation facilities under this Act.

■ Outline of CPA and applied technology

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 technology to be applied is gasification technology and the maximum thermal energy generation volume is less than or equal to 45MWth

Table 1. Outline of the Project

Item	Contents
Host Country	Sri Lanka
PoA Boundary	Whole Sri Lanka
Applied approved methodology	AMS_SSC_I.C.(ver.18), Leakage part of biomass is referred to AM0042
Project Participants	BEASL, EX Corporation (Japan)
Coordinating/Managing entity	BEASL
Applied technology and size of Project	A project to generate thermal energy from renewable biomass resources which replaces industrial thermal energy originating from fossil fuel. The maximum thermal energy generation volume is less than or equal to 45MWth
Expected project starting date	May 2011
Expected project starting date of the first CPA	December 2011(Lion Brewery)

Methodology applied

The methodology to be applied is " small scale methodology I.C. (Ver.18)". AM0042 is applied to the leakage part of biomass.

2. Content

(1) Framework of the Study

Framework of the study is described below.

Table 2. Framework of Study

Entity	Scope of Work
Bio Energy Association of Sri Lanka (hereafter, BEASL)	: Analysis of Programmatic CDM promotion policy with the Coordinating/Managing Entity (CME), Logistics
Lion Brewery Ceylon Limited. (hereafter, Lion Brewery)	: First CPA, Collection of data required for PDD preparation and conducting the validation
Ener Fab (Pvt)Ltd. (hereafter, EnerFab)	: Biomass Assessment Survey, Analysis of gasification technologies
Det Norske Veritas Certification AS (hereafter, DNV)	: Implement validation as a Designated Operational Entity (DOE)
Fujii Consultant Office	: Technical assistance to EnerFab gasification technology.
Hokkaido Electric Power Co., Inc. (hereafter, HEPCO)	: Investigation on purchase of credits, PDD preparation support

(2) Challenges and issues

The challenges and major issues encountered during the course of this study are described below.

Table 3. Challenges and issues

Item	Contents
1) Identification of the first CPA for conducting validation	Lion brewery was selected as the first CPA site for conducting validation. Out of the potential sites that showed interest in participating in the PoA framework, the sites with the potential to quickly move to the actual business phase were also identified.
2) Improvement of EnerFab's technology	Technical assistance from Japanese prominent experienced engineer was provided in order to enhance the quality of gasifier technology.
3) PoA framework formulation	In addition to the operating policy of C/ME, action plan for expansion of the PoA, consensus building on cost bearing method after PoA expansion, preparation of monitoring manual, and CER distribution rules were addressed.
4) Biomass generation / Demand Analaysis	Based on last year's study, a detailed investigation on the availability of Gliricidia and its utilization status were conducted. The biomass availability report prepared was used as evidence for validation process which is a requirement for the project's registration.
5) PDD revision work / Validation	Revision on the PoA_DD and CPA_DD which was drafted in last year's study were made based on the discussion among relevant entities. Evidences for the validation were prepared.
6) Additionality establishment	Necessary information and documents were prepared in order to establish additionality in accordance with "Guidelines for Demonstrating Additionality of Renewable Energy Projects =< 5 MW[1] and Energy Efficiency Projects with Energy Saving <= 20GWH Per Year"

(2) Content of the study

During the course of this study, site visits to Sri Lanka were conducted five (5) times. Details are presented below.

Table 4. Outline of site visits to Sri Lanka

Duration	Tasks
First visit 2009.8.11to 15	Coordination with local counterparts and stakeholders of Sri Lanka. Collection of basic information. • Intentions of Lion Brewery and Aitken & Spence to participate in the PoA were confirmed • BEASL was officially selected as C/ME • Discussion with EnerFab, Peradeniya University and local consultants were carried out on biomass availability assessment study. • Regarding EB 54 guideline, discussions were carried out with the Ministry of Science and Technology, BEASL and Enerfab on the method to acquire the necessary data to identify the share of biomass based gasification technology in Sri Lanka • Information necessary for validation was collected
Second visit 2009.10.11to 19	Coordination with local counterparts and stakeholders of Sri Lanka. Collection of basic information.

[1] 15 MW for thermal energy equivalent

	• Discussion with BEASL regarding the operation framework management procedures of C/ME • Discussions were carried out on biomass availability assessment study method
Third visit 2009.11.5 to14	• Technical site visits to the existing gasifier plants and discussions were carried out with site engineers • Assistance to improve the gasification technology
Fourth visit 2009.12.10 to20	• Discussion with BEASL on the operation framework management procedures of C/ME • Progress check of biomass availability assessment study which is done by EnerFab • Collection of necessary information
Fifth visit 2010.1.12 to20	• Discussion with BEASL on the operation framework management procedures of C/ME and preparation of documents • Site visit by DNV under the validation process • Conducting of seminar for collecting new potential sites • Technical assistance to EnerFab

(Task 1: Identification of the first CPA for conducting validation)

Due to the condition required by the DOE, it was agreed that only one CPA could be incorporated before registration of the PoA. Among the potential project sites (including Premium Exports Ceylon Limited and Ceylon Cold Stores PLC), the site of Lion Brewery was selected as the first CPA for conducting validation. The selection of Lion Brewery was done based on the recognition of the fact that a relatively large scale CPA (such as Lion Brewery) which was expected to generate the highest amount of CERs among the potential sites and which also was very cooperative to this initiative, would be necessary for the success of the PoA.

(Task 2: Improvement of EnerFab's technology)

EnerFab is the only known fabricator of gasifier in Sri Lanka. EnerFab has installed more than ten (10) gasifiers in Sri Lanka since 2006 up to now. As the decision makers of this PoA decided that gasifier is the only applicable technology to this initiative, the study team consisting of an experienced Japanese engineer specialized in gasification conducted field surveys to assess EnerFab's technology. Through the investigation, it was confirmed that EnerFab's gasfication technology using fuel wood such as Gliricidia and Cinnamon was a technically viable energy conversion system for commercial purpose. In Japan, gasifiers using biomass (e.g. waste) are subsidized by the government. The fact that Enerfab was providing the usage of gasifiers to its clients on a commercial basis without any subsidies which increased the opportunity to utilize unused biomass resources (such as Gliricidia) in the country was highly appreciated. Through the field investigation, a few technical issues such as durability and tar issues were identified at some of the existing facilities that have been operating for several years. However, it was determined that most of these issues could be improved with minor changes. A more significant matter that should be emphasized is to utilize the existing facilities as innovative examples from which data can be collected to improve the technology in the future in each steps of planing, designing, production and operation.

(Task 3: PoA framework formulation)

Before the implementation of the PoA, consensus building among stakeholders especially C/ME and the first CPA owner regarding the following issues were necessary and the draft documents and forms were prepared based on the discussion with the C/ME and Lion Brewery.

- Cost bearing method (at PoA's initial stage and after expansion)
- Operating policy of C/ME
- Action plan for expansion of the PoA
- Monitoring manual
- CER distribution rules
- Agreement between C/ME and CPA
- Recording keeping form

C/ME will check the eligibility of the applicants of new CPAs based on the eligibility conditions. Agreement between C/ME and CPA has also been drafted given that the agreement would be modified for each case.

(Task 4: Biomass generation / Demand Analaysis)

In last year's study, biomass assessment study was conducted. However, estimation of the availability of Gliricidia planted in home gardens as live fence (or some other purposes) was not easy and required further investigation. Biomass assessment study is a requirement for the proposed CDM and this year's study was conducted in order to make a reliable estimation which can be used not only to satisfy the validation requirement but also can be used as a basic data to be utilized for promoting Gliricidia utilization in Sri Lanka.

As a result, the annual generated amount of the Gliricidia fuel wood was estimated to be approximately 532 thousand tons. Survey results showed that demand for Gliricidia from traditional biomass using industry and household usage was negligible. Further, even if the biomass demand at pre-existing factories where fossil fuel was converted into biomass fuel is counted as Gliricidia demand, the amount is estimated to be approximately 163 thousand tons per annum which still leaves a surplus of 369 thousand tons of Gliricidia, a number 46 times larger than the demand at Lion Brewery.

Table 5 Gliricidia Fuel Wood Availability within the targeted area

Item	Figure	Remark
a) Gliricidia fuel wood generation amount within 50km radius from the project site	532,046 t/y	
b) Demand of Gliricidia fuel wood within 50km radius from the project site assuming that all the large scale factories which converted from fossil fuel into biomass fuel use only Gliricidia	162,900 t/y	
c) Availability of Gliricidia fuel wood within 50km radius from the project site	369,146 t/y	a) - b)
d) Fuel wood demand of Lion Brewery	8,094 t/y	
e) Availability of Gliricidia fuel wood within 50km radius from the project site	45.6	c) / d)

(Task 5: PDD revision work / Validation)

The PoA_DD and CPA_DD drafted during last year's study were revised based on the discussion with the relevant entities and new updates that were available. The evidences were also prepared for validation (Refer to "4. Validation").

- Revision of baseline emissions (amount of fuel replacement, specific gravity of furnace oil)
- Revision of Grid emission factor (electricity generation, , specific gravity and net calorific value of fossil fuels)

- Revision on additionality establishment based on a new guideline for demonstrating additionality for small renewable energy projects published at EB54
- Revision of benchmark for investment barrier analysis (applying annual average lending rate of the year of 2010 based on the new bank interest rate effective from 1st January 2010)
- Revision of the financial analysis of Lion Brewery's CPA
  - Increase in furnace oil price (Effective from 1st September 2010)
  - Increase in electricity price (Effective from 1st January 2011)
  - Exchange rate (Average of the year of 2010)
  - Increase in corporate tax for alcohol industry (Increase from 35% upto 40% effective from 1st April 2011)

(Task 6: Establishment of Additionality)

It was decided at EB54 in May 2010 that renewable energy project of capacity equal to or less than 5MW (for thermal interpreted as 15MW) can apply "Guidelines for Demonstrating Additionality of Renewable Energy Projects =< 5 MW and Energy Efficiency Projects with Energy Saving <= 20GWH Per Year" in order to establish the additionality of the project. Among the options defined in the guideline, the following options were applicable to this PoA.

1) The project activity is for distributed energy generation with the following conditions:
   - Each of the independent subsystem/measure in the project activity is smaller than or equal to 750 kW (2.25MW for thermal use) installed capacity;
   - End users of the subsystem or measure are households/communities/ SMEs.
2) The project activity employs specific renewable energy technologies/measures recommended by the host country DNA and approved by the Board to be additional in the host country

The guideline is very significant because if the project satisfies either of the conditions defined in the guideline, it does not need to demonstrate the investing barrier which is the most difficult part in the establishment of additionality in most cases. In this PoA, 2) was selected because it has a higher applicability. However, in the guideline, the conditions applicable to renewable electricity project is clearly indicated as "The total installed capacity of technology/measure contributes less than or equal to 5% to national annual electricity generation". However no conditions are mentioned for renewable thermal project. Regarding this issue, unofficial comments were obtained from the CDM EB members indicating that a similar condition will be applied to thermal projects. Hence, based on this recognition, in order to obtain the recommendation letter from DNA, efforts were made during the course of this study to justify that the biomass based gasification technology has less than 5 % share of the total thermal energy supply of the country.

This study result shows that the share of the biomass based gasification technology was 0.16% which is far lower than 5%. "Harita Lanka" which is a Sri Lankan national development policy, clearly mentions biomass gasification green technology as one of the technologies to be promoted. Based on these evidences, it is expected that there will not be any difficulties in obtaining recommendation letters from DNA for submission to the CDM EB.

On the other hand, regarding the guideline the DOE pointed out that there was no clear description of whether 5 MW indicates electricity or thermal energy although previous guidelines apply the conversion factor of 3 for thermal energy against electricity in general. This issue needs to be clarified by sending comment to CDM EB.

3. Results of Study for CDM Project Implementation

(1) Determination of Baseline Scenario and Project Boundary

Baseline Scenario

The baseline of the proposed project is that the industrial thermal energy is continued to be supplied by the usage of fossil fuels such as furnace oil and diesel. Biomass, mainly Gliricidia branch, which is pruned periodically, is left at backyards of farms or farmlands to decay and is not sold or utilized. In cases where biomass such as Gliricidia (which can be harvested on short rotations) is newly grown in unutilized land and the harvested biomass is supplied to industry for thermal purpose, the baseline scenario is the continual soil degradation due to the unused state of the land to be continued.

Applied Baseline and Monitoring Methodology

This project applies SSC AMS-I.C. *"Thermal energy production with or without electricity(Ver.18)*". In addition, based on this methodology, AM0042 *" Grid-connected electricity generation using biomass from newly developed dedicated plantations (Ver.02)*" was applied for biomass utilization.

Project Boundary

- PoA boundary: within Sri Lanka
- CPA boundary: Based on SSC AMS-I.C. and AM0042, the boundary applies to each CPA under the PoA are defined as follows :
  - the physical and geographic location of each biomass thermal energy generating facility
  - the area where the biomass is extracted or produced (only for the case where new cultivation are involved)

Application to the first CPA

The CPA is within the boundary of PoA as Lion Brewery is located within Sri Lanka. The boundary of the CPA is defined as boundary of the premise of the Lion Brewery as it does not include new cultivation.

(2) Project Emissions

1) Baseline emission

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

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

$BE_{thermal,CO2,y}$	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 (GJ)

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

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

Table 6 Baseline emissions of Lion Brewery's CPA and the parameters used for calculation

Item	Unit	Figure	Remarks
a) Amount of fuel to be replaced	kL/y	2,130	
b) Specific gravity of fuel to be replaced	t/kL	0.972	Energy Data 2007, SEA
c) Net calorific value of fuel to be replaced	GJ /t	41.0	Energy Data 2007, SEA
d) Net calorie supplied	GJ/y	81,911	a)*b)*c)
e) CO2 emission factor of fuel to be replaced	$kgCO_2/GJ$	77.4	Residual oil: 77.4 (IPCC 2006)
f) Baseline emissions	tCO_2/y	6,572	d)*e)/1000

2) Project emission

Project emission is composed of the following two components: (1) Emissions from on-site consumption of fossil fuels due to the project activity, and (2) Emissions from electricity consumption by the project activity. Emission (1) occurring from Lion Brewery's CPA is estimated to be zero (0) as the usage of on-site fossil fuel is not assumed for operating the installed facilities. On the other hand, expected amount of emission (2) is calculated by using the following steps:

CO2 emissions from electricity consumption by the project activity

Project emission from electricity consumption by the project activity is calculated by using following equation.

$$PE_{y,power} = E_{PJ,y} \times CEF_y$$

$PE_{y,power}$ Annual project emissions from system power supply (tCO2e/year)

$E_{PJ,y}$ Electricity requirement of installed plant (MWh)

CEF_y CO2 emission factor of system power supply (tCO2e /MWh)

Calculation of Electricity Consumption(EC_y)

Electricity consumption was calculated based on the preconditions from the supplier as shown in the Table 7.

Table 7 Electricity Consumption

Item	Figure	Remarks
a) Electricity requirement (kW)	20	
b) Annual operation hours (h/y)	8,064	336days×24hour
c) Electricity consumption (kWh/y)	149,760	a)×b)

Calculation of Grid Emission Factor

All the electricity to be consumed by the project activities are grid electricity. The grid emission factor was

calculated as 0.695kgCO2/kWh based on the data from Ceylon electric board and Sustainable Energy Authority in accordance with "Grid-connected electricity generation using biomass from newly developed dedicated plantations (Version 02)".

Emissions from electricity consumption by the project activity

Based on the above steps, Emissions from electricity consumption by the project activity was calculated as follows:

Table 8. Emissions from electricity consumption by the project activity

Item	Figure	Remark
a) Electricity consumption (MWh/y)	149.8	
b)Emission factor of grid electricity (kgCO2/kWh)	0.695	
c)Emissions from electricity consumption (tCO/kWh)	104	a) x b)

3) Leakage Emissions

Regarding leakage, the following three (3) factors need to be considered. However, due to reasons listed below, emission is not expected from any of the factors described below.

i) Leakage associated to transfer of energy producing equipments

This leakage is expected to be zero (0) as these equipments will not be transferred from other sites in the three candidate projects.

ii) Emissions from biomass generation / cultivation

This leakage is expected to be zero (0) as the three candidate projects do not involve any new cultivation of biomass.

iii) Competing use of biomass

This leakage is expected to be zero (0) because of the following reasons:

- Domestically in Sri Lanka, branches of Gliricida are hardly used and generally, after periodic pruning, the branches are left at back yards of farms to decay, and
- Biomass assessment was conducted to identify the available amount of Gliricidia in procurement boundary of the CPA (50km from the site). According to the report, the storage amount within a radius of 50 kms is more than 46 times greater than the required amount of biomass even in an extremely conservative case. Hence it is concluded that it is not necessary to consider the leakage.

(3) Monitoring Plan

As this Programmatic CDM will involve the switching of source of energy by utilizing renewable biomass, both C/ME and CPA(s) are requested to conduct monitoring activities on biomass in addition to those on facility(ies) operation. Consequently, in accordance with the definition provided by AM0042 and EB23 Annex18. C/ME in cooperation with CPA(s) shall conduct monitoring activities as follows.

Table 7. Parameters from Biomass related Monitoring Activities

Parameter	Unit	Method	Frequency	Internal Auditing Method
Type of Biomass	-	Interview (Supplier(s))	Occasionally	Site survey to be conducted by C/ME
Supply Source	-			
Procured Quantity (by Type)	t/y	Delivery Note & Invoice	Daily	Cross check with related department including accounting by third party
Demand & Supply in the procurement area		Interview (Supplier(s))	Occasionally	Site survey to be conducted by C/ME
Distance from procurement source (area)	Km	Check with Database	Daily	

Gasification can be equipped to production lines involving both hot air & hot water generating purpose and steam generating purpose. In these cases, flow meter and temperature gauge needs to be installed. It will also be required to install pressure gauge (in addition to flow meter and temperature gauge) in the case of steam generation in order to conduct monitoring activities. However, if the generated substitute energy will be procured by other facility(ies), monitoring activity is required to be done at energy consuming point(s).

Table 8. Parameter from Gasification Monitoring Activities

Parameter	Unit	Method	Frequency	Internal Auditing Method
Operation Hours (Continuous)	h	Operation Record	Daily	
Quantity of Biomass consumed	MT	Operation Record	Daily	Cross check with accounting department
Flow of generated energy	M3/y, t/y	Flow Meter	Continuous Data Recording	Maintenance of facility(ies) and calibration are as per manufacturer's recommendation
Temperature of generated energy	℃	Temperature Gauge	Continuous Data Recording	Maintenance of facility(ies) and calibration are as per manufacturer's recommendation
Pressure of generated energy (In the case of steam)	Bar	Pressure Gauge	Continuous Data Recording	Maintenance of facility(ies) and calibration are as per manufacturer's recommendation
Electricity consumed by facility	MWh	Electricity Meter	Once/Month	Cross check with accounting department
Fossil Fuel consumed (only when consumed)	t/y	Delivery Note & Invoice	Daily	On site check by third party(ies)

All the data collected above shall be kept in Operation Data File, converted into electronic form, audited, approved by authorized person, then submitted to C/ME without delay. Other parameters required in the monitoring report are as follows.

Table 9. Other parameters required in monitoring report

Parameter	Unit	Method	Frequency	Accuracy check
Emission Factor by Fossil Fuel Type	tCO2/GJ	IPCC	Once/Year	Check up-date(s) in IPCC2006 Guideline
Net Calorific Value of Fossil Fuel	GJ/mass	IPCC	Once/Year	
Net Calorific Value of Biomass	GJ/mass	Analyze value at institutes	Once/Year	Check compatibility with other source of information etc
Thermal Energy to be procured from new facility to production line(s)	GJ/y	Calculation (based on value obtained from monitoring)	Once/Year	

A flow chart for monitoring activities is shown in figure 1.

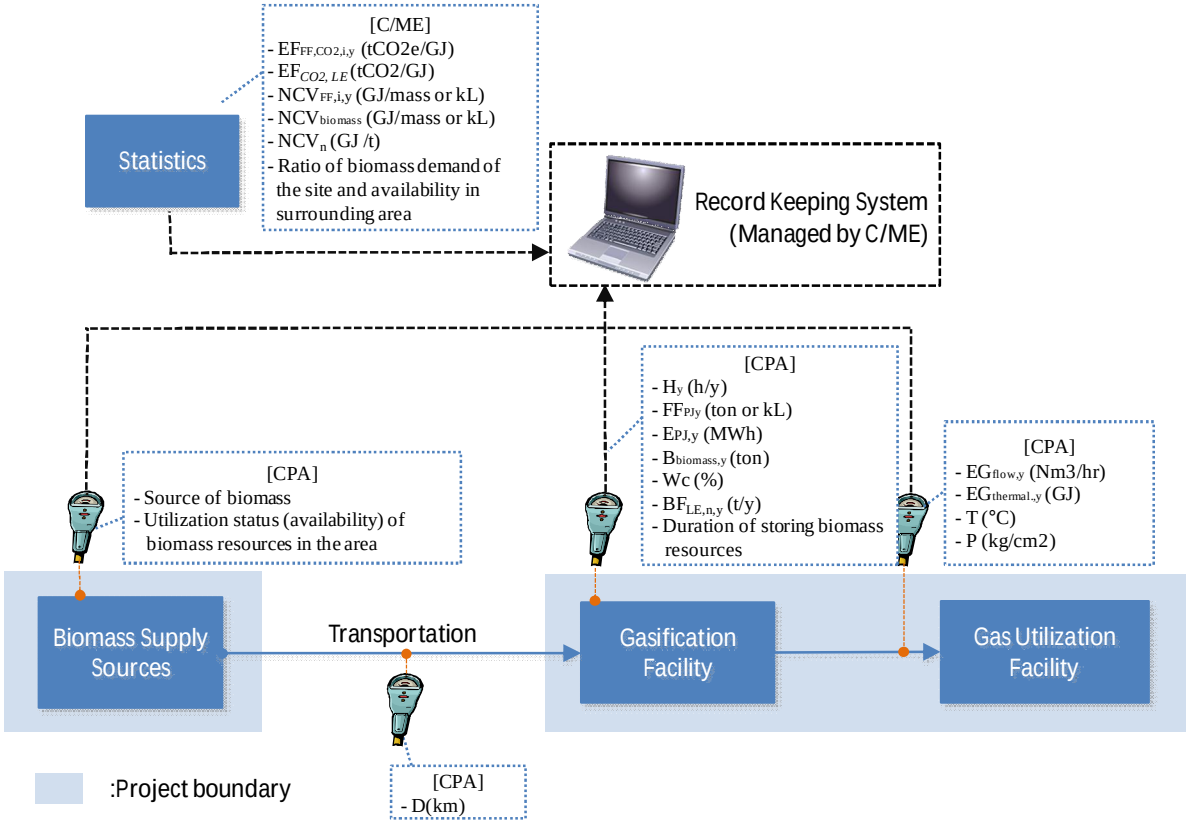

Figure 1. Monitoring Record Keeping System

(4) Reduction of GHG

The reduction amount expected from this estimate is 6,468 tCO2/y for Lion Brewery. The total for the four (4) identified companies is an annual reduction of 4,400 tCO2/y and the total for the both is 10,868 tCO2/y. Details are provided below.

Table 13 GHG emission reduction (Total)

year	Lion Brewery				Other potential sites				Total
	Baseline Emissions	Project Emissions	Leakage Emissions	GHG Emissions	Baseline Emissions	Project Emissions	Leakage Emissions	GHG Emission Reduction	GHG Emission Reduction
	tCO2/y	tCO2/y	tCO2/y	tCO2/y	tCO2/y	tCO2/y	tCO2/y	tCO2/y	tCO2/y
2011	6,572	104	0	6,468	4,631	231	0	4,400	10,868
2012	6,572	104	0	6,468	4,631	231	0	4,400	10,868
2013	6,572	104	0	6,468	4,631	231	0	4,400	10,868
2014	6,572	104	0	6,468	4,631	231	0	4,400	10,868
2015	6,572	104	0	6,468	4,631	231	0	4,400	10,868
2016	6,572	104	0	6,468	4,631	231	0	4,400	10,868
2017	6,572	104	0	6,468	4,631	231	0	4,400	10,868
2018	6,572	104	0	6,468	4,631	231	0	4,400	10,868
2019	6,572	104	0	6,468	4,631	231	0	4,400	10,868
2020	6,572	104	0	6,468	4,631	231	0	4,400	10,868
合計	65,720	1,040	0	64,680	46,310	2,310	0	44,000	108,680

(5) Project time, credit acquirement time

The project span for the PoA is to be 28 years. The final decision on credit acquirement time for the respective CPA is 10 years without renewal. Further, the project start date is set as the date of purchase order of gasifier facility which is a date when a large amount of cost will be generated in the project implementation phase.

(6) Environmental impact and other indirect impacts

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

a) Biomass procurement

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 when using biomass from new 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)

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 as elaborated in CDM SSC-PoA-DD.

Table 14 The level of Conducting Environmental Analysis

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

【Applicability to the first CPA】

The items listed above are not applicable to the Lion Brewer's CPA, 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 that they are not procured from dedicated plantations of wood biomass resources.

(7) Stakeholders comments

In this study, stakeholders comments were collected from three methods of i) Interview of governmental bodies

and promotional bodies, ii) Interview with farmers to understand the cultivation and usage of Gliricidia and iii) Questionaires to participants of the seminar held in February 2010.

Regarding i) above, there were comments from DNA, the Power and Energy Ministry, the Science and Technology Ministry regarding strong expectations of the promotion of renewable energy and CDM, comments from Peradeniya University and BEASL supporting this project from the viewpoint of promotion of cultivation and usage of Gliricidia. The comment from MGC was the importance of Gliricidia as the role it could play to provide relief to the civil war affected areas of Sri Lanka and also the details on promotion of the cultivation of Gliricidia. The National Development Bank commented on the usage of CDM to decrease the risk factor in biomass projects and hence decrease the hurdle for the procurement of funds. There were expectations on beneficial effects to the Gliricidia producing villages from JICA.

Regarding ii) above, it was understood that many farms did cultivate Gliricidia within their farms and that the branches were periodically pruned, but these branches were left within their premises without any usage. Many farms commented on the lack of market for the sale of Gliricidia and some farms misunderstood Gliricida, which is a fast growing plant to be a land grabbing plant. These facts highlighted the need of awareness-raising.

Regarding iii) above, 25 replies were received to the questionaires. 13 replies were from potential users of biomass fuel and out of that 12 were interested in participating in this PoA. Majority of the comments were positive and showed interest in this project.

(8) Project implementation structure.

The project implementation structure is demonstrated below with BEASL acting as the CME, the implementing body of the first CPA is Lion Brewery and EnerFab acting as the operation partner for the first CPA. Hokkaido Electric Power Co., Inc.is one of the potential purchasers of the CER generated from the PoA.

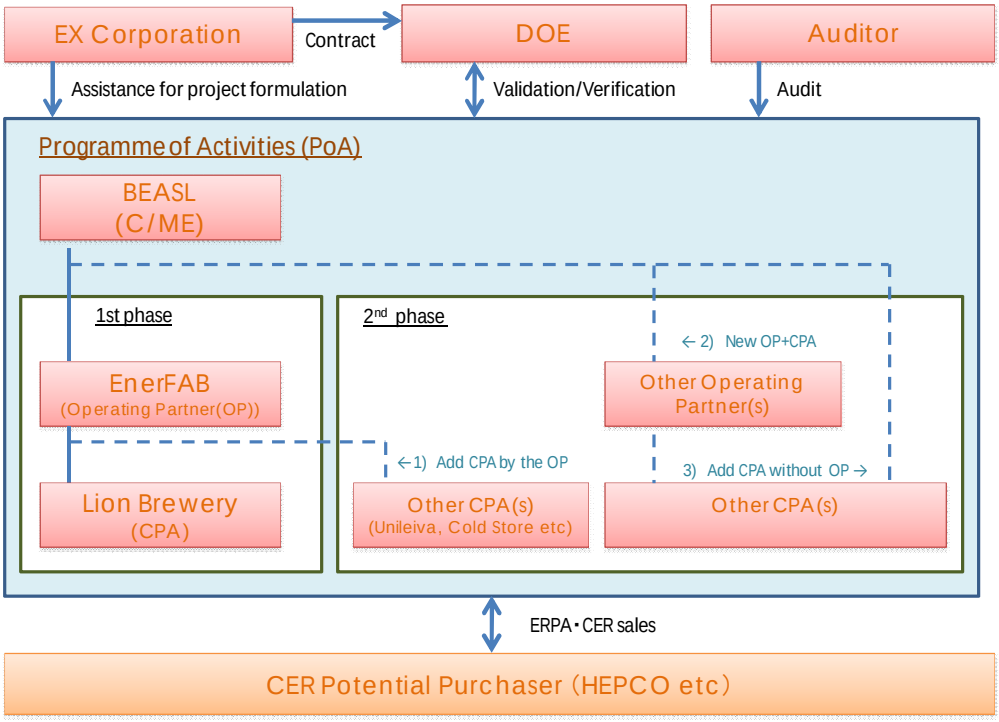

Figure 2. Project Implementation framework

(9) Fund planning

<The first CPA>

Lion Brewery is assuming that it will invest its own funds. In this project, a major portion of expenditure will be attributed to facility/equipment installation at the initial stage. Therefore CPA will assume that all the initial investment shall be required in the first fiscal year of the operation. Fund raising and business plan will continue to be discussed among the parties concerned.

<Second CPA and consecutives>

We assume that it might be more difficult to get capital injection into the project or that only a higher interest rate for banking loan applicable for the ESCO comprising of EnerFab and other small and medium enterprises. Therefore we will continue to collect information on all types of financial support and/or assistance or grants offered by any organization / authorities / entities. It will also include financial contributions being planned such as Sri Lanka Carbon Fund of Ministry of Environment of Sri Lanka

(10) Economic Analysis

Economic viability of the three candidate projects is as follows. For Lion Brewery and Premium Exports where furnace oil is to be replaced, the economic viability without CER sales was very low and IRRs (15 years, after tax) do not even reach the benchmark, which was determined by the new interest rate of the Sri Lankan Central Bank after the drastic rollback of their interest rate.

Table 15 Preconditions for the economic viability assessment

Parameter	Specification
Finance	Equity: 100%
Depreciation	15years
Corporate tax	40%
Credit selling price	LKR 2,200/tCO2 (1,650yen/tCO2@ LKR 0.75/yen)

Table 16 Economic viability Assessment

Without CER		With CER	
IRR (15y, After tax)	Payback period	IRR (15y, After tax)	Payback period
-1.9%	16	10.6%	11

(11) Establishment of Additionality

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

The CPAs equal to or below 15 MW thermal energy can establish additionality using "Guidelines for Demonstrating Additionality of Renewable Energy Projects =< 5 MW[2] and Energy Efficiency Projects with Energy Saving <= 20GWH Per Year". According to the guideline, project activities employ specific renewable energy technologies/measures recommended by the host country DNA and approved by the Board to be additional in the host country is regarded as additional.

However, there is no project which has established additionality based on this guideline yet and the UNFCCC is calling for public comments on this guideline at the moment (from 18 Feb till 8 March 2011). Hence, there are uncertainties concerning the timing of obtaining the approval from CDM EB for this PoA. If it fails to establish additionality based on the guideline, all the CPAs have to follow the "Tool for the demonstration and assessment of additionality (Version 05.2)"(EB39, Annex10)" for additionality establishment.

[2] 15 MW for thermal energy equivalent

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

The CPAs beyond 15MWth shall establish additionality in line with Attachment A of Appendix B of the Simplified Modalities and Procedures for Small-Scale CDM project activities and Methodological tool; "Tool for the demonstration and assessment of additionality (Version 05.2)"(EB39, Annex10).

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

(12) Prospects of commercialization

Lion Brewery is very positive to the idea of switching energy source from fossil into biomass and have shown their keen interest in joining the programmatic CDM. They are still considering alternatives to Enerfab as a facility supplier which might cause a delay in the future. C/ME has already submitted Prior Consideration to DNA in the host country as well as UNFCCC. Table below shows details of potential CPAs other than Lion Brewery.

Table 15. General Information of other potential CPAs

Potential CPAs	Fossil Fuel	Emission Reduction Q'tity	Current Situation
Cold Store	Diesel	1,166 tCO2/y	Because of dropping down of fossil fuel price, they have become negative to switching energy source
Unilever	Diesel	Approx.1,000 tCO2/y	They have selected biomass direct combustion facility as substitution of their existing heat generating facility. As a result, quantity of emission reduction will become smaller than last year
Aitken & Spence Hotel Group	Furnace Oil Kerosene Diesel	1,822tCO2/y (Three sites in total)	They have shown their interest to participate in this programmatic CDM. However the quantity of emission reduction is only a few hundred tCO2.
Le Ferne Laboratories Pvt Ltd.	Diesel	412tCO2/y	They are interested in switching energy source from current utilizing fossil fuel into biomass. There are plans for further discussion in future

4. Validation

(1) Outline of Validation

Four (4) DOEs with experience of validation for programmatic CDM have been contacted. One among the four is from Japan. Based on their offered terms & conditions, negotiations with DOEs submitting the quotations were carried out and based on this, DNV India were selected as they have a geographic advantage.

As DNV did not offer to conduct validation for more than one CPA, we have selected Lion Brewery as the first CPA as they have the largest quantity of emission reduction among the potential CPAs and also show the strongest interest in participation in this programmatic CDM. Site survey team from DNV were received during February

17-18, 2011 and validation report were obtained from DNV on March 02, 2011. We will collect further information including evidences which DNV request us to add as Correct Action Request or CAR in their validation report, amend and/or revise PoA-DD and CPA-DD and continue to correspond with them for earliest registration.

(2) Corresponding Log with DNV

The first contact with DNV was done in November 2010. However, as it took a long time to finalize the deal than what was expected at the initial stage, contract was finalized at the beginning of January which is a delay according to our schedule. The progress as of today is as follows;

- submitted PDD and other requested documents to DNV on January 09, 2011,
- published PoA-DD and CPA-DD for collecting public comments at UNFCCC's website from January 29 to February 27, 2011
- DNV conducted validation on both February 17 & 18, 2011. During the site visit, checking of the contents of PoA DD was done in the first day along with the confirmation of the detailed plan for C/ME`s operation structure. On the second day a site visit of Lion Brewery was carried out along with the checking of the contents of CPA-DD. The draft validation report was obtained on the second of March, 2011.

4. Survey result regarding co benefit

In the last year's study, co-benefit quantitative evaluation was conducted regarding SOx, NOx, dust and CO2. The result shows that emission reduction was expected for all the evaluated items.

5. Survey result for contribution to sustainable development

In addition to Effect of co-benefit evaluation (reduction of GHG gas, improvement of the environment), the following contributions to sustainable development is expected from this project.

■ Soil protection and derived effects from soil protection in the host country

Gliricidia belongs to the leguminosae family and has the ability to fix atmospheric Nitrogen. Its cultivation is possible in various different conditions except cases where there is absolutely no nutrient in the soil or the soil is highly acidic or alkaline. The leaf from this plant is full of Nitrogen and hence when it falls on the soil, the Nitrogen content is returned to the soil which helps improve the soil quality. The following effect can be expected be using Gliricidia in unused land and land with limited usage.

a) Improvement of soil condition
b) Prevention of soil erosion (cultivation areas and cultivation plot)
c) Diversification of plants and living organisms
d) Absorption of CO2

■ Environmental improvement and pollution prevention measures in the host country

The fuel usage of Gliricidia chips, as compared to diesel and furnace oil, emits a lower amount of SOx, NOx, dust and SPM. The reduction is noteworthy especially when furnace oil is replaced. In coconut and tea farms which are the major agri products of Sri Lanka, many factories use furnace oil and hence by promoting the

cultivation of Gliricidia in farms adjacent to factories and replacing the fuel, a big contribution can be made to prevent air pollution and also improve the health of the people residing in the surrounding areas.

- Improvement of energy self sufficiently

Sri Lanka relies heavily in the import of energy due to increase in domestic demand of energy and with the rise in price of fossil fuel, usage of Gliricidia is expected to contribute to help improve the self sufficiency of energy.

- Support to the war-ravaged areas and areas affected by natural disasters

The host country has experienced civil war for a long time and in the Northern, Eastern and North Eastern areas severely affected by the civil war, the people have run away from their homes leaving the farm lands which have become unused. In these areas and areas in the southern regions which are affected by Tsunami and other natural disasters and coastal areas which are dry and cannot be cultivated, the cultivation of Gliricidia is reported to be possible and the cultivation of Gliricidia can be expected to increase in these areas.