CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006

CONTENTS

A. General description of project activity

B. Application of a baseline and monitoring methodology

C. Duration of the project activity / crediting period

D. Environmental impacts

E. Stakeholders' comments

Annexes

Annex 1: Contact information on participants in the project activity

Annex 2: Information regarding public funding

Annex 3: Baseline information

Annex 4: Monitoring plan

SECTION A. General description of project activity

A.1 Title of the project activity:

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Title in full: M/S. Kothari Sugars and Chemicals Ltd (KSCL)'s Bagasse Based Co-generation Project, at Perambalur district, Tamil Nadu, India

Short title: KSCL Bagasse CHP

Version of document: Version 3.0[1].

Date of document: 8 March 2007

A.2. Description of the project activity:

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M/s. Kothari Sugars and Chemicals Ltd (KSCL) is constructing a sugar mill in Tamil Nadu with a crushing capacity of 3,000 tonnes of cane per day, and is proposing to install a new bagasse-fired co-generation unit to meet captive electricity requirements of the sugar mill and export surplus electricity to the Tamil Nadu state electricity grid.. Presently there is no sugar mill, co-generation plant or steam generation at the site and the proposed project is a green-fields project.

The purpose of the project activity is to generate electricity and heat utilising available bagasse from the KSCL-operated sugar mill. The generated steam will be used in the sugar mill, and electricity will be used for in-house consumption and surplus electricity will be exported to the grid.

The project activity reduces carbon dioxide emissions by substituting conventional fossil fuel generated electricity. Grid electricity in Tamil Nadu is mainly generated from fossil fuels, while the project activity produces electricity from bagasse, a waste product of the sugar industry. The KSCL Bagasse CHP project is expected to generate some 139 GWh (net) per year for use in the sugar mill and export to the grid. The project activity will have large impact in terms of reducing greenhouse gas emissions, as the project displaces mainly coal-fired power plants.

The main fuel for the plant is bagasse, which is generated by the new sugar mill itself. During the season sufficient bagasse is available from the sugar mill to fuel the plant and to accumulate some fuel reserves for the off-season. However, during the off-season other fuels will also be used. During the off-season, further bagasse will be obtained from another, nearby sugar mill, also operated by KSCL.

KSCL is currently negotiating biomass fuel supply contracts to supply the remainder of the required fuel for the project activity, including sugar cane trash. However, while plentiful biomass resources are available in the region, the absence of a working biomass fuel market and the impact of the monsoon will limit the amount of biomass used in the off-season. For the purpose of the calculations in this document it is assumed that biomass and coal will each provide half of the fuel input during the off-season.

The high-pressure, high-temperature steam generated will be used in the sugar mill. All electricity

[1] The PDD is being revised in order to comply with the revised ACM0006, Version 4 methodology .

requirements of the sugar mill will be met by the project activity, while any surplus electricity is exported to the Tamil Nadu Electricity Board (TNEB) through a 110 kV substation nearby. The project activity is expected to generate 139 GWh per year net of parasitic losses. The sugar mill requires about 26 GWh per year for its operations, and the remaining 113 GWh will be exported to the grid.

The project will:

- generate renewable electricity;
- generate renewable heat;
- reduce greenhouse gas emissions in India compared to a business-as-usual scenario;
- reduce the wastage of biomass resources;
- stimulate the biomass industry in India, including domestic manufacturing;
- create local employment during the assembly, installation, and operation of the plant; and
- reduce other pollutants resulting from the power generation industry in India such as sulphur, soot and photochemical agents, compared to a business-as-usual approach.

The project activity contributes to sustainable development by generating economic growth in the region, conservation of natural resources by substituting fossil fuels with locally available biomass residues, and by reducing the potential wastage and dumping of biomass residues and provision of additional income to local farmers for additional biomass requirements.

The project activity will also have social benefits wherein it will boost employment for neighbouring populations and increasing income for farmers. It will also allow operational personnel to develop skills to use local equipment and technologies, improving the local socio-economy. The rural population and communities wherein the project is implemented will have expanded access to electricity as the grid power. The economic benefits of the project to the region is also significant with investment of around 830 million INR (about 14.3 million Euro), and annual hard-currency CDM revenues.

A.3. Project participants:

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Name of Party involved	**Private and/or public entity (ies) project participants**	**Project participant**
India (host)	▪ Project proponent: M/S. Kothari Sugars and Chemicals Ltd	▪ No
United Kingdom of Great Britain and Northern Ireland	▪ Carbon Resource Management Ltd	▪ No

Please refer to Annex 1 for contact information of project participants

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

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A.4.1.1. Host Party(ies):

>> India

A.4.1.2. Region/State/Province etc.:

Tamil Nadu state

A.4.1.3. City/Town/Community etc:

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Sathamangalam-village, Ariyalur-Taluk, Perambalur-district, Tamil Nadu – 621 707

Figure 1 Perambalur district, Tamil Nadu

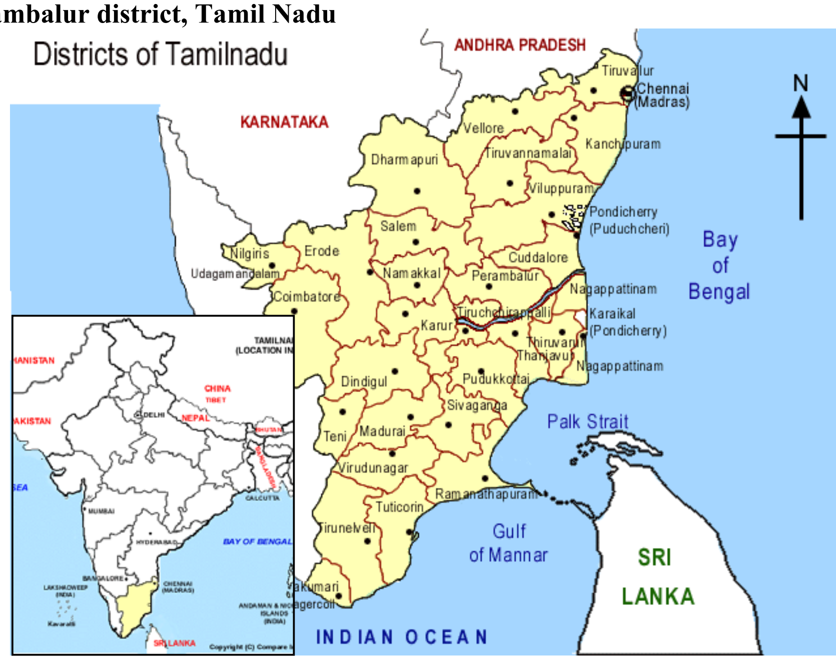
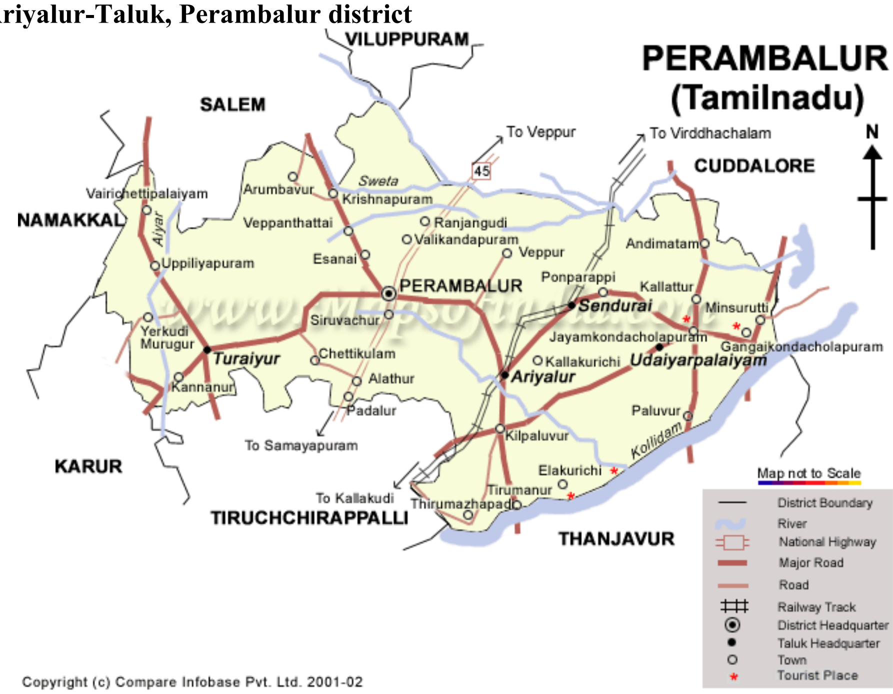


Figure 2 Ariyalur-Taluk, Perambalur district



A.4.1.4. Detail of physical location, including information allowing the unique identification of this project activity (maximum one page):

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The KSCL Bagasse CHP plant will be build at the new sugar mill complex, located at Sathamangalam village, Vetriyur (PO), Ariyalur Taluk, Perambalur District, Tamil Nadu-621707, India. The nearest major urban settlement is Tanjavur, approximately 25km from the site. The nearest railway station is in Ariyalur. The plant is located at latitude of 11.14^o N and longitude of 78.56^o E. The plant will be connected to a 110 kV substation of the Tamil Nadu Electricity Board, approximately 5km from the site.

A.4.2. Category(ies) of project activity:

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Using the agreed consolidated methodology ACM0006/Version 04 the category of the project activity is:

- Sectoral scope 1: Energy industries
- Category: Grid-connected electricity and heat generation from biomass residues
- Sub-type: Combined Heat and Power

A.4.3. Technology to be employed by the project activity:

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The project activity involves the installation of 1 steam boiler with a capacity of 80 tonnes of steam per hour, and 1 turbogenerator with a rated capacity of 24MW.

Boiler:

- Make: Isgec John Thompson (New Delhi)
- Capacity: 80 TPH
- Outlet pressure: 84 ata (87 kg/cm^2)
- Outlet temperature: 515°C
- Feed water inlet temperature: 105°C

Turbogenerator:

- Make: Hongzhou Turbine Corporation (HTC, China)
- Capacity: 24 MW
- Double extraction and condensing
- Turbine steam inlet: 84 kg/cm^2
- Steam temperature inlet: 510°C
- Power output: 11kV

The project activity will include all auxiliary installations and systems, including fuel and ash handling system, cooling water system, feed water system, raw water and DM water system, Instrument air system, electrical system and EHV transmission system for its successful operation.

The power plant supplier will train KSCL on operation and maintenance aspects of the boiler and its auxiliaries. Later, a detailed training programme will be provided to develop skills for all plant operators at KSCL plant.

Experienced professionals/ technical consultants from power plants will be hired to train the plant operators on regular basis.

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

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The project activity is expected to reduce greenhouse gas emissions by about 827,194 tCO_2e during 10-year crediting period. In absence of the project activity the energy requirement of the sugar mill of 26 GWh per year would have been met though importing grid electricity, which is mainly generated using coal, and the remaining 113 GWh per year would not have been generated from renewable sources.

Table 1 KSCL Bagasse CHP estimated emission reductions

Period	Project emissions	Leakage	Baseline	Emission reductions
Year 1	32,387	-	107,586	75,199
Year 2	35,985	-	119,540	83,555
Year 3	35,985	-	119,540	83,555
Year 4	35,985	-	119,540	83,555
Year 5	35,985	-	119,540	83,555
Year 6	35,985	-	119,540	83,555
Year 7	35,985	-	119,540	83,555
Year 8	35,985	-	119,540	83,555
Year 9	35,985	-	119,540	83,555
Year 10	35,985	-	119,540	83,555
Total first crediting period	**356,252**	**-**	**1,183,446**	**827,194**
Crediting time (years): 10				
Annual average:	*35,625*	-	*118,345*	*82,719*

In each year the amount of CERs actually generated by the project will vary depending on the metered net power generation and fossil fuel use by the KSCL Bagasse CHP project, determining the actual emission reductions ex-post.

A.4.5. Public funding of the project activity:

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There is no public funding from Annex I Parties for this Project.

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline and monitoring methodology applied to the project activity:

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The project participants propose to use the approved baseline methodologies ACM0006 (version 4) “Consolidated baseline methodology for grid-connected electricity generation from biomass residues” in conjunction with ACM0002 (version 6, 19 May 2006) “Consolidated baseline methodology for grid-connected electricity generation from renewable sources” to calculate the Operating Margin emission factor and the Build Margin emission factor.

In applying this methodology, “Tool for demonstration and assessment of additionality” (version 3, 16th February 2007) agreed by the CDM Executive Board is used for showing the additionality of the Project.

The project participants propose to use the approved consolidated monitoring methodologies ACM0006 (version 4) and ACM0002 (version 6), which have to be used in conjunction with the ACM0006 and ACM0002 baseline methodologies.

B.2 Justification of the choice of the methodology and why it is applicable to the project activity:

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The approved methodology ACM0006 is applicable to grid-connected and biomass residue fired heat and power generation (co-generation) projects. As per the methodology, the project activity may include: “the installation of a new biomass power generation plant at a site where currently no power generation occurs (Greenfield power projects)”.

The project activity meets the applicability criteria of the consolidated methodology ACM0006:

Criteria 1: No other biomass types than biomass residues[2] are used in the project plant and these biomass residues are the predominant fuel used in the project plant (some fossil fuels may be co-fired)

The co-generation plant boilers will operate on bagasse and other biomass residue fuels. The usage of biomass types like municipal solid waste (MSW) is not envisaged. During off-season the required bagasse for the off-seasonal operation will be met by the excess bagasse stored during the crushing season, the purchased bagasse from the outside factories and the bio-mass residue fuels such as cane trash procured. However, due to the lack of structured biomass residue fuel markets in the region and the impact of the monsoon, it is expected that about half of the fuel requirement during off-season will be met from coal.

Criteria 2: For projects that use biomass residues from a production process (e.g. production of sugar or wood panel boards), the implementation of the project shall not result in an increase of the processing capacity of raw input (e.g. sugar, rice, logs, etc.) or in other substantial changes (e.g. product change) in this process

Implementation of the project activity has no direct or indirect effect on sugar milling capacity in the facility. The sugar production is guided by the sugar demand of the market and local sugar cane production.

Criteria 3: The biomass residues used by the project facility should not be stored for more than one year.

Excess bagasse available during the season (172 days) will be stored for use during off-season (158 days). The excess bagasse will not be stored for more than a year as the project operates both during season and off-season. During off-season, bagasse from another KSCL-managed sugar mill and other biomass residue fuels will be used.

[2] For this specific methodology, **Biomass residues.** *Biomass residues* are defined as *biomass* that is a by-product, residue or waste stream from agriculture, forestry and related industries. This shall not include municipal waste or other wastes that contain fossilized and/or non-biodegradable material (small fractions of inert inorganic material like soil or sands may be included). Note that in case of solid biomass residue for all the calculations in this methodology, quantity of biomass residue refers to the *dry* weight of biomass residue.

Criteria 4: No significant energy quantities, except from transportation or mechanical treatment of the biomass residues, are required to prepare the biomass residues for fuel combustion, i.e. projects that process the biomass residues prior to combustion (e.g. esterification of waste oils) are not eligible under this methodology.

Prior processing of bagasse/biomass residues is not essential. During season, the wet bagasse received at the co-generation plant with approx 50% moisture will be directly fed into the boilers. The excess bagasse stored and the other biomass residue resources procured for operations during off-season will be almost dry prior to feeding them into the boiler.

The applicable baseline scenario for the proposed project is the Scenario 3 of Table 1 of "Consolidated baseline methodology for grid connected electricity generation from biomass residues" ACM0006 / Version 04; Sectoral Scope: 01. Scenario 3 comprises the following baseline components:

- Baseline for power generation: The generation of power in new grid-connected power plants (P4).
- Baseline for generation of heat: The generation of heat in boilers using the same type of biomass residues (H4). A conservative baseline assumption is that the required heat would have been generated from the same bagasse biomass residues without registration of the project activity as a CDM project.
- Baseline for the use of biomass residues: The biomass residues is used for heat generation at the project site (B4), with the remainder of the biomass residues dumped of left to decay or burned in an uncontrolled manner without utilising it for energy purposes (B1 or B3).

B.3. Description of the sources and gases included in the project boundary

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Emission sources within the project boundary:

ACM0006 prescribes that for the purpose of determining GHG emissions of the project activity, project participants shall include the following emissions sources:

- CO_2 emissions from on-site fossil fuel and electricity consumption that is attributable to the project activity. This includes fossil fuels co-fired in the project plant, fossil fuels used for on-site transportation or fossil fuels or electricity used for the preparation of the biomass residues, e.g., the operation of shredders or other equipment, as well as any other sources that are attributable to the project activity; and
- CO_2 emissions from off-site transportation of biomass residues that are combusted in the project plant.

For the purpose of determining the baseline, project participants shall include the following emission sources:

- CO_2 emissions from fossil fuel fired power plants connected to the electricity system; and
- CO_2 emissions from fossil fuel based heat generation[3] that is displaced through the project activity.

[3] In the baseline, heat is generated from the same biomass residue source. Emissions reduction from heat generation therefore is zero.

ACM0006 allows project participants to decide whether to include CH_4 emissions in the project boundary if the most likely baseline scenario for the biomass would be case B3, which applies to small part of the bagasse in the KSCL Bagasse CHP project. However, the project participants choose not to include these emissions in the project boundary, simplifying the project monitoring, and resulting in a more conservative baseline.

There is no fossil fuel or electricity consumption for preparation of biomass residues and no mechanical devices are being used for the same. As the wet bagasse is directly fed into the boiler after crushing on-site transportation of fuels is not considered. Emissions associated with off-site transportation of biomass residues have been considered.

Spatial extent of the project boundary:

The spatial extent of the project boundary encompasses the plant at the project site, that means for transportation of biomass residues to the project site (e.g. vehicles), and all power plants connected physically to the Tamil Nadu Electricity Grid and in turn the southern regional grid of India of which the project plant is connected to. The spatial extent of the project electricity system, including issues related to the calculation of the build margin (BM) and operating margin (OM), is further defined in the "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (ACM0002).

Table 2 illustrates which emission sources are included and which are excluded from the project boundary for determining of both baseline and project emissions.

Table 2 Overview of emissions sources included in or excluded from the project boundary

Scenario	Source	Included gases
Baseline	Grid electricity generation	CO_2
	Heat generation*	–
	Surplus biomass residues	–
Project activity	On-site fossil fuel consumption due to the project activity	CO_2
	Off-site transportation of biomass residues	CO_2
	Combustion of biomass residues for electricity and heat generation	–
	Biomass residues storage	–

*Note: * With heat generation in the baseline from biomass residues, emissions are zero.*

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

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Step – I: Identification of the baseline scenario

Scenario 3 (Greenfield Power Projects) of the combinations of project types and baseline scenarios applicable to the selected methodology ACM0006 is applicable to the KSCL Bagasse CHP project. The methodology has been applied in the following context of project activity:

- The project is a renewable energy project generating heat and power using bagasse from the sugar mill
- The co-generation plant is installed at a site where currently no power generation occurs prior to implementation of project activity.
- The power generated from the project is fed into the grid after captive consumption, which in the absence of the project activity would have been drawn/purchased from the grid
- In the absence of project activity the bagasse/biomass residues would have been used in the boilers at project site

Step – II: Establishing additionality of the project activity

The project activity is contributing in terms of adding power generating capacity to the TNEB grid and towards decreasing the carbon intensity of the grid mix by avoiding/delaying capacity addition powered by combustion of fossil fuels.

Section B.5. provides a comprehensive additionality analysis which has been carried out as per the 'Tool for demonstration and assessment of additionality' (version 3). The project has been established to be additional based on the sugar industry data and the project documents such as detailed project report etc. as the project incorporates high pressure, high temperature energy generation from biomass residues, which faces significant barriers in Tamil Nadu.

Step – III: Determining the project and baseline emissions

The baseline emission factor is calculated using background data which has been collated from various reliable sources such as CEA, TNEB, IPCC, etc. for using them in the analysis below. Key information and data used to determine the baseline scenario are presented in Table 3 below.

a) Project emissions from combustion of fossil fuels for transportation of biomass to the project plant (PET)

During the season, only bagasse from the KSCL sugar mill will be used, and the biomass residues are not specially transported. During off-season, some stored bagasse will be used, and other fuel will be imported from another KSCL-operated sugar mill (bagasse, accounting for nearly 20% of off-season requirements) and other suppliers (agricultural biomass residues, including cane trash). Emissions from transport will be calculated on the basis of mode of delivery and distances from the fuel source to the plant. Using formulae provided in ACM0006, it is ex-ante estimated that the total transport emissions for the biomass residues supply in off-season is approximately 183 tCO_2e per year, on the basis that biomass provides half of the fuel requirements during off-season. Actual emissions are calculated based on actual transport data.

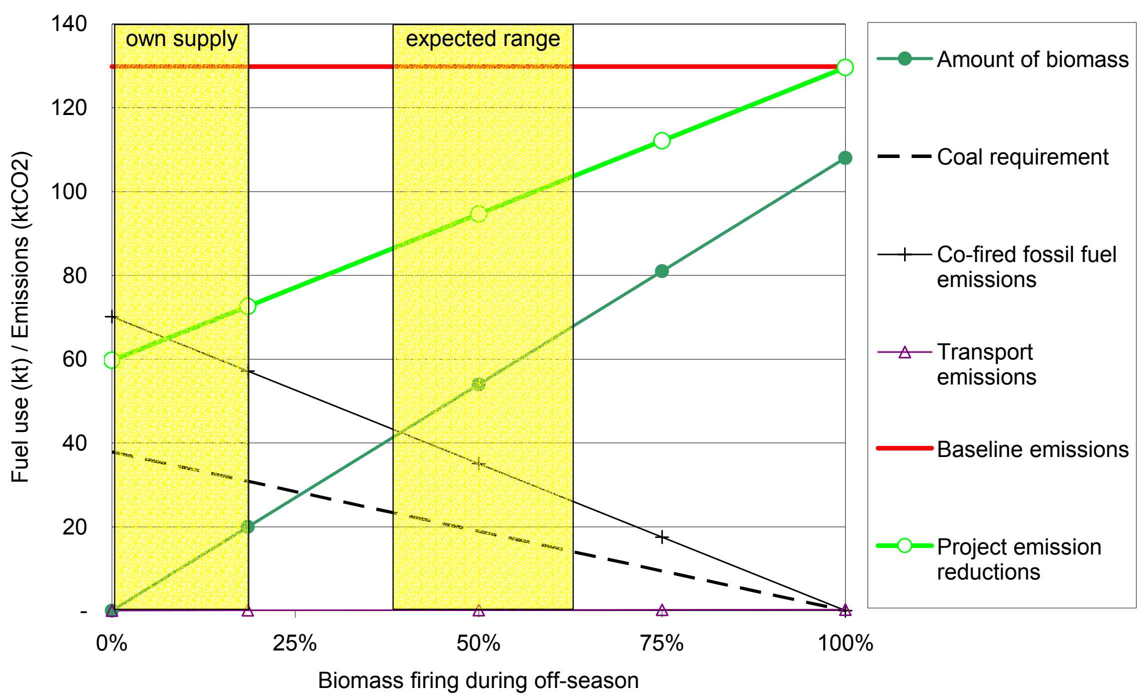
b) Project emissions from on-site consumption of fossil fuels (PEFF)

The KSCL Bagasse CHP project is designed such that it does not require fossil fuels for start-up. A special section of fine bagasse residues is collected and is used for this purpose. However, any fossil fuel usage will be monitored and emissions will be calculated using the formulae provided.

KSCL is currently negotiating supply contracts for the required biomass residue fuel for the off-season from other sources then their own nearby sugar mill. There is sufficient supply of biomass residues locally which is not currently used. However, if biomass residues cannot be contracted for the full 100% of requirements during off-season, coal will be used for co-firing. Total coal usage will be monitored, and emissions calculated using the formula provided. If no additional biomass residue is secured, and coal is used off-season for all but KSCL's own bagasse supply of 20%, emissions would be 57 ktCO_2e per year. It is expected due to the lack of a working biomass residue fuel market and the impact of the monsoon that approximately half of the fuel requirements during off-season will be met by coal.

Figure 3 shows the relationship between biomass fuel usage during off-season and project emissions and emission reductions achieved.

Figure 3 Fuel usage and emission ranges



c) Project Emissions from usage of Machinery for pre-treatment of bagasse

The KSCL bagasse based CHP project is designed such that no pre-treatment of bagasse is required prior to burning the boiler. Therefore no machinery is needed for pre-treatment of bagasse.

d) Methane emissions from combustion of biomass (PE_biomass_CH4)

This source is not included in the project boundary.

e) Emission reductions from the displacement of electricity (ER_electricity)

The KSCL Bagasse CHP is a Greenfield power plant: no electricity generation would have taken place onsite without implementation of the project activity. In the baseline scenario, the sugar mill would have imported electricity from the grid, while the project activity will be supplying electricity to the mill and export any excess zero-emissions renewable power to the grid. Emission reductions are calculated from the net quantity displacement of fossil fuel based electricity and the emissions factor of grid electricity.

Step 1: Determination of EF_electricity

The emission factor for the grid electricity displaced by the project activity is calculated as outlined in ACM0002 using the combined margin method taking the average of the Simple Operating Margin and the Build Margin using the default weightings of 0.5 to calculate the average. The data for the consumption of fossil fuels by grid-connected plants and generation data is taken from the Central Electricity Authority which is part of the Ministry of Power, India. The southern grid emission factors calculated based on the above methodology is 0.95 tCO_2e/ MWh. The data are presented in Annex 3.

However, Central Electricity Authority have published Baseline Carbon dioxide emission factor database for Inidan regional grids[4]. The combined margin baseline emission factor for southern grid,0.86 tCO_2e/MWh, being conservative is considered for calculating CERs . The resulting emissions factors are also given in Table 3 below. The calculated Combined Margin Baseline Emissions Factor is fixed at 0.86 tCO_2e/MWh for the duration of the crediting period.

Step 2: Determination of EG

The basis for the calculation of the emission reductions from displacement of grid electricity is the net amount of electricity generated (less auxiliary consumption from the power plant) and supplied either to the sugar mill or to the grid. The total amount of electricity generated by the KSCL Bagasse CHP is thus discounted for parasitic losses of the CHP plant itself and transmission to the grid. However, the net generation includes both the on-site consumption of power and the sale of excess electricity to the grid. It is estimated that 139 GWh of electricity (net of parasitic losses) is used onsite or exported to the grid.

The baseline emission reductions achieved from the electricity displaced by the KSCL Bagasse CHP project can now be estimated at 119,540 tCO_2e per year.

e) Emission reductions due to the displacement of heat (ER_heat)

As a conservative approach, emission reductions from the displacement of heat are assumed to be zero, as it is not uncommon in India that heat would have been generated from the bagasse, with the remainder of

[4] http://cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm

the bagasse not being utilised.

f) Baseline emissions due to the natural decay or uncontrolled burning of biomass (BE_biomass)

These emissions are not included in the project boundary.

Table 3 Variables used for calculating the baseline emission factor using ACM0006

Description	Value	Unit	Source
Carbon emissions factors			
Coal	25.8	tC/TJ	IPCC[1]
Crude	20.0	tC/TJ	IPCC[1]
Natural gas	15.3	tC/TJ	IPCC[1]
Oxidation rates			
Solids	100.0	%	IPCC[1]
Liquids	100.0	%	IPCC[1]
Gases	100.0	%	IPCC[1]
3-year weighted average EF_OM (2002-2005)	1.000	tCO2e/MWh	CEA, India[2]
Build margin (1999-2005)	0.720	tCO2e/MWh	CEA, India[2]
Baseline Emission Factor Electrity	0.860	tCO2e/MWh	CEA, India[2]
Average truck load for biomass fuel supply	9	t	World Bank[3]
Average transport emissions	0.56	kg CO2e/km	Calculated from World Bank[3]
Average distance	59	km	Estimated

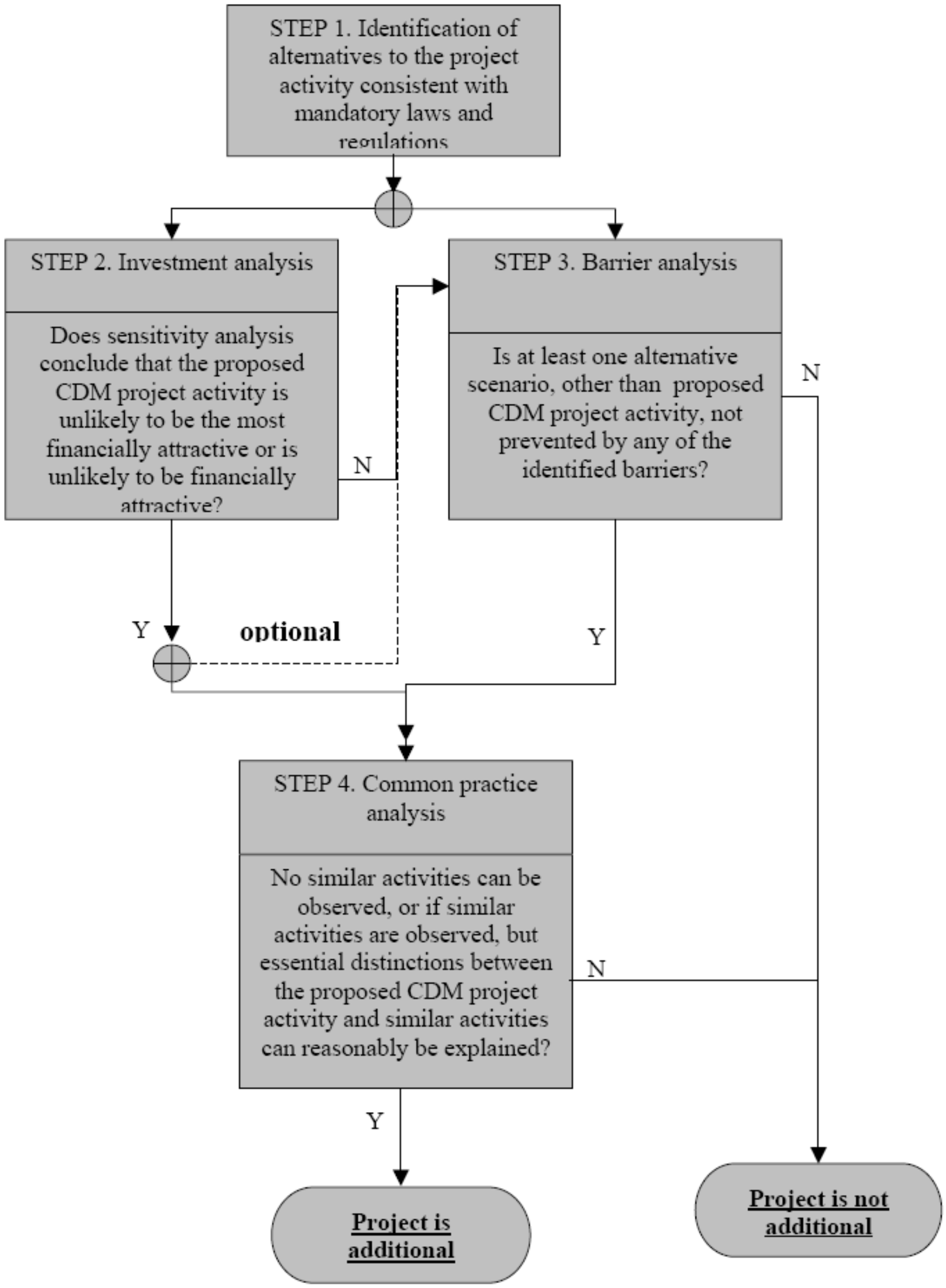
1. 2006 IPCC Guidelines for National Greenhouse Gas Inventories
2. CDM_Carbon dioxide baseline database, Central Electricity Authority, India
3. India Road Tranport Service Efficiency Study, World Bank South Asia Regional Office

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality): >>

As per the decision 17/cp.7, paragraph 43, a CDM project activity is additional if anthropogenic emissions of green house gases by sources are reduced below those that would have occurred in absence of registered CDM project activity. The methodology requires the project proponent to determine the additionality based on ***'Tools for demonstration and assessment of additionality'*** (version 3).

The flowchart in the figure below provides a step-wise approach to establish additionality of the project activity.

Figure 4 Flowchart for demonstrating additionality



The proposed crediting period for the KSCL Bagasse CHP project will start upon registration of the CDM project.

Step 1: Identification of alternatives to the project activity consistent with current laws and regulations

Sub-step 1a. Define alternatives to the project activity;

As per the methodology, realistic and credible alternatives should be separately determined regarding power generation, heat production and biomass use.

Power generation

For power generation, the realistic and credible alternatives may include:
P1 The proposed project activity not undertaken as a CDM project activity
P2 The proposed project activity (installation of a power plant), fired with the same type of biomass residues but with a lower efficiency of electrical generation (e.g. an efficiency that is common practice in the relevant industry sector)
P3 The generation of power in an existing plant, on-site or nearby the project site, using only fossil fuels
P4 The generation of power in existing and/or new grid-connected power plants
P5 The continuation of power generation in an existing power plant, fired with the same type of biomass residues as (co-)fired in the project activity, and implementation of the project activity, not undertaken as a CDM project activity, at the end of the lifetime of the existing plant
P6 The continuation of power generation in an existing power plant, fired with the same type of biomass residues as (co-)fired in the project activity and, at the end of the lifetime of the existing plant, replacement of that plant by a similar new plant

As a greenfield project, scenarios P5 and P6 are not applicable. Alternative P3 is also not applicable because there is no plant near to the project site, therefore, P3 it is also excluded from further considerations.

With no significant biomass-fired power generation in Tamil Nadu according to official statistics, scenarios P1 and P2 face significant barriers as described below in step 3. Since there is no legislative requirement to install cogeneration plants in sugar mills, KSCL is not mandated to undertake the project activity. In the baseline scenario, (i) KSCL will use bagasse as fuel for generation of process heat for the proposed sugar mill (see heat production below) (ii) no power will be generated at site and exported to the grid (iii) Power will be drawn from grid for meeting the requirement of the sugar mill. Thus, alternative P4 represents the most likely baseline scenario, with the project offsetting grid emissions.

Heat production

As the proposed project activity is a cogeneration project, alternatives for heat generation are also identified. For heat generation, realistic and credible alternatives may include:
H1 The proposed project activity not undertaken as a CDM project activity
H2 The proposed project activity (installation of a cogeneration power plant), fired with the same type of biomass residues but with a different efficiency of heat generation (e.g. an efficiency that is common practice in the relevant industry sector)
H3 The generation of heat in an existing cogeneration plant, on-site or nearby the project site, using only fossil fuels
H4 The generation of heat in boilers using the same type of biomass residues

H5 The continuation of heat generation in an existing cogeneration plant, fired with the same type of biomass residues as in the project activity, and implementation of the project activity, not undertaken as a CDM project activity, at the end of the lifetime of the existing plant
H6 The generation of heat in boilers using fossil fuels
H7 The use of heat from external sources, such as district heat
H8 Other heat generation technologies (e.g. heat pumps or solar energy)

As a greenfield project with no cogeneration plant nearby, scenarios H3, H5 and H7 are not applicable.

With no significant biomass-fired cogeneration in Tamil Nadu according to official statistics, scenarios H1 and H2 face significant barriers as described below in step 3. Alternatives H4 and H6 are likely scenarios for heat generation for industry in Southern India, with no other heat generation technologies used widely. However, within the sugar industry, bagasse is relatively frequently used as fuel in boilers. Thus, as the most conservative alternative, H4 is used as the baseline scenario, with the project offsetting zero-emission heat from biomass.

Biomass use

For the use of **biomass residues**, the realistic and credible alternative(s) may include, *inter alia*:
B1 The biomass residues are dumped or left to decay under mainly aerobic conditions. This applies, for example, to dumping and decay of biomass residues on fields.
B2 The biomass residues are dumped or left to decay under clearly anaerobic conditions. This applies, for example, to deep landfills with more than 5 meters. This does not apply to biomass residues that are stock-piled1 or left to decay on fields.
B3 The biomass residues are burnt in an uncontrolled manner without utilizing it for energy purposes.
B4 The biomass residues are used for heat and/or electricity generation at the project site
B5 The biomass residues are used for power generation, including cogeneration, in other existing or new grid-connected power plants
B6 The biomass residues are used for heat generation in other existing or new boilers at other sites
B7 The biomass residues are used for other energy purposes, such as the generation of biofuels
B8 The biomass residues are used for non-energy purposes, e.g. as fertilizer or as feedstock in processes (e.g. in the pulp and paper industry)

Since the proposed project is a new greenfield project with no existing cogeneration plant and no working biomass fuel market in Tamil Nadu, only scenario B4 is a credible and plausible alternative. The biomass is readily available at the site and therefore most logical and least cost option is to use the biomass for process heat generation for the sugar manufacturing process. Any excess biomass would be dumped or burned without utilising it for energy purposes (B1 or B3). There is no mandate for KSCL to regulate dumping of bagasse from the sugar mills.

Conclusion

Thus among all the identified alternatives, the most credible and plausible alternative that results in the lowest baseline emissions is:

- Power, P4 The generation of power in new/or existing grid-connected power plants
- Heat, H4 The generation of heat in boilers using the same type of biomass residues
- Biomass, B4 The biomass residue is used for heat generation at the project site

- And B1 or B3, the excess biomass residue that is not needed for heat generation is dumped for decay or burned without energy utilisation

Thus the above alternative forms the baseline scenario 3, as presented in ACM0006, version 4:

"The project activity involves the installation of a new biomass residue fired cogeneration plant at a site where no power was generated prior to the implementation of the project activity. The power required by the sugar mill would have been purchased from the grid. The biomass residues would in the absence of the project activity (a) be used for heat generation in boilers at the project site and (b) be dumped or left to decay or burned without utilizing it for energy purposes. This may apply, for example, where the quantity of biomass residues that was not needed for heat generation was dumped, left to decay prior to the project implementation"

Sub-step 1b. Enforcement of applicable laws and regulations.

Any of the baseline scenarios described above is not mandated by law. The utilisation of bagasse for power generation in the cogeneration plant is the decision of KSCL management keeping in view the environmental and financial aspects in view of opportunities offered by CDM.

Step 2: Investment analysis OR Step 3: Barrier analysis

Project participants have chosen to use step 3.

The barrier analysis is required to determine whether the proposed project activity faces barriers that:
(a) Prevent the implementation of this type of proposed project activity; and
(b) Do not prevent the implementation of at least one of the alternatives through the following sub-steps:

Sub-step 3a. Identify barriers that would prevent the implementation of type of the proposed project activity

In India, there are multiple barriers associated with implementation of bagasse cogeneration projects as a source of renewable energy based electricity. The barriers exist at different levels and most of them are interlinked. The project activity had its associated barriers to successful implementation, which have been overcome by KSCL to bring about additional greenhouse gas reductions. The project activity is additional as it overcomes the barriers as described below:

Investment barrier

The cost of setting up a cogeneration plant is equivalent or more than setting up a sugar plant. Presently, the high interest cost of capital from both banking and non-banking financial institutions makes the co-generation less attractive for sugar mills[5]. In addition, it is capital intensive to implement high pressure configuration cogeneration projects as compared to conventional low pressure (21 - 44 kg/cm^2) or medium-pressure (66 Kg/cm^2) cogeneration plants. KSCL has faced investment barriers from high upfront cost and great difficulty to reach financial closure for the project. KSCL incurred an investment cost of INR 208.4 Million for installation of high pressure configuration cogeneration plant. Financial

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[5] Commission for agricultural costs and prices report on price policy for sugarcane for the 2004-05 season (point No. 25) http://dacnet.nic.in/cacp/sugar-final.htm.

Institutions also insisted on high proportion of internal accrual in the funding of the project. KSCL, therefore, had to agree high cost debt from banks, 2.00% higher than the normal interest rate applicable for infrastructure projects. Due to this, the interest cost will be higher by Rs.5.8 million p.a. for term loan of INR 290 million[6]. Revenues from sale of CERs was given due consideration for repaying high cost debt in turn reducing the interest burden.

Banks and financial institutions required a power purchase agreement (PPA) to be signed before approving a loan. In addition, they requested an escrow agreement in place to safeguard payment from Tamil Nadu Electricity Board (TNEB) who is the counterparty to the PPA[7]. Under normal circumstances, the signing of a PPA takes a long time and will not be finalised in the initial stages when loans are sought from and negotiated with financial institutions. Also TNEB does not provide an escrow account facility. However, the envisaged additional revenues from the project due to CDM registration will improve the financial viability of the project and also will have positive effect on the return on investment.

Institutional Barriers

The Ministry of Non conventional Energy Sources (MNES) has issued guidelines for State electricity boards for the purchase of electricity from non conventional energy sources at base tariff of Rs. 2.25 per unit with an annual escalation of 5% until 10 years from 1995. However in September 2001, TNEB deviated from MNES guidelines and fixed the unit price at Rs. 2.70 per kWh for next 5 years without escalation[7]. The unit price of electricity would have been Rs. 3.01 per unit and Rs. 3.49 per unit during the years 2001 and 2004 respectively had TNEB continued to pay according to MNES guidelines. Currently with effect from 2006, with the intervention of Tamil Nadu Electricity Regulatory Commission, TNEB is paying a fixed price of Rs. 3.15 per unit (during crushing season) and Rs. 3.01 per unit (during off season) with no escalation for subsequent years. With a fixed unit price of electricity the cogeneration project is financially vulnerable to the increase in operating costs and KSCL management is banking on the financial assistance from the sale of carbon credits to cushion any potential increase in operating costs.

In addition, financial condition of electricity board is vulnerable - TNEB had accumulated losses of Rs. 35.11 Billion as on March, 2005[8] - and the agreed PPA price could be at risk. KSCL had to take this risk and face this institutional barrier on which they have limited or no control and therefore CDM funds are critical to KSCL.

Technical Barrier

The project activity has adopted a high-pressure co-generation technology and double extraction condensing type turbo-generator. The pressure level is high compared to many other sugar plants, which normally use low pressure configurations compared to 87 Kg/cm^2 for the KSCL plant. This high pressure level is new to the sugar industry and stringent water quality is to be maintained for boiler feed water which is a challenging task.

There is no biomass plant established in the district where the project activity is established. Further,

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[6] Evidence submitted to the validator.

[7] Tamil Nadu Electricity Regulatory Commission, Order No. 3 date: 15/5/2006.

[8] http://powermin.nic.in/indian_electricity_scenario/Final_Report_Rating.pdf, page no: 85.

installation of boilers with this range of high pressure and temperature in independent biomass power plants of similar capacity even in other regions is also not a common practice. The most common steam parameters are only 66 Kg/cm^2 and 480 ºC, which would result in a lower power generating efficiency. However, the high pressure and high temperature boiler is more expensive.

There is little experience in the installation and operation of high pressure (87 Kg/cm^2) boilers or with the operation of similar capacities of plant in the sugar industry. Only 3.6 % of projects have similar installed capacity out of 517 sugar mills in India[9], and out of these 3.6% only a small number are installing high pressure boiler configuration. New projects which are choosing such configuration have also considered CDM benefits and are requesting registration. One of the major complexities in the design of high pressure cogeneration systems is the requirement for water treatment - the use of a high pressure boiler at the project activity has therefore necessitated significant additional expenditure on the water treatment plant.

The project activity therefore involves two new technologies, both of which KSCL have no previous experience in installing and operating. CER revenue provides an added incentive to utilise these technologies, and assists on overcoming the costs and risk inherent in installing the technologies.

Other Barriers

To operate the power plant in the off-season period approximately 108,000 tonnes of biomass fuel is required. This is an additional significant barrier to the project activity as bagasse during off-season is not readily available from the cane crushing operation of the plant, as during the season and most of this fuel requirement will have to be met from outside sources. Nearly one-fifth of the requirement can be met from excess bagasse which has been stored during the season at the plant itself and another KSCL-operated plant nearby. However, the remaining estimated 88,000 tonnes has to be sourced from many small suppliers scattered over a large area. Even though the Tanjavur District where the project is located, is a prominent agricultural belt in Tamil Nadu, mobilising the required quantity of biomass is challenging, as there is no organised biomass fuel market.

The project may collect surplus bagasse from the surrounding region but this will require additional investment for collection systems and is seen as supplementary to the main fuel source bagasse. A biomass collection system is complicated by the fact that no large suppliers are available in the region and that the biomass would need to be sourced from many small suppliers. At current prices the carbon credit revenue stream will provide over Rs 0.27/kWh. This equates to 8.5 % of the total price paid for electricity generation by the TNEB and will thus aid the project in overcoming this significant barrier.

Conclusion

The barriers discussed above are strong enough to hinder growth of the sector significantly, and the project has to overcome the above barriers for successfully implementing the power project. In this scenario, availability of CDM funds will help to improve the financial viability of the project and therefore increase the return on investment.

Sub-step 3b. Show that the identified barriers would not prevent the implementation of at least one of

[9] "List of Cane Sugar Factories and Distilleries in India", Published by The Sugar Technologists Association of India season 2005-06.

the alternatives (except the proposed project activity)

None of the barriers discussed would prevent the baseline scenario, scenario 3. The investment and institutional barriers would not pose a barrier to the power sector in Tamil Nadu continuing to provide electricity to the grid from existing and/or new power plants. There are no technical barriers for utilising bagasse in standard boilers only for heat generation and dumping or burning the excess biomass residue without energy utilisation.

Therefore, the identified baseline, scenario 3, combining electricity use from the grid, heat generation from biomass residue / bagasse and dumping or burning of excess bagasse without energy utilization is conservative and not prevented by any of the barriers which prevent the project activity from being implemented without CDM registration.

Step 4: Common practice analysis

Prevailing practice in TNSEB is carbon intensive power generation, as shown in the table below, which shows that the share of the thermal based power generation is of 78 %.

Table 4 Net power generation by fuel type in the last three years (Southern Grid)

	2002-03		2003-04		2004-05	
Fuel	**GWh**	*%*	**GWh**	*%*	**GWh**	*%*
Coal	70,706	*54.84*	71,761	*55.19*	73,448	*53.83*
Lignite	14,932	*11.58*	16,399	*12.61*	16,415	*12.03*
Gas	15,000	*11.63*	15,714	*12.09*	11,925	*8.74*
Diesel	4,183	*3.24*	3,096	*2.38*	2,270	*1.66*
Hydro	18,373	*14.25*	16,587	*12.76*	25,153	*18.44*
Nuclear	4,171	*3.23*	4,465	*3.43*	4,186	*3.07*
Wind	1,576	*1.22*	1,992	*1.53*	3,042	*2.23*
Total	128,941	*100*	130,014	*100*	136,439	*100*

Source: www.cea. nic.in.

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

In the state of Tamil Nadu there are 38 sugar factories, only 12 of which export electricity to the grid.[10] In terms of other projects, similar to proposed project activity, being commissioned in Tamil Nadu there are 3 bagasse based cogeneration plants under commissioning which are of a similar scale. In addition, Tamil Nadu Newsprint and Paper Limited (TNPL) have installed coal or lignite fired boilers in 6 sugar mills in Tamil Nadu and supplies the steam in exchange for the bagasse[11].

The latest data available on bagasse based cogeneration from the Sugar Technologists' Association of India lists only 22 mills with bagasse cogeneration of similar or larger capacity in India. Some of these

[10] List of Cane Sugar Factories and Distilleries, Season 2005-06", Published by The Sugar Technologists' Association of India.

[11] Industries Department, Policy Note – 2003 – 2004, Demand No. 26, Page no.8, para no.2

projects are also considering CDM benefits, for instance, the 22MW Rajashree Sugars and Chemicals Ltd has already registered as a CDM project.

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

All three new bagasse cogeneration plants of similar capacity in Tamil Nadu are being proposed as a CDM projects.

Only 22 sugar mills in India have similar or larger capacity than the KSCL proposed cogeneration plant, many of these are registering as CDM projects. Considering that there are 517 sugar mills in India the uptake of cogeneration on a similar scale, represents only 4%. Therefore it must be considered that similar activities to the proposed project activity are not common practise and hence the project is additional.

The promise of additional income from the sale of certified emission reductions (CERs) on the basis of successful CDM registration has provided the developer's lender enough confidence to approve the loan for the cogeneration plant.

The additional income also improves the financial performance of the project, such that the longer lead times and additional management time required will be compensated.

In conclusion, all the steps above are satisfied, the proposed CDM project is not the baseline scenario, and the project activity is additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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Carbon dioxide emissions from combustion of fossil fuels for transportation of biomass to the project plant (PET_y)

The CO_2 emissions associated with transportation of biomass fuel during off-season using trucks for delivering the fuels to project site is calculated using option 1 of ACM0006, based on average distance and truckload.

$$PET_y = \Sigma_i BF_{i,y} / TL_y * AVD_y * EF_{km,\ CO2,y} \quad \text{(ACM0006: 4[12])}$$

where:

PETy	CO2 emissions during the year *y* due to transport of the biomass residues to the project plant (tCO2/yr)
$BF_{i,y}$	Quantity of biomass residue type *i* combusted in the project plant during the year y (tonnes);
TL_y	is the average truck load of the trucks used measured in mass or volume of biomass;
AVD_y	is the average round return trip distance (from and to) between the biomass fuel supply sites and the site of the project plant in kilometres (km) during year y;

[12] Using the formula numbering from ACM0006.

$EF_{km, CO2,y}$	is the average CO_2 emission factor for the trucks measured in tCO_2/km during the year y

Carbon dioxide emissions from the on-site consumption of fossil fuel ($PEFF_y$)

The KSCL Bagasse CHP plant is designed such that it does not normally require fossil fuels for start up. However, fossil fuels may be used for start up or to supplement bagasse/biomass fuel during off-season. The CO2 emissions from combustion of these fossil fuels are calculated using following formula:

$$PEFF_y = \Sigma_i(FF_{projectplant\ i,y} + FF_{project\ site,i,y}) * NCV_i * EF_i \qquad \text{(ACM0006: 6)}$$

where:

$PEFF_y$	are the CO_2 emissions during the year y due to fossil fuels co-fired by the generation facility in tonnes of CO_2;
$FF_{projectplant\ i,y}$	is the quantity of fossil fuel type i co-combusted in the plant during the year y in tonnes;
$FF_{project\ site,i,y}$	Quantity of fossil fuel type *i* combusted at the project site for other purposes that are attributable to the project activity during the year *y* (mass or volume unit per year)
NCV_i	Net calorific value of fossil fuel type *i* (GJ / mass or volume unit)
$EF_{CO2,FF,i}$	CO_2 emission factor for fossil fuel type *i* (tCO_2/GJ)

Description of formulae used to estimate baseline emissions

ACM0006 refers to the calculation of baseline emission factor using ACM0002 (Consolidated baseline methodology for grid connected electricity generation from renewable energy sources) estimated as under:

Baseline emissions due to displacement of electricity

For the displacement of electricity, the baseline scenario is the electricity that would have been generated by the operation of grid connected power plant and by the addition of new generation sources, in absence of the project activity.

Calculation of the Simple OM emission factor (EF_{OM})

The Simple OM emissions factor is taken from Central Electricity Authority (CEA), India published Baseline Carbon dioxide emission database version 1.1. Central Electricity Authority is a statutory body under Government of India which monitors and reports the electricity generation, transmission, and distribution performance of the power utilities in India. CEA has published baseline carbon dioxide emission database for all regional power grids in India. Being a conservative figure, CEA published Operating margin emission factors have been used for calculating baseline emissions for the project.

Besides, KSCL and ITPI have calculated simple operating margin emissions factor based on 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, for the last 3 years for which data is available at the time of writing (2002/3, 2003/4 and 2004/5): The OM emission factor calculations are available on www.cdmbaselineindia.org. However, this emission factors were not used for calculating the project baseline emissions.

$$EF_{OM} = \Sigma_{i,j} (F_{i,j,y} * COEF_{i,j}) / \Sigma_j GEN_j \qquad \textit{(ACM0002: 2[13])}$$

[13] Formula number from ACM0002.

where:

$F_{i,j,y}$	is the amount of fuel i (in a mass or volume unit) consumed by relevant power sources j in year(s) y;
j	refers to the power sources delivering electricity to the grid, not including low-operating cost and must-run power plants, and including import to the grid;
$COEF_{i,j,y}$	is the CO_2 emission coefficient of fuel i (tCO_2 / mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources j and the percent oxidation of the fuel in year(s) y;
GEN_j	is the electricity (MWh) delivered to the grid by source j.

The CO_2 emission coefficient $COEF_i$ is obtained as:

$$COEF_i = NCV_i * EF_{CO2,i} * OXID_i \qquad (ACM0002: 3)$$

where:

NCV_i	is the net calorific value (energy content) per mass or volume unit of a fuel i;
$OXID_i$	is the oxidation factor of the fuel;
$EF_{CO2,i}$	is the CO_2 emission factor per unit of energy of the fuel i.

Where available, local values of NCV_i and $EF_{CO2,i}$ should be used. If no such values are available, country-specific values (see e.g. IPCC Good Practice Guidance) are preferable to IPCC world-wide default values.

Calculation of build margin emissions factor (EF_{BM})

Build margin emission factor is also taken from the CEA published Baseline Carbon dioxide emission database version 1.1.

The Build Margin emissions factor is the generation-weighted average emissions factor (tCO_2/MWh) of the power plant capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently. This 20% capacity has been added between 1999 and 2005.

$$EF_{BM} = \Sigma_{i,m} (F_{i,m,y} * COEF_{i,m}) / \Sigma_m GEN_{m,y} \qquad (ACM0002: 9)$$

Where $F_{i,m,y}$, $COEF_{i,m}$ and $GEN_{m,y}$ are analogous to the variables described for the Simple OM method above for plants m.

Calculation of baseline emission factor (EF)

The combined margin emissions factor for biomass plant is calculated as the average of the simple OM and BM, uses default values of 50%.

$$EF = w_{OM} * EF_{OM} + w_{BM} * EF_{BM} \qquad (ACM0002: 10)$$

Where the weights w_{OM} and w_{BM}, are 50%.

Calculation of baseline emissions due to displacement of electricity

The baseline emissions from the displacement of electricity from the grid can now be calculated from the baseline emissions factor and the electricity generated, net of parasitic losses, including own consumption at the KSCL sugar mill and export of excess power to the grid. With no electricity generation on-site in the baseline, the baseline emissions can be calculated as follows:

$BE_y = EF * EG_y$ *(ACM0002: 12)*

Where:

BE_y	are baseline emissions due to displacement of electricity during the year y in tonnes of CO_2;
EG_y	is the net quantity of electricity generated in the bagasse-based cogeneration plant due to the project activity during year y;
EF	is the CO_2 baseline emission factor for the electricity displaced due to the project activity as calculated above.

Description of formulae used to estimate leakage

The main potential source of leakage for this project activity is an increase in emissions from fossil fuel combustion due to diversion of biomass from other uses to the project plant as a result of the project activity. If for a certain type of biomass used in the project activity in year y, leakage effects cannot be ruled out, leakage effects shall be calculated as follows:

$L_y = EF_{CO2,LE} * (\Sigma_k (BF_{PJ,k,y} * NCV_k)$ *(ACM0006: 25)*

where:

L_y	Leakage emissions during the year *y* (tCO_2/yr)
$EF_{CO2,LE}$	CO_2 emission factor of the most carbon intensive fuel used in the country (tCO_2/GJ)
$BF_{PJ,k,y}$	Incremental quantity of biomass residue type *k* used as a result of the project activity in the project plant during the year *y* (tons of dry matter or liter)[8]
k	Types of biomass residues for which leakage effects could not be ruled out with one of the leakage approaches
NCV_k	Net calorific value of the biomass residue type *k* (GJ/tonne of dry matter or GJ/liter)

If L_y is positive, these leakage emissions will be used in the emission reductions calculations in D.2.4. If L_y is negative, leakage is assumed zero. (L_y is negative if the theoretical heat generation from the biomass fuels for which leakage could not be ruled out is less than the actual heat generation from the biomass residues in the cogeneration plant.)

However, for the KSCL Bagasse CHP project activity, the use of biomass residues does not result in increased fossil fuel consumption elsewhere. Much of the biomass residues expected to be utilised at the plant (approximately 50%) during off-season are procured from KSCL's other sugar mill which is at a distance of 45 kms (90km roundtrip) from the project site where currently excess bagasse is available during the season, and sugar cane trash will be procured from cane suppliers that supply both sugar mills. Currently neither the excess bagasse nor the cane trash is utilised.

The rest of the biomass residues requirement will be procured within a distance of 20 kms (40km roundtrip) from the project site. The geographical boundry of the project is considered as 100 kms radius around the project site by making a conservative estimate of biomass residue availability during the 10

year crediting period. The average round trip distance for procuring additional biomass residues will be 59 kms.

The project activity is located in an important agricultural area in Tamil Nadu, where biomass residues are abundant. However, there is no local biomass residue/fuel market, making it difficult and time consuming for KSCL to procure the fuel for the off-season as this would likely involve a large number of suppliers of small quantities of fuel.

However, following option L2 in ACM0006 it is shown in “Biomass to Energy, Advanced Bioresidue Energy Technologies Society, Indian Institute of Science, 2003” under the chapter “The National Biomass Resource Assessment Program” that an abundant surplus of biomass is available in the region which is not currently utilised; see Table 5.

Table 5 Power potential from agricultural crops in Tamil Nadu

Crop area (ha)	14,827,200
Residue generation (t)	45,172,460
Current residue utilisation (t)	29,963,430
Excess biomass (t)	15,209,030
Projected biomass residue utilisation by the project activity (t)	223,175
Potential power generation capacity on excess biomass (MW)	**1,357.64**

Source: the National Biomass Resource Assessment Program, supported by MNES, “Biomass to Energy, Advanced Bioresidue Energy Technologies Society”, Indian Institute of Science, 2003, p.91.

The proposed project represents less than 2% of the potential power generation from the biomass residues available in Tamil Nadu. According to ACM0006, if it can be demonstrated that there is an abundant surplus of the biomass residue in the region of the project activity which is not utilised, then leakage may be considered zero. For this purpose, it must be demonstrated that the quantity of available biomass residues of this type in the region is at least 25% larger than the quantity of biomass residue that are utilised, including by the project plant. Total utilisation, including the projected utilisation by the project plant is 30,186,605 tonnes of biomass residue. The total available residue therefore is 49.6% larger than that currently used including the projected utilisation of the proposed plant. Therefore, leakage from biomass diversion is considered to be zero.

Description of formulae used to estimate emission reductions for the project activity

The project activity mainly reduces CO_2 emissions through substitution of power and heat generation with fossil fuels by energy generation with biomass. The emission reduction ER_y by the project activity during a given year y is the difference between the baseline emissions due to the substitution of electricity generation with fossil fuels (BE_y) and the project emissions (PE_y) and emissions due to leakage (L_y). Under scenario 3, where heat would have been generated by the same biomass source, no emission reductions for the substitution of heat generation with fossil fuels ($ER_{heat,y}$) can be claimed for. The project participants in the KSCL Bagasse CHP project have chosen not to include methane emissions in the project boundary, so no baseline emissions due to the natural decay or burning of anthropogenic sources of biomass residues ($BE_{biomass,y}$) are counted.

$$ER_y = BE_y + ER_{heat,y} + BE_{biomass,y} - PE_y - L_y = BE_y - PE_y - L_y \qquad (ACM0006{:}\ 1)$$

where:

ER_y	are the emissions reductions of the project activity during the year y in tonnes of CO_2;
BE_y	are the emission reductions due to displacement of electricity during the year y in tonnes of CO_2;
$ER_{heat,y}$	are the emission reductions due to displacement of heat during the year y in tonnes of CO_2 (under scenario 3 $ER_{heat,y}$ is zero);
$BE_{biomass,y}$	are the baseline emissions due to natural decay or burning of anthropogenic sources of biomass residues during the year y in tonnes of CO_2 equivalents (the project participants have chosen not to include methane emissions in the project boundary, thus $BE_{biomass,y}$ is zero);
PE_y	are the project emissions during the year y in tonnes of CO_2;
L_y	are the leakage emissions during the year y in tonnes of CO_2.

The lifetime aspects of the power plant does not come into picture as the project is a Greenfield project a and there was no power plant or steam generation prior to the project activity.

B.6.2. Data and parameters that are available at validation:

(Copy this table for each data and parameter)

Data / Parameter:	EG_y
Data unit:	MWh
Description:	Net quantity of electricity generated in the project plant during year y
Source of data used:	TNEB & KSCL
Value applied:	139,000
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data will be based on TNEB meter readings at the sub-station and the KSCL meter for internal electricity use (not including parasitic losses). EG is net of parasitic losses and includes internal electricity use and electricity exported to the grid.
Any comment:	The actual net generation will be monitored, and reductions are based on the monitored quantity.

Data / Parameter:	EF
Data unit:	tCO2/MWh
Description:	CO2 emission factor of the grid
Source of data used:	The data is based on the CEA published study for baseline emission factors for Indian regional grids. (www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm)
Value applied:	0.86
Justification of the choice of data or description of	IT Power India and Carbon Resource Management calculated southern grid emission factors as 0.95 tCO_2e/ MWh based on the CEA published data on electricity generation.

measurement methods and procedures actually applied :	However, Central Electricity Authority (CEA) have published Baseline Carbon dioxide emission factor database[14] for Indian regional grids. The combined margin emission factor for southern grid, 0.86 tCO2e/MWh, is used for CERs caluculations as it more conservative. CEA is a statutory organization constituted by Goverement of India to advise on the matters relating to the national electricity policy, CEA also collects and record the data concerning to the generation, transmission, trading, and distribution. CEA has developed Carbon dioxide emission baseline database for all Indian regional grid. The database currently covers emission factors for five fiscal years 2001-2005 and will be updated annually.
Any comment:	The emissions factor has been calculated ex-ante, and is fixed for the duration of the crediting period.

Data / Parameter:	EF_{OM}
Data unit:	tCO2/MWh
Description:	CO2 operating margin emission factor of the grid
Source of data used:	The data is based on the CEA published study for baseline emission factors for Indian regional grids. (www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm)
Value applied:	1.00
Justification of the choice of data or description of measurement methods and procedures actually applied :	IT Power India and Carbon Resource Management calculated southern grid emission factors as 1.1 tCO_2e/ MWh based on the CEA published data on electricity generation. However, Central Electricity Authority (CEA) have published Baseline Carbon dioxide emission factor database[15] for Indian regional grids. The combined margin emission factor for southern grid, 1 tCO2e/MWh, is used for CERs caluculations as it more conservative. Central Electricity Authority (CEA) is a statutory organization constituted by Government of India to advise on the matters relating to the national electricity policy, CEA also collects and record the data concerning the generation, transmission, trading, and distribution. CEA has developed Carbon dioxide emission baseline database for all Indian regional grid. The database currently covers emission factors for five fiscal years 2001-2005 and will be updated annually.
Any comment:	EFOM has been calculated ex-ante, and is fixed for the duration of the crediting period.

[14] http://cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm

[15] http://cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm

Data / Parameter:	EF_{BM}
Data unit:	tCO2/MWh
Description:	CO2 build margin emission factor of the grid
Source of data used:	The data is based on the CEA published study for baseline emission factors for Indian regional grids. (www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm)
Value applied:	0.72
Justification of the choice of data or description of measurement methods and procedures actually applied :	IT Power India and Carbon Resource Management calculated southern grid emission factors as 0.71 tCO_2e/ MWh based on the CEA published data on electricity generation. However, Central Electricity Authority (CEA) have published Baseline Carbon dioxide emission factor database[16] for Indian regional grids. The combined margin emission factor for southern grid 0.72 tCO2e/MWh, is used for CERs caluculations as it more conservative. Central Electricity Authority (CEA) is a statutory organization constituted by Government of India to advise on the matters relating to the national electricity policy, CEA also collects and record the data concerning the generation, transmission, trading, and distribution. CEA has developed Carbon dioxide emission baseline database for all Indian regional grid. The database currently covers emission factors for five fiscal years 2001-2005 and will be updated annually.
Any comment:	EFBM has been calculated ex-ante, and is fixed for the duration of the crediting period.

Data / Parameter:	Fi
Data unit:	mass or volume
Description:	Amount of fossil fuel consumed by each power plant
Source of data used:	The data is based on the CEA published study for baseline emission factors for Indian regional grids. (www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm)
Value applied:	As per the CEA Study indicated above
Justification of the choice of data or description of measurement methods and procedures actually applied :	Obtained from power producers, dispatch centres or latest local statistics
Any comment:	Historic data is used to calculate the emissions factor ex-ante.

[16] http://cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm

Data / Parameter:	GENj/k/n
Data unit:	MWh/y
Description:	Electricity generation of each power plant j, k or n
Source of data used:	The data is based on the CEA published study for baseline emission factors for Indian regional grids. (www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm)
Value applied:	As per the CEA Study indicated above
Justification of the choice of data or description of measurement methods and procedures actually applied :	Used in the calculation of Simple OM/BM
Any comment:	Historic data is used to calculate the emissions factor ex-ante.

Data / Parameter:	*$COEF_i$*
Data unit:	tCO2 / mass or volume unit
Description:	CO2 emission factor of fossil fuel type i
Source of data used:	IPCC 2006, National statistics
Value applied:	**Fuel** / **NCV (TJ/kt)** / **EF (tC/TJ)** / **OXID** / **COEF (tCO2e/t)** Coal / 20.0 / 25.8 / 100% / 1.890 Diesel / 43.0 / 20.2 / 100% / 3.185
Justification of the choice of data or description of measurement methods and procedures actually applied :	Using the latest IPCC data and the national data (Annual Statistics of Central Electricity Authority) for NCV of coal.
Any comment:	

Fuel	NCV (TJ/kt)	EF (tC/TJ)	OXID	COEF (tCO2e/t)
Coal	20.0	25.8	100%	1.890
Diesel	43.0	20.2	100%	3.185

Data / Parameter:	EF_{km}
Data unit:	Kg CO2 / km
Description:	Average CO2 emission factor for transportation of bagasse/biomass by trucks
Source of data used:	India: Road Transport Service Efficiency Study, The World Bank, 1 Nov 2005.
Value applied:	0.564
Justification of the choice of data or description of measurement methods and procedures actually applied:	Calculated from the average fuel efficiency reported for the Indian Transport sector, based on average 9 tonnes trucks which dominate the sector. Fuel efficiency is 4.5km/l of diesel, resulting in 0.564 kgCO2/km.
Any comment:	This factor will be conservative as much of the local biomass fuel is likely to be delivered in animal-drawn carts.

B.6.3 Ex-ante calculation of emission reductions:

>>

Estimate of GHG emissions by sources:

Project emissions (PE_y) include CO_2 emissions from the transportation of biomass to the project site (PET_y) and CO_2 emissions from on-site consumption of fossil fuels (start-up and co-firing) due to the project activity ($PEFF_y$). Methane emissions are not included in the project boundary for the KSCL Bagasse CHP project.

$$PE_y = PET_y + PEFF_y \qquad \text{(ACM0006: 2)}$$

Project emissions from combustion of fossil fuels for transportation of biomass to the project plant

As described in section B.2. transport emissions are calculated using the average truck load and distance for the biomass to be transported, amount of biomass transported to the project plant, and the emissions factor of the trucks used. The emissions are calculated as follows:

$$PET_y = \Sigma_i\ BF_{i,y} / TL_y * AVD_y * EF_{km} \qquad \text{(ACM0006: 3)}$$

Sufficient bagasse is generated during the season for the operation of the KSCL Bagasse CHP plant. Some bagasse generated on-site will be stored for use during the off-season. Further biomass residues will be imported from another KSCL-operated sugar mill, where the excess bagasse is available, and from other supplies nearby.

Total emissions from transport of biomass residue fuel to the plant are dependent on the amount of biomass residue that is contracted.

Project emissions from on-site consumption of fossil fuels

The KSCL Bagasse CHP project is designed such that it does not require fossil fuels for start-up. A special section of fine bagasse residues is collected and is used for this purpose. However, any fossil fuel usage will be monitored and emissions will be calculated using the formulae provided.

KSCL is currently negotiating supply contracts for the required biomass residue fuel for the off-season from other sources then their own nearby sugar mill. There is sufficient supply of biomass residues locally which is not currently used. However, if biomass residues cannot be contracted for the full 100% of requirements during off-season, coal will be used for co-firing. Total fossil fuel usage will be monitored, and emissions calculated using the formula provided.

$$PEFF_y = \Sigma_i(FF_{project\ planti,y} + FF_{projectsite,i,y})*NCV* COEF_i \qquad \text{(ACM0006: 6)}$$

Total emissions from fossil fuel use in the plant are dependent on the amount of biomass residues that is contracted. For the purposes of this document it is assumed that half the fuel requirement will be met by biomass residues and half from coal.

Total project emissions

Total project emissions are calculated using the formulae above, and are dependent on the amount of biomass residues that is actually contracted. About one fifth of the required additional biomass residues during off-season has already been secured from excess bagasse during the season at the project activity and at another KSCL-operated sugar mill. Figure 3 and Table 6 show the estimated project emissions.

Table 6 Estimated project emissions (tCO_2 per year)

Biomass residue supply scenario	Already-secured	Likely	Maximum
Biomass residue share in off-season	18.5%	50%	100%
Transport emissions (PET)	113	198	334
On-site fossil fuel use (PEFF)	58,319	35,787	0
Total project emissions (PE)	58,432	35,985	334

For the purposes of estimating the project emissions and resulting emission reductions, it is assumed that half of the fuel requirement for off-season will be met from biomass residues.

Estimated leakage

Leakage is estimated to be zero, as plentiful biomass residues supplies are available, although biomass residues fuel markets are non-existent and the project activity may not be able to procure residues to fulfil their full fuel requirements during off-season.

Baseline Emissions

Baseline Emissions (BE_y, in tCO_2e), for each year, are calculated by adding the Baseline Emissions ($BE_{electricity,y}$, in tCO_2e) from grid electricity as follows:

$$BE_y = BE_{electricity,y}$$

The Baseline Emissions from grid electricity, for each year y, are calculated by multiplying the baseline emissions factor (EF, in tCO_2e/MWh) by the annual net generation of the project (EG_y, in MWh), as follows:

$$BE_{electricity,y} = EF * EG_y$$

With the baseline emissions factor (EF) calculated using operating and build margins as described in detail in sector B.2 and following ACM0002 with the following formulae:

$$EF = w_{OM} * EF_{OM} + w_{BM} * EF_{BM}$$
$$EF_{OM} = [\Sigma_{i.j} F_{i,j,y} * COEF_{i,j}] / [\Sigma_j GEN_{j,y}]$$
$$EF_{BM} = [\Sigma_{i.m} F_{i,m,y} * COEF_{i,m}] / [\Sigma_m GEN_{m,y}]$$
and
$$COEF_i = NCV_i * EFCO_{2,i} * OXID_i$$

The weight for operating and build margin emission factors (w) is 0.5 by default. The operating margin is calculated using the average of the most recent three years of generation in the Southern Grid region for which data is available (2002/3,2003/4, and 2004/5). The build margin is calculated from publicly

available statistics using the 20% most recently added generation following the procedure as explained in section B.2, comprising of new plant build since 1999.

The operating and build margins data has been taken from the CEA CO2 baseline database (www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm). The combined margin for the southern grid is 0.86 tCO_2 / MWh.

Using this calculation methodology, the estimated annual baseline emissions from grid electricity will be 119,540 tCO_2e/y.

However, we have provided the detailed calculation of baseline data as per our study in Annex 3, wherein the combined margin for the southern grid is 0.95 tCO_2 / MWh. (www.cdmbaselineindia.org)

B.6.4 Summary of the ex-ante estimation of emission reductions:

>>

Assuming production in the first year is 10% below the design levels, the average annual emission reductions over the ten-year crediting period are estimated to be 82,719 tCO_2e/y, see Table 7 below.

Table 7 Project emissions and emission reductions (tCO_2e)

Period	Project emissions	Leakage	Baseline	Emission reductions
Year 1	32,387	-	107,586	75,199
Year 2	35,985	-	119,540	83,555
Year 3	35,985	-	119,540	83,555
Year 4	35,985	-	119,540	83,555
Year 5	35,985	-	119,540	83,555
Year 6	35,985	-	119,540	83,555
Year 7	35,985	-	119,540	83,555
Year 8	35,985	-	119,540	83,555
Year 9	35,985	-	119,540	83,555
Year 10	35,985	-	119,540	83,555
Total first crediting period	**356,252**	**-**	**1,183,446**	**827,194**
Crediting time (years): 10				
Annual average:	*35,625*	-	*118,345*	*82,719*

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

B.7.1 Data and parameters monitored:

Data / Parameter:	$BF_{i,y}$
Data unit:	Tonnes of dry matter
Description:	Quantity of biomass residue type i used for combustion in the project plant during year y
Source of data to be used:	On-site measurements by KSCL
Value of data applied for the purpose of calculating expected emission reductions in section B.5	223,175 tonnes (aggregate for season and offseason)
Description of measurement methods and procedures to be applied:	The actual weight of biomass residues will be measured using a belt weigher. The data recording will be done continuously, and also will be cross checked with the annual material and energy balance. 100% of the data will be monitored and will be archived both electronically and on paper
QA/QC procedures to be applied:	Consumption data will be verified with KSCL on-site measurement records supported by vouchers for quantity of biomass residues purchased and corresponding changes in the stock.
Any comment:	The quantity of biomass purchased is assumed to be equal to the quantity combusted (i.e., all purchased biomass is combusted). The data will be archived two years after the end of crediting period.

Data / Parameter:	AVD_y
Data unit:	km
Description:	Average return trip distance between bagasse/biomass residue supply sites and project site
Source of data to be used:	KSCL will maintain an on-site log book to record the data.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	59 kms
Description of measurement methods and procedures to be applied:	The data will be recorded based on the meter readings for the distance travelled by the truck as provided by the driver. 100% of the data will be monitored and will be archived both electronically and on paper.
QA/QC procedures to be applied:	This parameter corresponds to the mean value of km travelled by trucks that supply the biomass residue plant. The data will be archived two years after the end of crediting period
Any comment:	Bagasse from the sugar cane crushed onsite is not included, as no transport is required.

Data / Parameter:	N_y
Data unit:	-
Description:	Number of truck trips for the transportation of biomass residue
Source of data to be used:	KSCL will maintain an on-site log book to record the data.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	6,000
Description of measurement methods and procedures to be applied:	The data will be recorded based on the entry and exit of trucks into the project site. 100% of the data will be monitored and will be archived both electronically and on paper
QA/QC procedures to be applied:	The data can be cross checked by comparing with quantity of biomass residues combusted.
Any comment:	Source locations of trucks transporting biomass residue will be recorded when trucks go through the weighbridge in the project plant. The data will be archived two years after the end of crediting period.

Data / Parameter:	TL_y
Data unit:	mass
Description:	Average truck load of trucks used to supply bagasse/biomass fuels
Source of data to be used:	Weigh bridge measurement of weight of trucks at KSCL plant.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	9 tonnes
Description of measurement methods and procedures to be applied:	Weight measurement of trucks with biomass residues will be done at the entry and exit of the KSCL plant. 100% of the data will be monitored and will be archived both electronically and on paper
QA/QC procedures to be applied:	KSCL will carryout actual measurement and record the data
Any comment:	Additional biomass residue resources are expected to be collected by different trucks and from different locations. This parameter will correspond to the mean value of truck load.

Data / Parameter:	$FF_{i,y}$
Data unit:	mass or volume unit
Description:	On-site fossil fuel consumption of fuel type i for co-firing in the project plant
Source of data to be used:	On-site measurements by KSCL
Value of data applied	18,934 tonnes

for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	The quantity is measured by installing a beltweigher/weighing scale at the boiler inlet. The data recording will be done continuously. 100% of the data will be monitored and will be archived both electronically and on paper
QA/QC procedures to be applied:	The data can be cross checked with the fuel purchase receipts and the entry records at the KSCL weigh bridge.
Any comment:	Fossil fuel may be used for start-up or during off-season in case of non-availability of additional biomass resources

Data / Parameter:	-
Data unit:	mass or volume unit
Description:	Quantity of biomass residues that are utilised in the defined geographical region
Source of data to be used:	Study data or statistical data from the on-going National Biomass Resource Assessment Programme being carried out by IISc, CGPL.
Description of measurement methods and procedures to be applied:	The data or statistics published by the IISc, CGPL study will be monitored annually.
QA/QC procedures to be applied:	The data can be cross checked with any biomass resource assessment survey conducted or available in the geographical region
Any comment:	The parameter is being monitored as approach L_2 is used to rule out leakage.

Data / Parameter:	-
Data unit:	mass or volume unit
Description:	Quantity of available biomass residues in the region
Source of data to be used:	Study data or statistical data from the on-going National Biomass Resource Assessment Programme being carried out by IISc, CGPL.
Description of measurement methods and procedures to be applied:	The data or statistics published by the IISC, CGPL study will be monitored annually.
QA/QC procedures to be applied:	The data can be cross checked with any biomass resource assessment survey conducted or available in the geographical region
Any comment:	The parameter is being monitored as approach L_2 is used to rule out leakage.

B.7.2 Description of the monitoring plan:

>>

Overall responsibility for monitoring and carrying out the monitoring following this monitoring plan lies with KSCL.

KSCL will establish a CDM project management office and assign dedicated people responsible for the monitoring and report the emission reduction due to the project activity.

The electricity output from the KSCL Bagasse CHP project is monitored and recorded using two meters. These meters are used for both CDM purposes and sales of the electricity generated to the grid company. A block diagram which details the monitoring plan adopted is given in Annex 4.

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

>>

Final version completed: 22/01/2007.

Name of persons determining the baseline:

- Mr Nishant Bhardwaj, nb@itpi.co.in. IT Power India Pvt. Ltd, 6&8 Romain Rolland St., Pondicherry, 605 001 India, Tel: +91 11 65640687, +919811717687.
- Mr Christiaan Vrolijk, cv@carbonresource.com. Carbon Resource Management Ltd, Technology House, 16-18 Whiteladies Road, Bristol, BS8 2LG, UK, Tel: +44 117 980 9442.

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

>>

22/09/2005 (Date of work order placed for boiler/turbine)

C.1.2. Expected operational lifetime of the project activity:

>>

25 years

C.2 Choice of the crediting period and related information:

C.2.1. Renewable crediting period

Not chosen.

C.2.1.1. Starting date of the first crediting period:

C.2.1.2. Length of the first crediting period:

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>

15/07/2007 (or date of registration whichever is earlier)

C.2.2.2. Length:

>>

10y-0m

SECTION D. Environmental impacts

>>

D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

>>

The project activity will not have a major impact on the environment but in contrast will benefit the environment by indirectly preventing the emissions as bagasse is considered as a renewable energy source and do not add any net CO_2 into the atmosphere as the carbon is recycled during cultivation of sugarcane. The following is a synopsis of the EIA for the project:

Air Environment

Micrometeorological data confirmed that climatology of the study area is consistent with the regional meteorology. As regards the status of ambient air quality, the change due to the additional stack emissions will be marginal. The comprehensive EMP to control dust emissions at the source will mitigate the impact on air quality.

Noise Environment

The impact of noise generated from the proposed unit on the general population is expected to be insignificant.

Water Environment

The impact of liquid effluent discharge from the unit on the ground water quality will be nil as the only liquid effluent, the domestic sewage is discharged into the land after passing through the septic tank followed by dispersion trench.

Land Environment

There would be a slightly positive impact, as the proposal would involve expansion of the greenbelt thus improving the land use and soil chemistry.

Socio-Economic Environment

The impact of the project would be more on the positive side than negative. Positive impacts are felt due to increase in employment opportunities and economic benefits.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

>>

The project does not have a significant environmental impact, but still measures are taken as described above, to minimise the impact.

SECTION E. Stakeholders' comments

>>

E.1. Brief description how comments by local stakeholders have been invited and compiled:

>>

A local stakeholder consultation was organised on 2 June 2006 for the proposed CDM project, the bagasse cogeneration power plant of Kothari Sugars and Chemicals Limited (KSCL), at the project site near Sathamangalam village, in Perambalur district, Tamil Nadu, India.

The consultation meeting was attended by the following stakeholders:

- Representatives from Kothari Sugars and Chemicals Limited
- Representatives from local elected bodies (village Panchayats) from three villages
- Representatives from local villages (cane growers)
- Representatives from local Non Governmental Organisations (NGO's)
- Representatives from local societies
- Representatives from Tamil Nadu Electricity Board
- Experts from IT Power India, Local Consultants
- Experts from Carbon Resource Management, International Consultants (UK)

The comments from the stakeholders were minor and were addressed during the meeting by Kothari Sugars and Chemicals Limited. The minutes of the stakeholder consultation have been compiled and are available from KSCL and IT Power India for reference.

The participants of the stakeholder consultation were requested to fill out a questionnaire which was specifically developed for the project activity. The questionnaires are available from KSCL.

E.2. Summary of the comments received:

>>

All the stakeholders present during the stakeholder consultation actively participated in the deliberations and provided their views on the project activity.

The members of the local elected bodies (the village Panchayat) from the three neighbouring villages had the following views:

- As the area in which the project activity is being undertaken is economically relatively under-developed. The project, therefore, will be a major boost for employment generation, improvement in the quality of life and educational standards of the people from the region.
- Due to reduced distance of transportation to the sugar mill, fresher cane can now be supplied to the factory – fresher cane fetches higher prices – which will be an economic benefit.
- The project activity is environmentally friendly as it uses the waste from the sugar industry to generate power.
- Farmers can further increase their income from supplying cane trash and other biomass waste which will also be purchased by KSCL for the cogeneration plant during off-season.

The local farmers/cane growers/villagers stated:

- The project activity will improve the employment prospects for the local community.
- Since the power generation happens at the project site, instances of power failure/breakdown will be minimal and in total the project will be beneficial for the development of the region.
- The project will accelerate the utilisation of under-utilised or barren land in the region which can augment the income generation potential of the local farmers.
- The land value has seen upward trend and is fetching good money for the people.
- Foresee additional revenue for local transporters (bullock cart, tractors etc.) for transportation of the cane to the plant.

The Non Governmental Organisations and local societies agreed that this is a developmental project and supports their principle of self sustainable villages with making use of locally available resources. They also indicated that the project will help in the local community development particularly with respect to the position of women in the community. They were of the opinion that the project has the potential to provide direct employment to 2,000 people and indirect employment to 10,000.

The Tamil Nadu Electricity Board indicated that the project will help in socio-economic development of the region, which is under-developed. The project will also provide more power to the grid and improves the power supply condition. As the project is of distributed generation type the transmission losses are minimal and the quality of power will be better.

Two queries/comments were made: participants requested (1) that KSCL take all appropriate action to prevent environmental pollution, and (2) that KSCL grow more trees at the project site.

E.3. Report on how due account was taken of any comments received:

>>
KSCL addressed the two queries/comments at the stakeholder meeting.

First, KSCL confirmed that all measures have been taken to deploy pollution control equipments at the plant as per the norms of Tamil Nadu Pollution Control Board, and that full EIA was prepared and was being approved.
Secondly, KSCL informed the participants of their intension to plant some 50,000 trees in the 230 acres site.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Kothari Sugars And Chemicals Limited
Street/P.O.Box:	115, Mahatma Gandhi Salai
Building:	Kothari Buildings
City:	Chennai
State/Region:	Tamil Nadu
Postfix/ZIP:	600 034
Country:	India
Telephone:	044-3022 5516 / 28334501 / 28334502
FAX:	
E-Mail:	kotharisugars@gmail.com
URL:	
Represented by:	
Title:	
Salutation:	Mr.
Last Name:	Kothari
Middle Name:	H
First Name:	B
Department:	Chairman
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Organization:	Carbon Resource Management Ltd.
Street/P.O.Box:	16-18 Whiteladies Road
Building:	Technology House
City:	Bristol
State/Region:	
Postfix/ZIP:	BS8 2LG
Country:	United Kingdom
Telephone:	+44 117 980 9440

FAX:	+44 117 980 9401
E-Mail:	nac@carbonresource.com
URL:	www.carbonresource.com
Represented by:	Nicholas A Clarke
Title:	Managing Director
Salutation:	Mr
Last Name:	Clarke
Middle Name:	
First Name:	Nick
Department:	
Mobile:	
Direct FAX:	+44 20 7864 4043
Direct tel:	+44 20 7864 4045
Personal E-Mail:	nac@carbonresource.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No ODA or Annex – I Government funding received. The project does not benefit from any public funding**.**

Annex 3

BASELINE INFORMATION

The electricity baseline emission factor for southern grid is taken from Baseline Carbon dioxide emission database Version 1.1 of Central Electricity Authority, India.

Relevant grid

The relevant grid for the determination of baseline emission factor is selected as the Southern Region grid. This is because although electricity generation and distribution remains largely in the hands of the Tamil Nadu Electricity Board (TNEB), the Indian state grids are becoming more integrated in the 4 regional grids.
The Southern Region grid is made up from generation in the following states and the central sector in the grid, as reported in the relevant statistics documents:

- Tamil Nadu
- Andra Pradesh
- Karnataka
- Kerala
- Lakshadweep
- Pondicherry

Data sources

The statistical data sources used for the emission reduction calculations are the following:

Data source	Information
Central Electricity Authority: • Baseline Carbon dioxide Emission database Version 1.1 (published annually)	• Simple Operating Margin emission factor for Southern grid • Build Margin emission factor for Southern grid. • Cumulative Margin emission factor for Southern grid.
2006 IPCC Guidelines for National Greenhouse Gas Inventories	• Emission coefficients for various fuels
Central Electricity Authority: • General Review (published annually)	• OM electricity generation • OM fuel consumption • NCV of the various fuels
Central Electricity Regulatory Commission • Annual Report • Regulations 2004 • Operational Norms for Thermal Generation Tariff	• BM unit heat rate norms
Planning Commission • Power Scenario at a Glance	• BM capacity additions
World Bank South Asia Regional Office	• Transportation emissions data

Operating Margin

The Simple OM emissions factor is taken from Central Electricity Authority (CEA), India published Baseline Carbon dioxide emission database version 1.1. Central Electricity Authority is a statutory body under Government of India which monitors and reports the electricity generation, transmission, and distribution performance of the power utilities in India. CEA has published baseline carbon dioxide emission database for all regional power grids in India. Being a conservative figure, CEA published Operating margin emission factors have been used for calculating baseline emissions for the project. The Operating margin emission factors for the southern grid is available at http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm

Besides, IT Power and CRM have calculated simple operating margin emissions factor based on 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, for the last 3 years for which data is available at the time of writing (2002/3, 2003/4 and 2004/5): 2006 IPCC guidelines for National Greenhouse gas inventories default oxidation factors were taken for calculating emission factor. The OM emission factor calculations are available on www.cdmbaselineindia.org. However, this emission factors were not used for calculating the project baseline emissions because of availability of CEA emission factors for all regional grids. Below table shows a glimpse of baseline emission factor calculated by ITPI and CRM.

Included years	2002/3	2003/4	2004/5	*3-year total*
Net generation, excluding must-run and low-cost (GWh)	102,760	106356.87	104,411	*313,528*
Fuel consumption				
Coal Consumption (tonnes/year)	65,997,000	52,985,000	53,144,000	*172,126,000*
Furnace Oil Consumption (tonnes/year)	103,163	50,275	40,805	*194,243*
Diesel Oil Consumption (tonnes/year)	736,047	12,668	53,583	*802,298*
LSHS Consumption (tonnes/year)	5,362	574,430	411,692	*991,484*
Light Diesel Oil Consumption (tonnes/year)	7,146	28,076	20,681	*55,903*
Gas (Corex) Consumption (m3/year)	-	1,932,274	1,710,347	*3,642,621*
Naptha Consumption (tonnes/year)	322,855	478,597	192,485	*993,936*
HSD Consumption (tonnes/year)	233,854	197,447	69,066	*500,367*
Natural Gas Consumption (million m3/year)	3,130	2,010	2,203	*7,343*
Lignite Consumption (tonnes/year)	17,738,000	20,755,000	22,121,000	*60,614,000*
Emissions				
CO2 emissions (tCO2e)	142,467,372	115,165,865	114,034,078	*371,667,315*
Emissions factor				
EF (tCO2e/MWh)	1.386	1.083	1.092	*1.19*

Build Margin

Build margin emission factor is also taken from the CEA published Baseline Carbon dioxide emission database version 1.1.

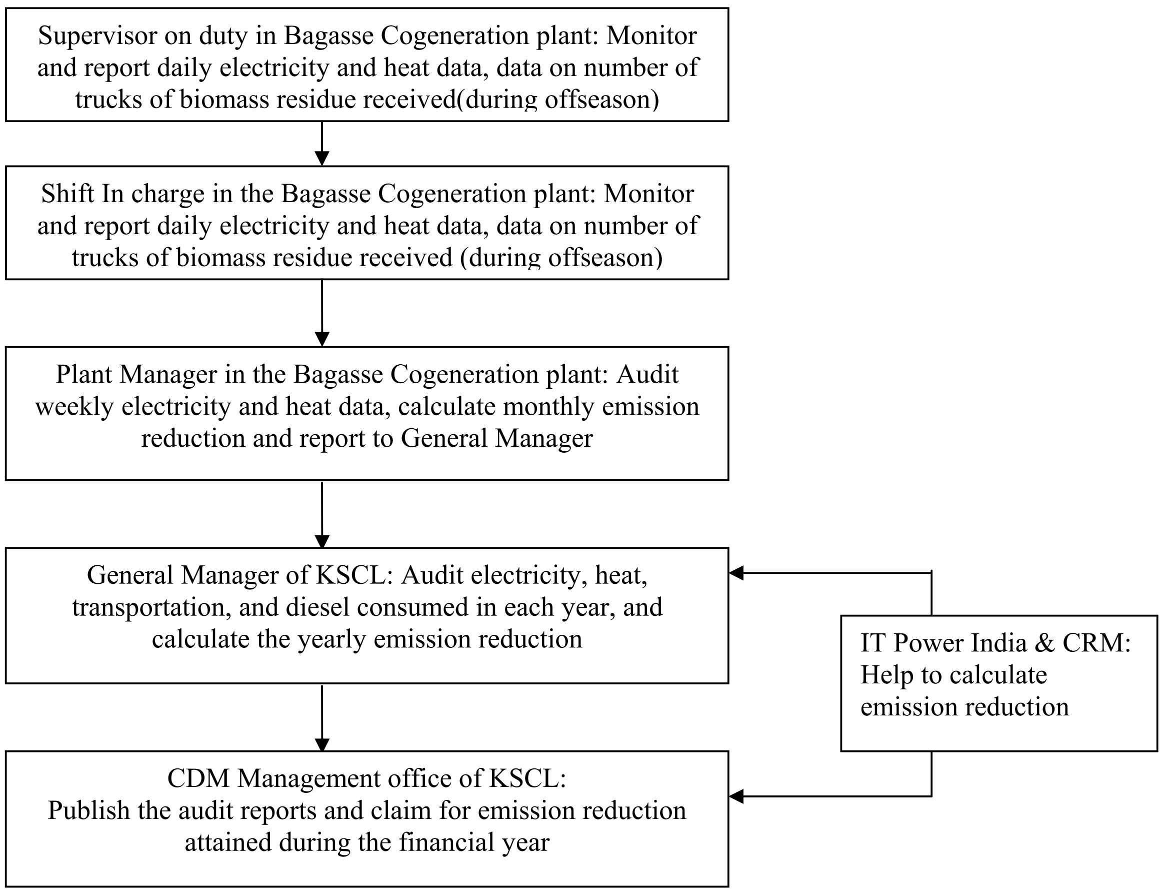
IT power group and CRM have also calculated Build margin emission factors using commissioning dates obtained from various sources (as specified above) for all plants located in the Southern Region. Given the size of the Southern grid, the most recent capacity additions accounting for 20% of generation must be taken as the base for the build margin calculation. These summary of capacity additions between 1 July 1999 and 30 July 2005, and the associated fuel consumption and emissions are outlined below. (Generation data, fuel consumption and emissions are obtained as for the approximate operating margin.)

Added capacity (date)	Capacity (MW)	Generation (GWh, 2004/5)	Emissions (ktCO2e)	EF (tCO2e/MWh)
All thermal plant	4,749	26,469	22,588	
Nuclear	440	2,925	-	
Hydro	1,811	2,420	-	
Total	**7,000**	**31,814**	**22,588**	**0.710**

The weight for operating and build margin emission factors (w) is 0.5 by default. Based on this the combined margin for the southern grid works out to 0.95 tCO_2 / MWh. However, as a conservative approach combined margin of 0.86 tCO_2e/ MWh from CEA study (www.cea.nic.in) has been considered for calculating CERs.

Annex 4

MONITORING INFORMATION



The Monitoring plan for KSCL

1. Introduction

KSCL bagasse based cogeneration project adopts the approved baseline methodologies ACM0006 (version 4)"Consolidated baseline methodology for grid-connected electricity generation from biomass residues" and ACM0002 (version 6, 19 May 2006) "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" to determine the baseline and calculate the emission reductions from the net electricity supply to the grid. The approved monitoring methodologies ACM0006 (version 4) and ACM0002 (version 6) are therefore used for developing the monitoring plan. This plan describes in more detail the process as set out in Section B.6.2 and B.7.1 of the Project Design Document.

2. Responsibility

Overall responsibility for monitoring and carrying out the monitoring following the above mentioned monitoring plan lies with CDM management office established by Kothari Sugars and Chemical Ltd.
Kothari Sugars and Chemicals Ltd in co-operation with IT Power India, the experts on cogeneration will train the staff in carrying out the monitoring works.

The technology providers will provide training to the relevant KSCL staff.

The data required in monitoring the emissions from project activity and the details of data handling and storage including the data source will be carried out as detailed in Section B.6.2 and B.7.1. All the data will be stored and will be available at the project site.

A team of Supervisors and Field Representatives headed by a Plant Manager to effectively control and monitor the complete process of fuel procurement, quality issues, and the handling and storage of material in the plant area. The monitoring data required are taken by supervisors and it is reported to the shift in charges. The shift in charge reports daily to the Plant Manager. The Plant manager submits a weekly report to the Management, which will be documented and stored in the project office. By this operational structure, the Management can monitor the project activity and make amendments immediately, if needed. The monitored parameters have low level of uncertainty. Therefore the possible monitoring data adjustments are not envisaged for the project.

Reported results and data will be compared with the previous results and data and will be thoroughly checked for any inconsistency.

3. Installation of meters

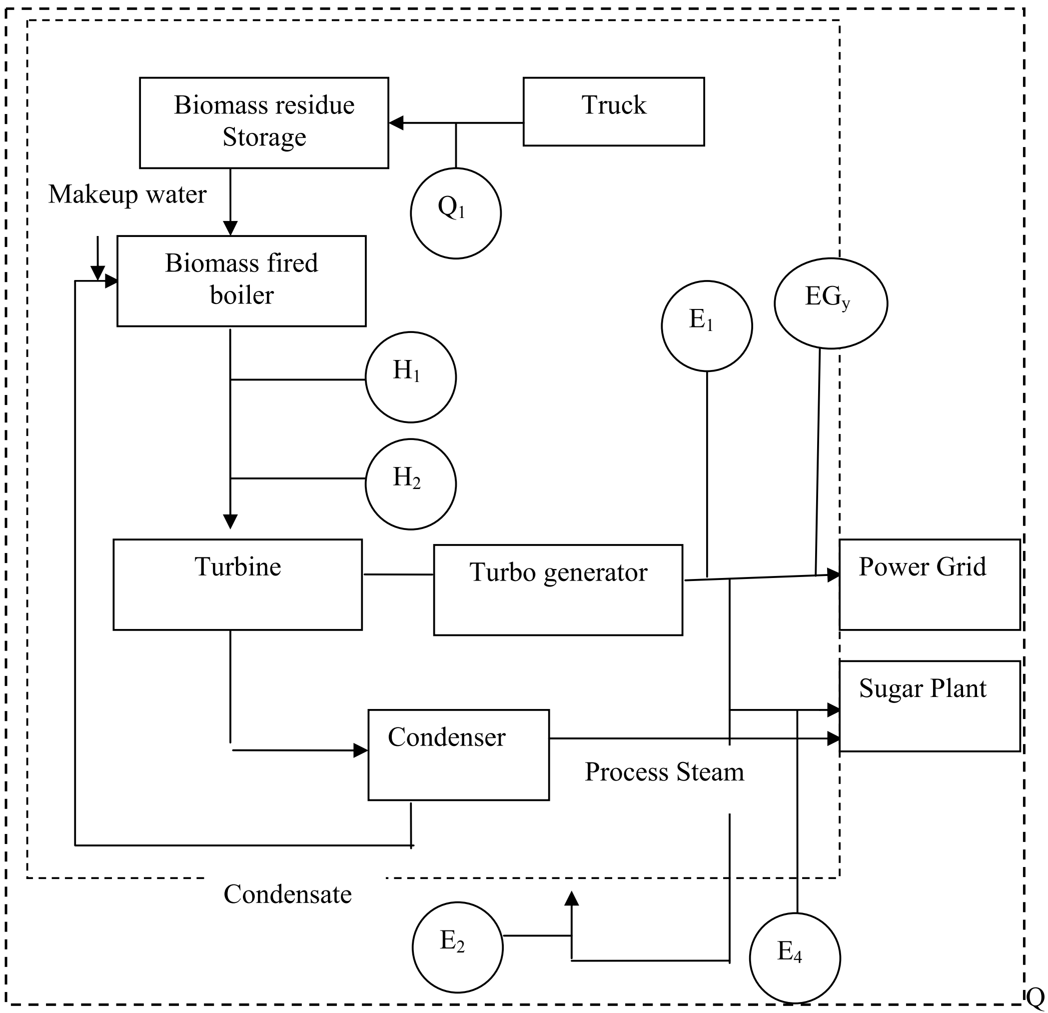
3.1 Installation of electricity meters

Project net electricity supply to the grid will be monitored through the use of on site metering equipment at the project site and at the substation. The main metering system equipment will be owned, operated and maintained by TNEB, and the backup metering system equipment will be owned, operated and maintained by KSCL.

Both meters will have the capability to be read remotely through a communication line. Both TNEB and KSCL. have the right to read either meter. Both meters record on memory the accumulated kilowatt-hours. The results from the main meter will be supplied by TNEB to KSCL on a monthly basis. KSCL will check its meter for consistency.

3.2 Installation of weighbridge

Weighbridge will be installed at the entrance of the power plant. This weighbridge can be used to measure the quantity of received biomass residues and quantity of coal arrived at the power plant, and the weighing result will be transferred to control room. The trucks transporting biomass will go through the weighbridge each time when trucks enter or leave the power plant, and the weighing result and biomass source location will be recorded in computer system. Number of trucks carrying biomass residue fuel arrived at the plant will be recorded. (during offseason)



Among these meters, labels Q, H and E represent respectively weighbridge, steam flow meter and electricity meter. The following table lists the labels in the diagram above and the parameters they measure respectively.

Table A10 The labels in the above diagram and the parameters they measure

Label	Meter type	Parameters measured
H1	Steam flow meter	Heat from biomass fired boiler
H2	Steam flow meter (back-up)	Heat from biomass fired boiler
E1	Electricity meter	Gross electricity generated from the project
E2	Electricity meter	Self consumed electricity generated by the cogeneration plant
EG_y	Electricity meter	Electricity delivered to the power grid
E4	Electricity meter	Electricity supplied to Sugar Plant
Q	Weighbridge	Quantity of biomass residue combusted by the project

4. Calibration

4.1. The electricity meter calibration

The Power Purchase Agreement between TNEB and KSCL defines the metering arrangements and the required quality control procedures to ensure accuracy.

The metering equipment are calibrated and checked annually for accuracy. The metering equipment shall have sufficient accuracy so that any error resulting from such equipment shall not exceed 0.5% of full-scale rating. The net energy output registered by the meters alone will suffice for the purpose of billing and emission reduction verification as long as the error in the meters is within the agreed limits.

Calibration is carried out by TNEB with the records being supplied to KSCL, and these records will be maintained by KSCL and the appointed third party.

Both meters shall be jointly inspected and sealed on behalf of the parties concerned and shall not be interfered with by either party except in the presence of the other party or its accredited representatives.

All the meters installed shall be tested by TNEB and KSCL within 10 days after:
- the detection of a difference larger than the allowable error in the readings of both meters;
- the repair of all or part of meter caused by the failure of one or more parts to operated in accordance with the specifications.

If any errors are detected the party owning the meter shall repair, recalibrate or replace the meter giving the other party sufficient notice to allow a representative to attend during any corrective activity.

4.2. The steam flow meter calibration

The steam flow meters are important while conducting the energy balances across the boiler and turbine. The data collected from the meters will be archived and used for energy auditing. The metering equipment are calibrated and checked annually for accuracy.

4.3 The weighbridge calibration

Weighbridge is important to measure the quantity of biomass residue and coal coming at the project site and getting combusted in the boiler. Weighbridge will be calibrated in accordance with Indian Standards.

5. Monitored data

The on-site net electricity supply to the grid (EG_y), times that trucks transporting biomass enter and leave the power plant (N_y), the combusted biomass residues ($BF_{i,y}$) and co-fired *i* type fossil fuel ($FF_{pp,\ i,y}$) will be monitored and recorded following the procedures above.

Average return distance between biomass residue supply site and the project site (AVD_y) and co-fired *i* type fossil fuel ($FF_{p\,p,\ i,y}$) will be crosschecked against commercial receipts or maps.

The uncertainty level of the monitored data is directly determined by the accuracy classes of the metering equipments. All data and their related uncertainties are listed in the following table:

Table A12. Main data to be monitored

Parameters to be monitored	Uncertainty level
On-site net electricity supply to the grid (EG_y),	Low. The accuracy class of electricity meter is 0.2% of full scale.
Net heat generation (Q_y)	Low. The accuracy class of steam flow meter is 0.075% of full scale.
Times that trucks transporting biomass enter and leave the power plant (N_y)	Low. Through crosscheck, uncertainty level can be mitigated to a very low level.
Combusted biomass ($BF_{i,y}$)	Low. The accuracy class of weighbridge is ±20kg.
Co-fired *i* type fossil fuel ($FF_{pp, i,y}$)	Low. The accuracy class of diesel flow meter is 1.5%. It will be further mitigated through crosscheck with commercial receipt.

6. Quality control

6.1 Audit

Monthly data for net electricity, heat generation, times that trucks transporting biomass residues enter and leave the power plant, purchased biomass residues and consumed fossil fuel will be approved and signed off by a designated Manager in the CDM Management office at KSCL. He will approve and sign off the yearly data that will be submitted to DOE. This audit will check compliance with operational procedures in this monitoring plan and Section B.6.2 and E.7.1 of the PDD. The meter readings for electricity will be crosschecked with sales receipt of the power grid company.

This internal audit will also identify potential improvements to procedures to improve monitoring and reporting in future years. If such improvements are proposed these will be reported to the DOE and only operationalised after approval from the DOE.

6.2 Meter failure case

6.2.1 Electricity meter failure case

Should any previous months reading of the main meter be inaccurate by more than the allowable error, or otherwise functioned improperly, the net energy output shall be determined by:
(a) first, by reading backup meter installed in the plant site, unless a test by either party reveals it is inaccurate;
(b) if the backup system is not with acceptable limits of accuracy or is otherwise performing improperly the KSCL and TNEB shall jointly prepare an estimate of the correct reading;
(c) if KSCL and TNEB fail to agree then the matter will be referred for arbitration according to agreed procedures.

6.2.2 Weighbridge failure case

Should any previous months reading of the weighbridge be inaccurate by more than the allowable error, or otherwise functioned improperly, the reading shall be determined as the maximum of biomass quantity consumed every month in the all previous months so as to guarantee the conservativeness of leakage test.

7. Data management system

Physical document such as paper-based maps, diagrams and environmental assessments will be collated in a central place, together with this monitoring plan. In order to facilitate auditors' reference of relevant literature relating to KSCL bagasse cogeneration plant, the project material and monitoring results will be indexed. All paper-based information will be stored by the technology department of KSCL and all the material will have a copy for backup.

And all data including calibration records is kept until 2 years after the end of the total credit time of the CDM project.

Table 13 below outlines the main documents relevant to monitoring and verification of the proposed project.

Table A13. Main Documents on Monitoring and Verification

I.D. No.	Document Title	Main Content	Source
F-1	PDD including the electronic spreadsheets and supporting documentation (assumptions, estimations, measurement, etc)	Calculation procedure of emission reduction and monitoring items	PDD in English and local language must be documented by the proposed project owner
F-2	Monitoring Quality Control and Quality Assurance Report	Equipments and national and industry standards	proposed project owner
F-3	The report on qualifications of the persons responsible for the monitoring and calculation	i.e. the title of a technical post, working experience etc.	proposed project owner
F-4	The report on monitoring and checking of electricity supplied to the grid	Record based on monthly meter reading and electricity sale receipts	proposed project owner
F-5	Record on maintenance and calibration of metering equipment	Reasons for maintenance and calibration and the precision after maintenance and calibration	proposed project owner
F-6	The report on baseline emission factor calculation	Data sources and calculation procedure	Proposed project owner
F-7	Record on CO_2 emission reduction monthly calculation	F4×F6	Proposed project owner
F-8	Project Management Record (including data collection and management system)	Comprehensively and truly reflect the management and the operation of the proposed project	Proposed project owner

8. Reporting

The steps required to derive at the emissions reductions are:

- KSCL reads main meter and reports the result to TNEB monthly.
- TNEB supplies reading to KSCL monthly.
- KSCL records readings from the backup meter.
- KSCL records the grid data needed by the CDM project before each verification, and calculates CO_2 emission factor of the grid based on the latest grid data.
- KSCL calculates emission reductions from displacement of grid electricity before each verification is conducted.
- KSCL carries out an internal audit on the readings, grid data, and emission reduction calculations
- KSCL reports annually the readings, grid data, coal-fired boiler data and calculations to the DOE for verification, within 10 working days of beginning verification.

9. Verification

The contracted DOE will receive the annual emission reduction report 10 working days before beginning each verification.

KSCL will facilitate the verification through providing the DOE with all required necessary information at any stage.