CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 02 - in effect as of: 1 July 2004)

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SECTION A. General description of project activity

A.1 Title of the project activity:

>> **The Godavari Sugar Mills Ltd (TGSML)'s 24 MW Bagasse Based Co-generation Power Project at Sameerwadi, Version 3, December 5, 2006**

A.2. Description of the project activity:

>> ■ **Purpose**

The purpose of the project activity is to utilize available mill generated bagasse effectively for generation of steam and electricity for both in-house consumption and to export surplus electricity to the grid. The project activity has positively contributed to the power deficit in Karnataka State, promoted sustainable economic growth and enabled conservation of environment and natural resources such as coal/ oil and other fossil fuels. The project has also helped in enhancing the socio-economic growth and development of the area.

■ **Salient features of the project**

The Godavari Sugar Mills Limited (TGSML) belongs to the Somaiya Group of companies. TGSML is the main promoter of the 24 MW cogeneration power plant (**"project activity"**), which is located in the existing sugar manufacturing premises at Sameerwadi village of Mudhol Taluk in Bagalkot district of Karnataka state. The main fuel for the project activity is their sugar mill generated bagasse.

At the time of implementation of the project activity in April 2002, TGSML had a sugar plant capacity of 6500 tons cane crushed per day (TCD) and was generating steam and power through seven boilers with aggregate steaming capacity of 180 ton per our (TPH) at 22.5 bar, 340 deg C and four (4) backpressure turbines with a total installed capacity of 8.5 MW respectively. The existing configuration of boiler and turbine was satisfying the captive steam and power requirements of the sugar mill.

Considering the lower electrical and thermal energy efficiencies (16.06 MWh/TJ and 1.9 tons steam/ ton bagasse respectively) of the already existing boiler and turbine system, TGSML implemented the cogeneration plant i.e. project activity as a power capacity expansion project which had relatively higher electrical and thermal energy efficiencies (47.76 MWh/TJ and 2.26 tons steam/ ton bagasse respectively) in order to effectively utilise the available bagasse generated by the sugar production unit and therefore increased the power generation capacity that would facilitate export to the state electricity grid. The project activity now operates along with the existing 3 boilers and 1 turbine.

The project activity i.e. the 24 MW cogeneration plant is the Phase 1 of their proposed 2-phase installation of cogeneration plants (2 Nos, each with steam generator and turbo generator). The second set of steam generators (2 X 100 TPH) and turbo generator of 30 MW is proposed to be installed in the Phase 2 (2007-08).

TGSML has subsequently increased the average crushing capacity of the sugar plant to 6,800 TCD during early 2002 and also proposes to increase the capacity to 9,800 TCD in year 2008. The project activity is exporting surplus power presently to Karnataka Power Transmission Corporation Limited (KPTCL) grid (now HESCOM), a part of the southern regional grid, after meeting the captive power and steam requirements of the sugar plant, distillery and the auxiliary power and steam requirements of the project activity, using bagasse as fuel.

Technical details

The 24 MW cogeneration project of TGSML consists of a double extraction cum condensing machine. A 130 tons per hour (TPH) nominal capacity boiler with the super heater outlet steam parameters of 65 kg/cm^2 and 490 ± 5^0C and a high efficiency extraction cum condensing (EC) type of turbo-generator set of 24 MW nominal capacity has been implemented for higher power output.

The steam generator is a travelling grate, stoker fired boiler, semi-outdoor, natural circulation, balanced draft type with bagasse burning without vapour separation in the bed. It is a bi-drum, wet bottom type unit designed for burning bagasse and other biomass fuels.

The steam generator is designed to operate with feed water temperature at economizer inlet of about 126 deg C and deliver steam to meet the turbo generator (TG) requirement at 100% MCR. The super heater sections are also of horizontal convection and radiation type and designed to maintain rated steam temperature of 490±5 deg C at outlet. The fuel system (bagasse) has 8 mins storage capacity prior to entry into the travelling grate. The boiler is provided with a set of soot blowers, which are automatic, sequential and electrically operated type.

One turbo generator and boiler operating with inlet flow of 119 TPH with extraction of 8.0 TPH and 58 TPH at 8.5 ata, 20 deg C superheat and 3 ata, 2 deg C superheat respectively yields 24 MW of power (Additionally backpressure mill turbines and one power turbine of the existing plant yield 80 TPH low-pressure process steam of 2.5 ata and 0.6 MW electrical power only). Inlet flow of 96 TPH with zero extraction for process steam yields about 24 MW of power during non-crushing season. The provision of extraction cum condensing machine allows the possibility of operating the plant during the off-season with the saved bagasse and procured biomass

Auxiliary systems

For the Phase 1, 130-TPH boiler and the 24-MW TG, the auxiliary systems include:

- Bagasse handling system with storage and processing arrangements,

- Feed water system (raw water and DM water system),
- Ash handling system,
- Water treatment plant,
- Compressed air system,
- Air conditioning system,
- Main steam, medium pressure and low pressure steam systems,
- Fire protection system,
- Instrument air system & the electrical system for its successful operation.

Power and fuel details

As per the requirements of sugar mill, the steam and power is supplied and surplus power is being exported to KPTCL (now HESCOM) after meeting cogeneration plant auxiliary requirements. The total captive power consumption for the sugar plant, colony and the auxiliary power consumption of the cogeneration unit works out to be 8 MW leaving about 24 MW + 1.5 MW (from existing backpressure turbine) – 8 MW (captive consumption) i.e. 17.5 MW of excess power export to KPTCL (now HESCOM) at 110 kV level for sale, during the crushing season of 8 months per annum.

During non-crushing period, 42-TPH bagasse is fired to produce 96.5 TPH steam to yield 24 MW of power of which 21 MW is exported to the KPTCL State grid (now HESCOM).

TGSML has exported 25.32 Million Units (MU) in the year 2002-03 (first year of operation), 99.04 (MU) during the second year i.e. 2003-04, 53.94 MU during 2004-05, 104.36 MU during Apr 05- March 06 respectively. It is expected that during the period 2006-09, the cogeneration plant would export about **99** MU to the Karnataka Power Transmission Corporation Limited (KPTCL) ((now HESCOM)) every year. Considering that the project activity is a power capacity expansion project the net quantity of increased electrical energy generation as a result of the project activity (i.e. incremental to the baseline generation) during the 7-year crediting period (2002 – 2009), works out to about **669,686** MWh.

- **Project's contribution to sustainable development**

The project activity has contributed to 'Sustainable Development of India' in following ways. The project activity is a renewable energy power project, which will use bagasse waste generated from sugar mill as a fuel for power generation and exports clean power to KPTCL grid (now HESCOM). This electricity generation would substitute the power generation by carbon intensive KPTCL grid (part of the Southern regional electricity grid), which uses carbon emissive conventional fuels like coal, diesel/oil, natural gas etc. Thus, project activity will reduce the CO2 emission and also save the conventional fuel.

Indian economy is highly dependent on "Coal" as fuel to generate energy and for production processes. Thermal power plants are the major consumers of coal in India, and yet the basic electricity needs of a large section of population are not being met. This results in excessive demands for electricity and place immense stress on the environment. Changing coal consumption patterns will require a multi-pronged strategy focusing on demand, reducing wastage of energy and the optimum use of Renewable Energy (RE) sources.

Since this project activity utilises renewable energy source, it will positively contribute towards the reduction in (demand) use of finite natural resource like coal/ oil, minimizing depletion or else increasing its availability to other important processes.

The project activity, by feeding clean power to grid will eliminate an equivalent carbon dioxide (CO_2), which would be generated to produce electricity to cater to the electricity requirement. Therefore this project activity has excellent environment benefits in terms of reduction in carbon emissions and coal resource conservation.

This project activity is in the rural setting and will contribute to the Environmental & Social issues locally and globally by:

- Export of 17.5 MW during season and 21 MW during off-season and thereby eliminating the generation of equivalent quantity of power using conventional fuel
- Conserving Coal, a non-renewable natural resource
- Making coal available for other important applications
- Reducing GHG (Carbon Dioxide)
- Contributing to a small increase in the local employment in the area of skilled & unskilled jobs for operation and maintenance of the equipment
- Capacity building of farmers in modern technology power generation and sale of power

The project imparts a direct positive impact by improvement of quality of life of local people by providing inflow of funds, additional employment, technological and managerial capacity building etc. The following paragraphs illustrate briefly how the project activity contributes to the four pillars (indicators) of sustainable development of India:

Social aspects

The location of the project in rural setting contributes towards poverty alleviation by generating both direct and indirect employment. Also growing, collection and use of sugarcane bagasse for commercial application will improvise the managerial skills of the local people. The local people will know the technological advancement and will help in capacity building. Also the project will help to bridge the gap of electricity demand and supply at local and national level.

Economic aspects

The project's initial investment is to the tune of Rs. 1,080 million in addition to which there will be continuous inflow of funds considering CDM revenues. In the absence of the project such an inflow of funds to the region was not envisaged. The project will also earn additional revenue to the local and central government.

Environmental aspects

The project activity is a renewable energy power project, which uses mill-generated bagasse of sugar mill as a fuel for power generation. The CO_2 emissions of the combustion process due to burning of bagasse, are consumed by the plant species, representing a cyclic process. The bagasse generation, storage and usage is governed by established system and channel to ensure no resource degradation. Plant uses state of the art control systems to minimize pollution like the electrostatic precipitators, reverse osmosis systems etc. to control the air and water discharges. Since this project activity generates green power, it has positively contributed towards the reduction in (demand) use of finite natural resource like coal/oil, minimizing depletion and in turn increasing its availability to other important purposes. Therefore this project activity has excellent environment benefits in terms of reduction in carbon emissions and coal resource conservation.

Technological aspects

The project activity uses one of the most efficient and environment friendly technology of cogeneration in the renewable energy sector. The project comprises of 130 tons per hour (TPH) capacity steam generator which generates about 120 TPH of steam with the outlet steam parameters of 65 kg/cm^2 and 490±5ºC, with 24 MW capacity turbine generator set of double extraction cum condensing (DEC) type turbine.

All necessary auxiliary facilities of the power plant are provided. The higher steam parameters result in higher annual savings of fuel per annum when compared to lesser steam parameters like 22 kg/cm^2 prevalent in the country.

A.3. Project participants:

The Godavari Sugar Mills Limited (TGSML) - Project Promoter

Name of Party involved	Private and/or public entity (ies) project participants	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/ No)
India (Host)	The Godavari Sugar Mills Limited (TGSML)	No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party (ies):

>> India

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

>> Karnataka

A.4.1.3. City/Town/Community etc:

>> Sameerwadi Village, Mudhol Taluk, Bagalkot District

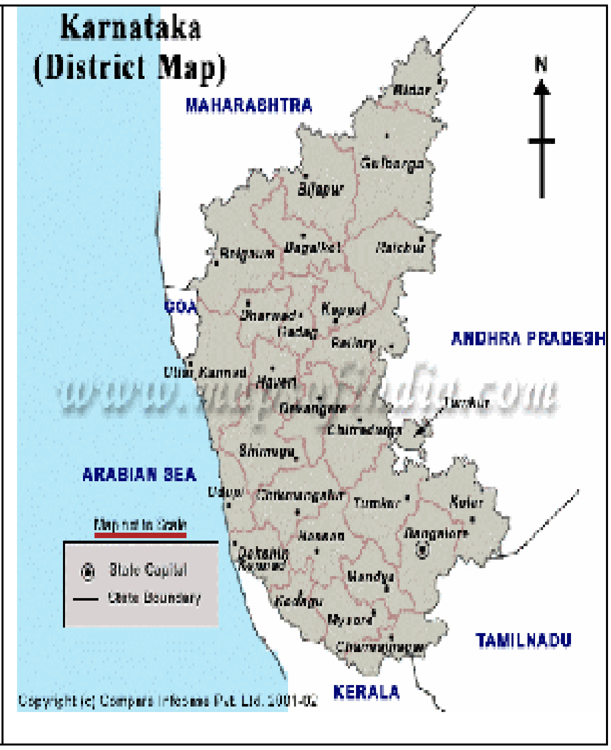
A.4.1.4. Detail of physical location, including information allowing the unique identification of this project activity:

>> The project activity has been implemented in the premises of existing sugar mill complex at Sameerwadi, Mudhol Taluk, Bagalkot District in Karnataka State at latitude 16° 23' and longitude 75° 3'. The site is 90-Kms. away from Miraj Junction in Maharashtra on the Pune – Belgaum section of the South-Central railway.

The project activity is located adjacent to the boiler house of the sugar plant. There is adequate space for storage of bagasse and water required.

The water requirement for the sugar plant is being met through bore wells located around the plant, however considering the inadequate yield of water from the bore wells, TGSML has obtained the permission of the Govt of Karnataka for withdrawal of 8640 m^3 of water per day from the Ghataprabha River, a tributary of River Krishna.

The electrical substation is situated very near to this project at Mahalingapur Station, which is just 8 kms to where the surplus power is exported. Site conditions, availability of space, transport facility, fuel, water, convenience of interconnection with electrical grid for the power evacuation etc were studied before implementation of the project.



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

>> The project activity is a bagasse based grid connected co-generation power project, which is primarily a renewable energy project. Hence the project activity is to be categorized under Category 1: Energy industries (renewable - / non-renewable sources) as per the scope of the project activities enlisted in the 'List of Sectoral Scopes' (Version, 27 February 2006) for accreditation of operational entities.

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

>> Project activity is a grid-connected bagasse based cogeneration power plant with high-pressure steam turbine configuration.

The plant is designed to operate with boiler outlet steam parameters of 65 kg/cm^2 and 490±5ºC using bagasse as a main fuel. The boiler is designed with a travelling grate and electric drive to burn bagasse. The inlet feed water is at 126^{o}C. The cogeneration turbine is a double extraction cum condensing machine.

One turbo generator and boiler operating with inlet flow of 119 TPH with extraction of 8.0 TPH and 58 TPH at 8.5 ata, 20 deg C superheat and 3 ata, 2 deg C superheat respectively yields 24 MW of power (Additionally mill backpressure turbines of the existing plant yield 62 TPH low-pressure process steam of 2.5 ata and 0.65 MW electrical power only). Inlet flow of 96 TPH with zero extraction for process steam yields about 24 MW of power during non-crushing season.

Although a few bagasse based cogeneration power plants are designed with above mentioned high pressure and temperature parameters in India as well as the State of Karnataka, the technology is well proven worldwide.

A.4.4. Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed CDM project activity, including why the emission reductions would not occur in the absence of the proposed project activity, taking into account national and/or sectoral policies and circumstances:

>> The cogeneration power plant uses environmentally sustain ably grown cane bagasse. The bagasse being a biomass renewable fuel, its combustion does not add any net carbon-dioxide to the atmosphere because of the carbon recycling during growth of cane. Therefore the project will lead to lesser GHG on-site emissions. Since, the bagasse contains only negligible quantities of other elements like Nitrogen, Sulphur etc. release of other GHGs are considered as negligible. Bagasse is expected to contain around 50% moisture; this will keep the temperatures at steam generator burners low enough not to produce nitrogen oxides.

In the project, fossil fuels like coal have been used due to extreme conditions of non-availability of bagasse during the year 2004-06 considering drought. However this extreme situation is not expected to occur in future. TGSML would procure biomass from outside sources to the extent of about 55,000 tons up to 2008. During 2008 TGSML proposes to implement the phase II of the cogen plant having an installed capacity of 30 MW (a back pressure turbine) after which there would be no shortage of bagasse at the project site.

The project activity of TGSML will generate 24 MW power and export to KPTCL grid (now HESCOM) a capacity of 17.5 MW during crushing season and 21 MW during off-season period after meeting its auxiliary power needs. The plant will run at a plant load factor of 90%.

The emission reductions are calculated based on the increased electricity generation by the project due to power capacity expansion when compared to the baseline which is estimated as **669,686** MWh in the proposed 7 year crediting period.

A.4.4.1. Estimated amount of emission reductions over the chosen crediting period:

>> The project would result in a CO_2 emission reduction of **418,451** tons during the 7-year crediting period from 2002 - 2009 which relates to the increased electrical energy generation from the project of about 669,686 MWh. The project emission from coal co-firing is estimated as 129,177 tons and emissions from transportation of biomass are estimated to be 8,130 tons during the 7 year crediting period. The project emissions have been deducted from the baseline emissions in order to compute the emission reductions from the project.

Without the project activity, equivalent energy load would have been taken-up by the Southern regional grid mix with thermal power plants and emissions of CO_2 would have occurred due to combustion of conventional fuels like coal, lignite, diesel/ naphtha, gas etc. Thus the project activity enables reduction of greenhouse gas emissions of the Southern electricity grid as provided in Table 1.1.

Table 1.1 Annual estimation of emission reductions by project activity

Years	**Annual estimation of emission reductions in tones of CO_2e**
2002-03	20,237
2003-04	91,236
2004-05	37,554
2005-06	2,513
2006-07	88,971
2007-08	88,971
2008-09	88,971
Total estimated reductions (tones of CO_2e)	418,451
Total number of crediting years	7 years
Annual average over the crediting period of estimated reductions (tonnes of CO2e)	**59,779**

A.4.5. Public funding of the project activity:

>> No public funding from parties included in Annex I is available to the project activity.

SECTION B. Application of a baseline methodology

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

Title: Consolidated baseline methodology for grid connected electricity generation from biomass residues

Reference -This is an UNFCCC approved consolidated baseline methodology ACM0006 version 3, dated 19/05/2006 which is based on the following approved methodologies.

- AM0004: Grid connected biomass power – generation that avoids unconnected burning of biomass
- AM0015: Bagasse based cogeneration connected to an electricity grid which is based on Vale do Rosario Bagasse cogeneration project in Brazil
- NM0050: "Ratchasima SPP Expansion Project in Thailand"
- NM0081: "Trupan biomass cogeneration project in Chile"
- NM0098: "Nobrecel Fossil to Biomass fuel switch project in Brazil"

The methodology also refers to ACM0002 version 6, 19/05/2006 ("Consolidated baseline methodology for grid connected electricity generation from renewable sources") and the latest version of the "Tool for the demonstration and assessment of additionality".

B.1.1. Justification of the choice of the methodology and why it is applicable to the project activity:

>> The project activity is bagasse based renewable energy power project, which feeds surplus electricity (power) to the KPTCL grid a part of southern regional electricity grid (comprising power generated through sources such as coal, lignite, naphtha, diesel and gas based thermal power, hydro power and renewable energy sources including small/micro hydro projects, bagasse/biomass based cogeneration/power projects *etc).* The selected methodology available on the UNFCCC web site is applicable to "grid connected and biomass-residue fired electricity generation from biomass residues" and is the most suitable approved UNFCCC methodology available for the project activity.

Further, the project activity meets the applicability criteria of ACM0006, version 3, 19/05/2006 as under.

1. It involves installation of a new biomass power generation unit which is operated next to existing power generation capacity fired with either fossil fuels or the same type of biomass residue as in the project plant (power capacity expansion projects)

2. It is a grid connected and biomass residue fired cogeneration project activity that displaces electricity generation in the electricity grid
3. Fuel used by project is bagasse, a by-product from sugar industry (agriculture related industry) therefore satisfying the biomass residue definition
4. No other biomass types other than biomass residues (bagasse and other agricultural residues as per biomass residues[1] definition) are used in the project plant and bagasse is the predominant fuel used in the project plant where some fossil fuels like coal may be co-fired
5. Implementation of the project activity does not result in an increase of the processing capacity of raw input (sugar) or other substantial changes (e.g. product change) in this process. In fact the purpose of the project activity is to effectively utilise the bagasse generated by the sugar mill and substitute power and heat earlier generated through biomass and fossil fuels.
6. The bagasse used by the project is not stored for more than one year as it would be used to generate steam and power for season and off-season respectively.
7. No significant energy quantities except from transportation of biomass (during off-season) are required to prepare the biomass residues for fuel combustion

For the project activity, Scenario 16 – Power Capacity Expansion Project of Table 1 of the ACM0006, version 3, 19/05/2006 methodology has been used for determining the baseline and emission reductions from the project as it is the most appropriate scenario for the project activity. Scenario 14 – “Energy efficiency projects” was also considered for the project but it did not suit the project as the project is neither a retrofit to the existing biomass plant nor does it replace the existing plant.

There are various barriers (investment, institutional, regulatory, managerial, common practice etc.) to the implementation of high efficiency cogeneration projects in the State, despite support from state and central government through their promotional policies. Details of the same are mentioned in the section B.3 of this document.

B.2. Description of how the methodology is applied in the context of the project activity:

>> The project activity fits in the Scenario 16 – Power Capacity Expansion Projects contained in Table 1 of the methodology i.e. “Combinations of project types and baseline scenarios applicable to the (ACM0006, version 3, 19/05/2006) methodology”.

The methodology is applied in the context of the project activity in the following ways:

1. Project is a power capacity expansion project

[1] For this specific methodology, biomass residues are defined as biomass that is a by-product, residue or waste stream from agriculture, forestry and related industries

2. Project involves installation of new cogeneration unit of 24 MW capacity, which operates next to an existing biomass power generation unit (old boiler and turbine system)
3. The existing unit is only fired with biomass and continues to operate in the same manner after the installation of the new power unit.
4. In the absence of the project activity:
   - Equivalent power would have been generated by the power plants in the grid and to a small extent be generated in the existing power plant at project site
   - Equivalent biomass would have been partly used for heat generation in existing boilers at the project site, partly used for power generation in existing power plants and partly dumped or left to decay
   - Equivalent heat would have been generated in on-site boilers fired partly with biomass and partly with fossil fuels

The project activity has increased installed power generating capacity (marginally) of the Southern regional electricity grid and has also avoided/ delayed the capacity addition of equivalent of project size and helped to reduce the carbon intensity of the grid mix.

The methodology demands realistic background data, which has been gathered from reliable sources (such as Central Electrical Authority (CEA), KPTCL, KERC, IPCC etc) for analysis to determine additionality and baseline emission factor. The stepwise application of the methodology is given below:

Step – I: Establishing additionality of the project activity
Analysis is carried out as per the Annex 1 of EB 16 report 'Tool for demonstration and assessment of additionality' in the next section. Information/data related to industry practice and other regulatory and project related documents have been used to establish the additionality of the project activity. Details of step I are a part of Section B.3.

Step – II: Determining the baseline emissions
The baseline emissions due to power generation by grid mix have been estimated based on the authentic grid data. For detailed analysis, data/information was collected from government/non-government organisations and other authentic sources. Following information/study reports/documents were consulted/ referred to apply the selected methodology.

- Data / information from Southern regional grid regarding present generation mix, sector wise installed capacities, generation efficiencies, technology used for power generation, present condition to meet peak demand and energy requirements *etc*.(Refer Annex 3 – Baseline data)
- Power generation mix of Southern regional grid for last 5 years (2000 – 2005) obtained from various electricity boards of southern states.(Refer Annex 3 – Baseline data)
- Study of Current Power Scenario and Policies
- Study of government policy/guidelines for generation of electricity by private participants

- Study of present status of renewable energy and policy / plan for development of renewable energy projects in the state.
- Study of relevant regulations

The emission factor for displacement of electricity in the selected grid is established as per the procedure of approved methodology ACM0002,version 6,19/05/2006 – Consolidated baseline methodology for grid connected electricity generation from renewable sources.

B.3. 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:

>> The TGSML project activity is a project comprising "grid connected electricity generation from biomass residues". It is a renewable energy based power generation project with net zero CO_2 emissions (due to the carbon sequestration by the sugarcane plants) and exports power to the Karnataka state grid.

The power generated from the project activity has displaced electricity that would otherwise have been generated by the grid-connected power plants in the Southern regional electricity grid, which has a CO_2 emission factor (combined margin carbon intensity) of **0.850**[2] kgCO2/ kWh. The combined margin emission factor has been calculated as per the guidance in ACM0002, version 6, 19/05/2006 in the absence of the project activity as provided in **Annex 3** of the PDD.

As per the decision 17/cp.7 para 43, a CDM project activity is additional if anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of the registered CDM project activity.

As per the selected methodology ACM0006,version 3, 19/05/2006, the project proponent is required to establish that the project activity is additional and therefore not the baseline scenario, for which the "Tool for the demonstration and assessment of additionality" Annex 1 to the EB 16 report (See Fig B1) has been used. Additionality of project activity as described in the selected methodology (ACM0006, version 3, 19/05/2006) is discussed further (section B.3.1 to B.3.4).

Description of baseline scenario

As described in the methodology, the most plausible baseline scenario will be identified among all the realistic and credible alternatives by using the tool to determine and assess additionality (in accordance with **Fig 2.1**).

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

B.3.1 Step 0: Preliminary Screening based on the starting date of the project activity

The construction of the project activity started in May 2000, which is after January 1, 2000. The project activity is likely to be registered as a CDM project activity at UNFCCC before December 31, 2006.

As TGSML would like to have the crediting period starting prior to the registration of their "project activity" they are required to:

A. Provide evidence that the starting date of the CDM project activity falls between 1 January 2000 and the date of registration of the first project activity (18th November 2004), bearing in mind that only CDM project activities registered before 31 December 2006 may claim for the crediting period starting before registration and;

B. Provide evidence that the incentive from CDM was seriously considered in their decision to proceed with the project activity. This evidence shall be (preferably official, legal and/or other corporate) documentation that was available at, or prior to, the start of the project activity.

There is evidence available that the project activity started after May 1, 2000. There is also sufficient evidence available in form of documentation clearly showing that the project promoter was well aware of carbon credits, and CDM incentive played a role in the decision taken by TGSML's management in implementing the cogeneration plant. The documents have been produced to the validator on request.

This clears the preliminary screening criteria of UNFCCC for registration of eligible project activity as a CDM project.

B.3.2 Step 1 - Identification of alternatives to the project activity consistent with current laws and regulations

The sub-steps include:

A. Sub-step 1a. Defining alternatives to the project activity
B. Sub-step 1b. Enforcement of applicable laws and regulations

In sub-step 1a and 1b, TGSML is required to identify realistic and credible alternative(s) that were available to TGSML or similar project developers that provide output or services comparable with the project activity. These alternatives are required to be in compliance with all applicable legal and regulatory requirements.

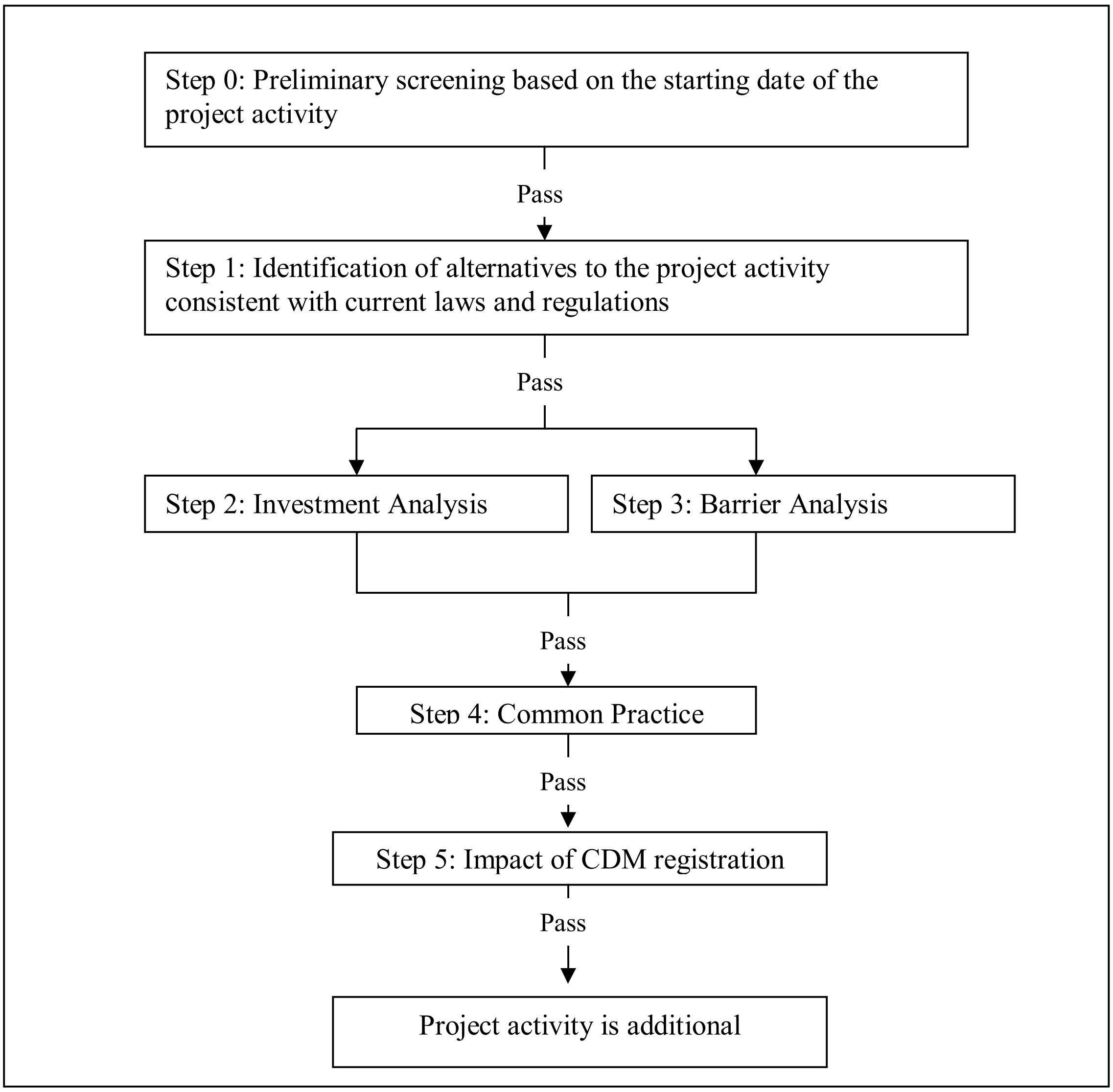


Fig 2.1 Flowchart for demonstrating additionality of the project

TGSML identified the different potential alternative(s) to project activity available to all other sugar-manufacturing units in India. As defined in the consolidated methodology ACM0006,version 3, 19/05/2006, the realistic and credible alternatives were separately determined by considering the following criteria, which also was aligned with the Scenario 16:

(i) How power would have been generated in the absence of the project activity?

Option P4: Power would have been generated from the existing and / or new grid-connected power plants.

Option P6: Continuation of power generation in an existing power plant, fired with the same type of biomass as (co-)fired in the project activity and, at the end of the life time of the existing plant, replacement of the plant by a similar new plant.

(ii) What would happen to the biomass in the absence of the project activity?

Option B1: The biomass would have been dumped or left to decay or burned in an uncontrolled manner without utilizing it for energy purpose.

Option B2: The biomass would have been used for heat and/ or electricity generation at the project site

(iii) And in case of cogeneration how heat would be generated in the absence of the project activity?

Option H4: Continuation of generation of heat in boilers using the same type of biomass residues.

Option H6: Generation of heat in boilers using fossil fuels.

The following paragraphs illustrate the various potential alternatives, and demonstrate additionality on the basis of why the non-project options are more likely.

Alternative for power generation

Option P4 / P6: Generation of power with existing and / or new grid connected power plants, with same type of biomass co-fired in the project activity and at the end of the lifetime of the existing plant and replacement of the plant by a similar new plant.

In the absence of the project activity, the power would have been generated partly (a) by the existing power plant (old configuration) to satisfy the captive power requirements of about 8 MW by the sugar plant and partly (b) by the power plants in the southern regional electricity grid. This is compliant with legal and regulatory requirements and therefore suitable to be considered as baseline for the project activity.

In India, all the sugar mills have their own cogeneration units, most of them operating with low-pressure boiler configuration of below 45 kg/cm^2 (Maximum are in the range of 21 kg/cm^2 to 45 kg/cm^2) to cater to the in house steam and power requirements.

Until April 2002 or prior to the project activity, TGSML was operating at lower pressure, lower efficiency boiler configuration, with no export of electricity to the State grid. TGSML was meeting the requirement of process steam and electrical power through 7 Nos bagasse fired boilers (2 X 37.5 + 3 X 20 + 1 X 45 + 1 X 18) all raising steam at 22.5 bar 340 deg C with aggregate steaming capacity of 180 TPH and 4 backpressure turbines of various sizes in the range of 1.5 to 2.5 MW with a total installed capacity of 8.5 MW. The boiler electrical energy efficiency (as defined under the methodology) for the old configuration (i.e. baseline) was one third (16.06 MWh/TJ) when compared to that of the project activity (47.76 MWh/TJ).

Conventionally it is easier for sugar mills to opt for low efficiency cogeneration plant considering that they are less capital intensive. Cogeneration plants with outlet boiler pressure of 45-kg/cm^2 produce lesser power (as compared to TGSML's 65 kg/cm^2) and are less capital intensive. TGSML had an option to install low or medium pressure boilers as against selected configuration of 65-kg/cm^2-outlet boiler pressure however they have implemented "modern and energy efficient technology", which was available in the country at the time of implementation of the project activity (2001-2002).

At the time of commencement of power export to KPTCL, the project activity was one of the first few in India and only fourth in the state of Karnataka to implement the bagasse cogeneration with this pressure and temperature configuration and hence clearly a unique project and not a business as usual scenario (BAU) as only three cogeneration plants with equivalent pressure and temperature configuration were implemented before the project i.e. April 2002.

The total installed capacity in Karnataka as on 31st March 2002[3] (just prior to the project activity) was 5,715 MW, which comprised 3,943 MW from KPCL's own projects, 334 MW from Vishweshvarayah Vidhyut Nigama Limited (VVNL) projects, 588 MW from IPPs, 14 MW other projects, 155 MW non conventional energy sources and 680 MW of Share from Central Sector Projects. Up to March 31st 2002 the installed capacity of non-conventional energy sources was only 0.027% of the total (state + central) share of power in Karnataka.

KPTCL generation mix[4] for year 2002 (just prior to the project activity) comprised around 41.98% thermal power plants, 51.03 % hydro projects and balance of only around 0.069% other projects (including renewable energy projects). Thermal power plant category includes coal-based plants and diesel based plants, and both the fossil fuels are responsible for substantial CO_2 emissions. Power export to KPTCL grid by the project activity will replace the conventional power (contributed by a generation mix predominated by fossil fuel based power plants) by cleaner power and therefore enable GHG emission reductions by the project.

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[3] KERC Annual Report 2001-2002

[4] KERC Annual Report 2001-2002

From the above it is evident that, prior to the project activity, there was negligible contribution of energy through renewable energy sources in Karnataka. TGSML's project activity resulting in export of green power to the KPTCL grid since April 2002 is a unique and pioneering contribution to the state of Karnataka and India around the time of its implementation.

Though TGSML registered their sugar mill in the year 1973 and has completed thirty one seasons of sugar manufacturing, they did not export power until the 'project activity' was implemented in April 2002. It is very likely that TGSML would have continued to operate with the lower efficiency boiler with slight modifications/ retrofits in the absence of the CDM project activity.

Alternative for steam generation

Options H4 / H6: Generation of heat in boiler using the same type of biomass residues Or Generation of heat in boilers using fossil fuel

The generation of heat at TGSML would have been generated in the existing boilers using the same type of biomass (i.e. bagasse) in the absence of the project activity. Option H4 is the most likely baseline option. However in case of cogeneration plants, the emission reductions or increases from displacement of heat needs to be determined. TGSML's old boiler and turbine system had a thermal energy efficiency which is lower than that of the project plant and therefore there would be no emission increases from the project activity.

Alternative for use of biomass

Option B1 and/ or B2: The biomass is dumped or left to decay or burned in an uncontrolled manner without utilizing it for energy purpose or Bagasse was used to generate heat and power at the project site

Prior to the project activity:

1. More than 96% of bagasse (generated by sugar plant) was used to generate steam and power in the old boiler and turbine system required for auxiliary, sugar plant and colony consumption
2. Very small portion (about 0.7 to 1%) excess bagasse was stored in the open at the project site where it would remain until used for start up during season and,
3. Very small portions (2-3%) of bagasse was sold to paper and cardboard industries for use as feedstock or raw material (non-energy purpose)

Had the project activity not been implemented, biomass would have been mostly used for power generation and less than 4-5 % used for other purposes as discussed above.

During storage of excess bagasse at site, it would decay naturally and also burn/ catch fire and burn in an uncontrolled manner. Baseline scenario for biomass disposal is therefore a combination of B1 and B2.

Summary on alternatives

Considering the alternatives explained above (suggested in the consolidated methodology ACM0006, version 3, 19/05/2006, it can be inferred that for the project activity, the baseline is a combination of:

1. Option P6: Continuation of power generation at the existing power plant (old boiler) fired with the same type of biomass as the project activity
2. Option H4: Heat generation in boilers using the same type of biomass (i.e. bagasse)
3. Option B1 and B2: Use of most of (96%) biomass to generate heat and power at the project site as well as open storage on-site (decays or burns uncontrollably) and sometimes also used as raw material for paper manufacturing (non-energy purpose)

The next step for additionality justification as per the **Fig 2.1** is either

1. Investment analysis (Step 2) OR
2. Barrier analysis (Step 3).

In view of overall project scenario, TGSML proceeds to establish project additionality by conducting barrier analysis as under.

B.3.3 Barrier Analysis (Step 3)

This analysis is required to determine how the project activity faced the barriers that:

1. Prevented the implementation of project activity; and
2. Did not prevent the implementation of at least one of the alternatives through the following sub-steps:

Sub-step 3a: Identification of barriers that would have prevented the implementation of the project activity

As per the report[5] by the Ministry of Non-Conventional Energy Sources (MNES), Government of India, the potential for bagasse based cogeneration in the major sugar producing states of India is estimated as 3500 MW of which Karnataka has a potential of 300 MW. There are several barriers due to which the above potential has not been harnessed. The project activity had its associated barriers to successful implementation, which have been overcome by TGSML to bring about additional green house gas reductions. Further, the project is additional as it overcomes the barriers discussed further in this section:

[5] Source of information: Ministry of Non-conventional Energy Sources, India, http://mnes.nic.in/bmp11pot.htm

(i) Technological Barrier

The project activity has adopted a high-pressure co-generation technology, which was relatively new in Karnataka at the time when the project activity was implemented (i.e. April 2002). The project activity uses a technology, which had low market share and less penetration around the time the project was implemented. Low penetrated technology is related to efficiencies of major equipments, trouble-free plant operation, availability of spares, availability of skilled manpower to operate the plant continuously *etc*. TGSML was one of the first few companies in Karnataka to overcome the technology barrier by adopting 65-kg/cm^2 pressure and STG of double extraction cum condensing type. The specialty of this turbine is that, with out compromising on the power output of 24 MW, process steam can be supplied to sugar plant as per it's process demands through extraction, thereby producing 24 MW both during season and off season.

The project activity has resulted in efficient utilisation of fuel (bagasse) i.e. during the pre-project scenario, the steam to bagasse ratio in sugar boilers (at steam pressure and temperature of 21 kg / cm^2 and 360° C) was 1.9 but in case of the project activity (cogeneration) the ratio improved to around 2.26 to 2.3. In the pre-project scenario, about 12 tons of steam was required to generate 1 MW power but after the project activity, the co-generation plant generates 2.4 MW from equivalent steam (12 tons).

The project exports power at 110 KV and is connected to 220 KV Mahalingpur substation. Cogeneration plant capacity is small when compared to the infinite bus it is connected to, and while the big thermal power stations can operate with wide range of voltage and frequency fluctuations, the 24 MW plant connected to the grid can not be operated with these wide fluctuations considering the safety of the equipment. Hence operating the cogeneration plant connected to the grid was challenging task .TGSML has adopted suitable technology to overcome this problem for safe islanding of the plant.

Considering the design accuracy and expertise required to run a cogeneration plant (of a high pressure steam cycle including export of power to the grid at 110 KV voltage level), TGSML had to appoint M/S Desein Pvt Ltd as consultants for erection and commissioning and had to award the Engineering Procurement and Construction (EPC) contract to M/s BSES. Other points are listed below:

- Special metallurgy has been used for construction of boiler and it's piping
- Traveling grate is installed for continuous disposal of ash from the furnace
- Electrostatic precipitator (ESP) is installed in the boiler to limit the stack emission below 150mg/NM^3
- The 130 TPH boiler was the biggest bagasse fired boiler operating in India at the time of project implementation

(ii) Other Barriers

TGSML had to overcome the managerial resource barrier because of lack of trained manpower to operate the cogen plant, considering handling of electronic based distributed control system (DCS) which required personnel with very good knowledge in instrumentation and electronics and relevant experience in trouble shooting. As IDBI insisted that qualified and well trained technical personnel should operate the cogen plant, and also as training people on the cogen plant was a challenge, TGSML placed the contract for operation and maintenance (O&M) of the project with M/s Desein Engineering, their Project Consultants

TGSML for long (around 32 years) have been involved in business of sugar production and rural economics and therefore had to overcome barriers in order to deal with the economics of electricity generation, distribution and dealing with power sector economics. The PPA related concerns are quite significant to justify that the project is still having several barriers during operation.

PPA related concerns

TGMSL signed the PPA with the then Karnataka Electricity Board (KEB) in October 1999, during which KEB agreed to pay a tariff as per MNES guidelines of Rs. 2.8 per unit (calculated from year 1994 – 95 as the base year) with escalation of 5% p.a. as per which the current tariff should be Rs 4.02/ kWh. Despite this fact, TGSML is still getting a tariff of Rs.2.8 only and the matter is currently in the high court.

When KEB transformed to KPTCL all the assets and liabilities were transferred to KPTCL and later on in the reformation process, KPTCL became only the transmission company, and the distribution of power shifted to the Electricity Supply Company (ESCOM). TGSML falls under the Hubli Electricity Supply Company (HESCOM) as per geographical location. The payment for sale of power was earlier being received from KPTCL but now it is from HESCOM. All the ESCOMS fall under the Umbrella of the Karnataka State Government even though all are separate companies under the Companies Act. Till date TGSML has a current outstanding with HESCOM of Rs 20, 88,40,060 since the payment for sale of power is due since September 2005 (for the base rate of Rs. 2.80/ kWh)

As seen above, TGSML's cash flows from sale of power are dependent entirely on the economic situation of the state electricity boards. TGSML had to take this risk and face this institutional barrier on which they have limited or no control and therefore CDM funds are very critical to TGSML.

Barriers discussed above are strong enough to hinder growth of the sector and therefore the project activity is additional as it has over come the above barriers by taking up risk of implementing power project.

The data on the 'Common Practice Analysis' (discussed below) of the bagasse-based cogeneration suggests that the barriers discussed are strong enough to hinder growth of the sector.

(iii) Investment barriers

It is costly to implement high pressure configuration cogeneration projects as compared to conventional low pressure or medium- pressure cogeneration plants and that's the reason why most of the sugar plants in the state as well as the country use low to medium pressure configuration.

TGSML faced investment barriers and in particular from high upfront cost and it was difficult to convince financial institutions/ bank in order to obtain financial closure for the project. As TGSML had been only into sugar production business for about 29 years (at the time of project implementation) with no background in power sector economics (with respect to sale of power), financial support from bank was a difficult proposition.

The major equipments of cogeneration are the high pressure boilers, turbines and electrostatic precipitator (ESP), which were eligible for 100% depreciation under the Income Tax Act and therefore the company (TGSML) wanted to partly finance by means of lease finance. Initially TGSML approached their lead bankers but did not get favourable response. Thereafter TGSML approached Industrial Development Bank of India (IDBI), State Bank of India (SBI) and Andhra Bank and, after convincing the banks TGSML invested in the project activity i.e. a high efficiency renewable energy project. SBI first sanctioned a lease finance of 17.5 Crores but due to technical reasons, after appraisal they sanctioned a term loan of 15 Crores only.

Term lenders for the cogen project also expressed to have exclusive charges on Sugar Assets in addition to the first charge of Cogen Asset, after which the company had detailed negotiation with sugar lenders and cogen lenders to dilute the sugar assets from exclusive charges to *parri passu*[6] charges. After 8 to 9 months it was finally negotiated. The completion of the project was also delayed by 18 months as the company had to approach cogen lenders from time to time for deferring the last drawal of disbursement. Till date the cogen lenders are yet to disburse about Rs 5.99 Crores for the project.

As a part of project finance, under the GHG Pollution Prevention project, TGSML received a grant of Rs 378.54 lacs from the United States Agency for Industrial Development (USAID) for the Co-Generation project activity.

It can be concluded that TGSML has faced significant barriers during investment stage. Further, considering a lot of uncertainty associated with the CDM transaction (at the time of project

[6] *Parri Passu*: 'Means on a like footing, or where everyone is to be treated equally. For example, on distribution of net profits everyone will receive an equal amount despite the value of their contribution. Co-generation lenders are secured by First Charge on Co-generation Assets and Power Receivables. Further TGSML has given security of First Parri Passu Charge along with Sugar Consortium bankers on the Fixed Assets of Sugar Unit at Sameerwadi. Thus, Co-generation lenders also have First Parri Passu Charge on Sugar Assets i.e. in case anything goes wrong, then the Co-generation lenders will have proportionate share on the Sugar Assets based on the outstanding of Sugar lenders and Co-generation lenders

implementation in 2002) and the then market rate of CER, the project can not sustain or wholly depend on CDM. In this scenario availability of CDM funds will surely help to improve the financial viability of the project and would therefore improve the return on investment.

Despite lot of uncertainties associated with CDM, TGSML took a pro-active approach by having confidence in the system (Kyoto Protocol/CDM) since long, and investing in the transaction cost such as preparing related project documents in order to fulfil CDM requirements.

(iv) Additionality test for Regulatory/Legal requirements

It is not mandatory for TGSML to undertake the project activity. The above tests and analysis suggests that the project activity is additional and the anthropogenic emissions of GHG by sources will be reduced below those that would have occurred in the absence of the registered CDM project activity. The project activity is estimated to reduce **418,451** tons of CO_2 in the proposed 7-year crediting period.

Sub-step (3b). Show that the identified barriers would not prevent a wide spread implementation of at least one of the alternatives (except the project activity already considered in step 3a):

Since the barriers mentioned above are directly related to venturing into the business of export of power to grid (sale of electricity) there are no impediments for sugar manufacturing plants and also TGSML to implement any of these alternatives.

Additionally, these barriers do not exist for the alternatives/ options discussed above and thus do not prevent the wide spread implementation of these alternatives.

B.3.3 Common Practice Analysis (Step 4)

From Steps 1 and 3 it can be concluded that the option/ alternative (combination of power generation, steam generation and biomass use), described in section 3.2 does not have hurdles or barriers, which prevent their implementation. However, the project activity faces managerial, institutional and investment barriers, which could prevent TGSML from implementing it as already elaborated in the 'Barrier Analysis'.

The common practice scenario as tabulated below in **Table 2.1** substantiates that the project activity without CDM benefits is not a preferred proposition for the sugar manufacturing units in similar socio-economic environment of Karnataka State. The old boiler and turbine configuration (which meets the plant's energy requirements with no surplus power generation) is the most common practice adopted by the sugar- manufacturing units across the country. The Indian sugar manufacturers have been utilising their bagasse in an inefficient manner by using low-pressure boiler (with low electrical and thermal energy efficiency) to generate steam and electricity only for in-house consumption.

In similar project sector, socio-economic environment, geographic conditions and technological circumstances, the project activity uses an efficient technology, which is not a common practice

Table 2.1: Common Practice Analysis for TGSML project activity

Total number of Sugar Mills in Karnataka (as on Dec 2004)	*46*
Cooperative Sugar Mills	*21*
Sugar Mills under private sector	*22*
Sugar Mills under joint sector	*3*
Sugar Mills with co-generation and export of power to grid (as on December 2004)	*10*
Sugar Mills with similar or better configuration as of TGSML at the time of implementation (April 2002) in State	*3*
Karnataka Renewable Energy Development Limited (KREDL)	

Before the project activity was implemented there were only three[7] sugar mills in the state of Karnataka out of 33 sugar mills, operating with grid connected cogeneration unit of high-pressure configuration of 65 kg/cm^2 (equivalent configuration as of proposed project). This shows a very low penetration of technology (12.1% in Karnataka) and justifies that the project activity is additional.

B.3.4 Impact of CDM registration (Step 5)

The benefits and incentives expected due to approval and registration of the project activity as a CDM activity will certainly improve the sustainability of the project activity and thus its consideration before implementation has helped to overcome the identified barriers (Step 3), which enabled the project activity to be undertaken.

Before implementation of the project activity TGSML considered all the barriers discussed above. Each of them especially investment and institutional barriers and the technological barriers could result in project failure resulting in huge financial losses. TGSML's management discussed various aspects of project activity implementation and finally, TGSML's management took the decision of taking the investment risks and secure the finance partially from bank funding and partially through internal accruals so as to invest in the CDM project activity after computing the proposed carbon financing.

The corporate decision to invest in:

1. Overcoming the barriers facing project implementation and operation
2. CDM project activity through equity

[7] In Karnataka State, prior to TGSML only Shamanur Sugars (1999), Bannari Amman Sugars (March 2000) and Shree Prabulingeshwara Sugars (Dec 2000) have used a high pressure configuration of 65 Kg/cm^2

3. Additional transaction costs such as preparing documents, supporting CDM initiatives and developing and maintaining M&V protocol to fulfill CDM requirements

was, guided by the anthropogenic greenhouse gas emission reductions the project activity would result in and its associated carbon financing the project activity would receive through sale of CERs, under the CDM.

It is ascertained that the project activity would not have occurred in the absence of the CDM simply because no sufficient financial, policy, or other incentives exist locally to foster its development in India and without the proposed carbon financing for the project the TGSML would not have taken the investment risks in order to implement the project activity. Further CDM fund will provide additional coverage to the risk due to failure of project activity, shut down of plant and loss of production. In such an event the BAU baseline option is continued with release of carbon dioxide emissions.

Further with CDM project activity registration, many more sugar manufacturing industries in India would take up similar initiatives under CDM by overcoming the barriers to project activity implementation resulting in higher quantum of anthropogenic greenhouse gas emissions reductions.

B.4. Description of how the definition of the project boundary related to the baseline methodology selected is applied to the project activity:

For the project activity the project boundary encompasses the power plant at the project site, transportation of biomass by means of vehicles from offsite to project site, and all the power plants physically connected to the state grid to which the project activity exports power. The project boundary covers fuel storage and processing, boiler STG and all other power generating equipments, captive consumption units and steam consuming equipments, since along with the use of low-pressure extraction steam for the process, part of the electricity generated will be used for auxiliary consumption.

Further, upstream emissions should be placed within the project boundary when the project developer can significantly influence these emissions. In principle this could mean that the bagasse source should be included within the system boundaries. TGSML's mill-generated bagasse satisfies most of the fuel requirement of the cogeneration plant (project activity, old boiler), but under certain circumstances the project activity may have to use purchased biomass/ bagasse/ or coal (fossil fuel) to satisfy additional fuel requirement. In order to calculate GHG emissions from project activity, emission sources included within the project boundary are:

- CO_2 emissions from on-site fuel combustion of fossil fuels co-fired in the cogeneration plant (project activity)
- CO_2 emissions from off-site transportation of biomass that is combusted in the project plant
- CH_4 emissions from combustion of biomass

For determining the baseline emissions, the emission sources included are:

- CO_2 emissions from fossil fuel fired power plants connected to the electricity system:

The spatial extent of the project electricity system including calculation of build margin (BM) and operating margin (OM) has been adopted from the consolidated methodology ACM0002,version 6, 19/05/2006.

The quantity of electricity required for the operation of the power plant shall subtracted while determining the net electricity generation for the project

As provided in the methodology, the transmission and distribution (T&D) losses in the electricity grid are neglected as it is not significantly affected by the project activity

Flow chart and project boundary is illustrated in the following diagram shown below:

B.5. Details of baseline information, including the date of completion of the baseline study and the name of person (s)/entity (ies) determining the baseline:

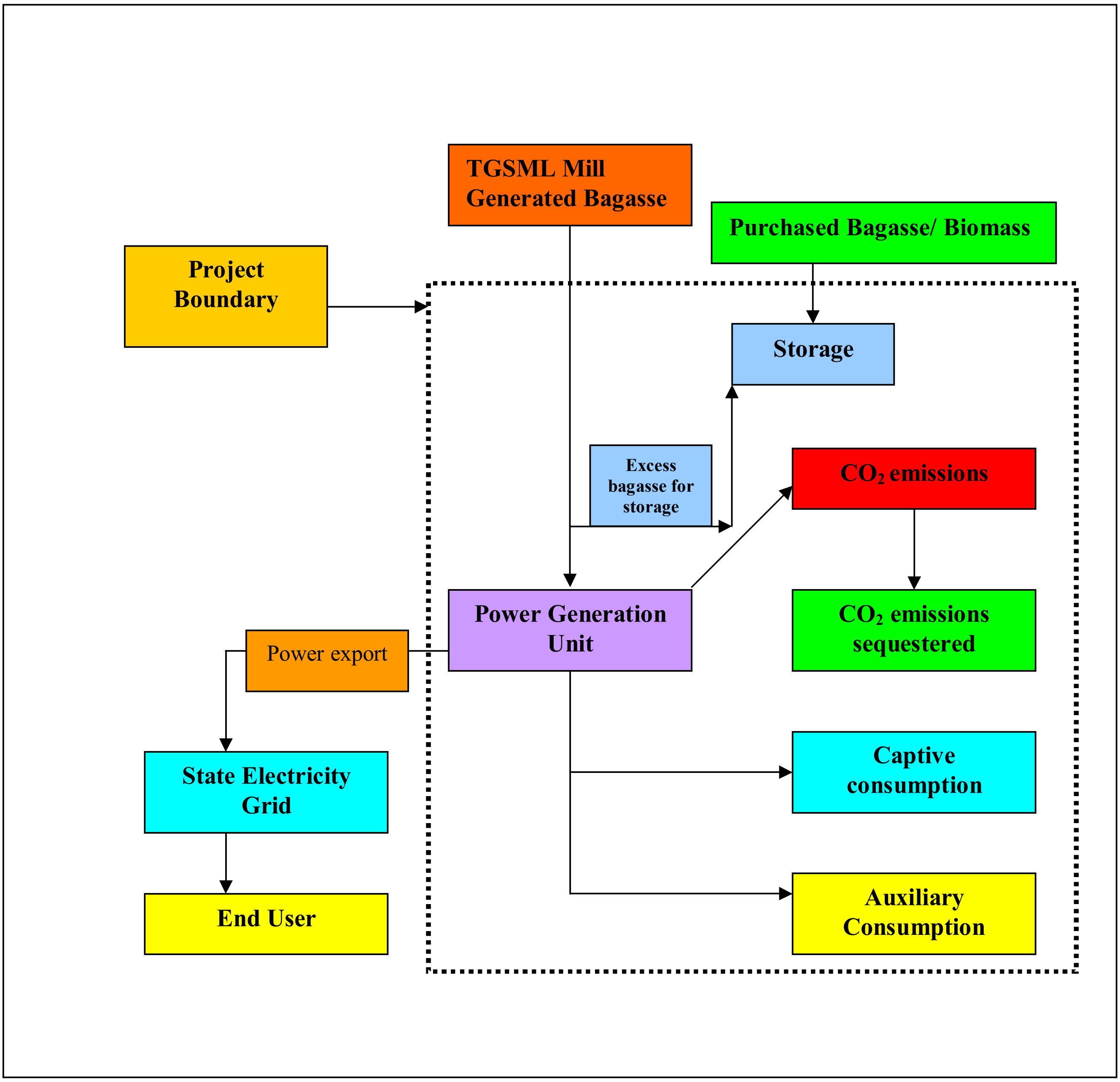
>>\` ***B.5.1 Date of completing the final draft of this baseline section:***

05 December, 2006

B.5.2 Name of person/entity determining the baseline:

The Godavari Sugar Mills Limited (TGSML), a project participant listed in Annex 1 of this document and their associated experts.

The associated experts are not the project participants.


TGSML Mill Generated Bagasse
Purchased Bagasse/ Biomass
Project Boundary
Storage
Excess bagasse for storage
CO_2 emissions
Power Generation Unit
CO_2 emissions sequestered
Power export
State Electricity Grid
Captive consumption
Auxiliary Consumption
End User

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:

>> The construction start date of the project activity is 01/05/ 2000

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

>> Life time of the project : 25 years, 0 months

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

For the proposed project, the preferred credit period opted is for 7 years renewed twice i.e. 21 years.

C.2.1. Renewable crediting period

>>
Renewable crediting period

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

>> 12/04/02

C.2.1.2. Length of the first crediting period:

>>
7 years 0 months.

SECTION D. Application of a monitoring methodology and plan

D.1. Name and reference of approved monitoring methodology applied to the project activity:

>> Title: Consolidated monitoring methodology (ACM0006,version 3, 19/05/), for grid-connected electricity generation from biomass residues.

Reference:

AM0004: Grid-connected Biomass Power-Generation that avoids uncontrolled burning of biomass

AM0015: Bagasse-based cogeneration connected to an electricity grid

NM0050: Ratchasima SPP Expansion Project in Thailand

NM0081: Trupán biomass cogeneration project in Chile

NM0098: Nobrecel Fossil-to-Biomass Fuel Switch Project in Brazil

This methodology is used in conjunction with the approved consolidated baseline methodology ACM0006,version 3,19/05/2006 (Consolidated baseline methodology for grid connected electricity generation from biomass residues)

The methodology also refers to ACM0002,version 6,19/05/2006 ("Consolidated baseline methodology for grid connected electricity generation from renewable sources")

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

>> The project activity is bagasse (biomass) based renewable energy power project, which feeds surplus electricity (power) to the KPTCL grid (comprising power generated through sources such as coal and gas based thermal power, hydro power and renewable energy sources including small/micro hydro projects, bagasse/biomass based cogeneration/power projects *etc).* The selected methodology available on the UNFCCC web site is applicable to "grid connected and biomass-residue fired electricity generation from biomass residues" and is the most suitable approved UNFCCC methodology available for the project activity.

D.2.1. Option 1: Monitoring of the emissions in the project scenario and the baseline scenario

D.2.1.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
1. BFi,,y	Quantity of biomass type i combusted in the project plant during the year y	TGSML	mass or volume unit	m	Continuously, prepare annually an energy balance	100%	Electronic and Paper	The quantity of biomass combusted should be collected separately for all types of biomass. Monitoring of this parameter for project emissions is required as biomass is transported to the project site and corresponding CO2 emissions are calculated
2. NCV_i	Net calorific value of biomass type I	TGSML	MWh/mass or volume	m	Annually	Sample	Paper	The NCV should be based on measurements or reliable local and national data
3. AVDy	Average return trip distance between biomass fuel supply sites and the project site	TGSML	km	m	Continuously	100%	Paper	If biomass is supplied from different sites, this parameter should correspond to the mean value of km travelled by trucks that supply the biomass plant.

ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
4. TLy	Average truck load of the trucks used for transportation of biomass	TGSML	mass unit or volume unit	m	Regularly	Once in 3 months	Paper	Project participants have to monitor this Parameter to calculate number of truck trips
5. $EF_{km, CO2}$	Average CO2 emission factor for transportation of biomass with trucks	IPCC	t CO2/km	c	Annually	Once a year	Paper	Local or national data should be preferred. Default values from the IPCC may be used alternatively and should be chosen in a conservative manner.
6. $F_{Trans,i,y}$	Fuel consumption of fuel type i used for transportation of biomass	TGSML	mass or volume unit	m	Continuously	100%	Paper	-
7. $FF_{project\ plant\ i,y}$	Onsite fossil fuel type 'i' for co-firing in the project plant	TGSML	Mass or volume unit	M	Continuously	100%	electronic	-
8. $COEF_{CO2,\ i}$	CO2 emission factor for fuel type I	IPCC	tCO2/mass or volume unit	m or c	Annually	100%	electronic	Local values / IPCC Guidelines/Good Practice

D.2.1.2. Description of formulae used to estimate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

>>With reference to the ACM0006,version 3,19/05/2006, for project emissions following two cases are considered.

1. CO_2 emissions from transportation of biomass to the project site.
3. CO_2 emissions from onsite consumption of fossil fuels due to the project activity.

It is required to account CO2 emissions from the combustion of any fossil fuels (if used) due to the project activity. For scenario 16 the CO2 emissions are calculated as follows:
(1) Carbon dioxide emissions from combustion of fossil fuels for transportation of biomass to the project plant (*PET_y*)

The CO_2 emissions resulting from transportation of the biomass to the project plant site by vehicles (trucks) from the nearby villages is calculated. As per the given methodology, Option 1 based on distance and vehicle type has been selected to calculate the CO2 emissions as given in the following equation:

$$PET_y = \frac{\sum BF_{i,y}}{TL_y} \times AVD_y \times EF_{Km,CO2}$$

Where:
$BF_{i,y}$ is the quantity of biomass type *i* used as fuel in the project plant during the year *y* in a volume or mass unit,
TL_y is the average truck load of the trucks used measured in tons or volume of biomass,
AVD_y is the average return trip distance between the biomass fuel supply sites and the site of the project plant in kilometers (km),
$EF_{km,CO2}$ is the average CO_2 emission factor for the trucks measured in t CO_2/km, and

(2) Carbon dioxide emissions from on-site consumption of fossil fuels (*$PEFF_y$*)

The project activity co-fires fossil fuels such as coal during off-season to a limited extent, considering the non-availability of bagasse during drought. CO_2 emissions resulting from the combustion of fossil fuels is calculated as per the equation provided below:

$$PEFF_y = \sum FF_{project\ plant,i,y}\ x\ COEF_{CO2,i}$$

where,

$PEFF_y$ - Is the project emissions from fossil fuel co-firing during the year *y* in tons of CO_2,

$FF_{project\ plant\ i,y}$ - Is the quantity of fossil fuel type i combusted in the biomass power plant during the year *y*,

$COEF_{CO2,i}$ - Is the CO_2 emission factor of the fossil fuel type i.

D.2.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHGs within the project boundary and how such data will be collected and archived:								
ID number	**Data variable**	**Source of data**	**Data unit**	**Measured (m), calculated (c), estimated (e),**	**Recording Frequency**	**Proportion of data to be monitored**	**How will the data be archived? (electronic/ paper)**	**Comment**
1.$EG_{project\ plant,y}$	Net quantity of electricity generated in the project power plant during the year y	TGSML	MWh	m	Continuously	100%	Electronic	This data is required to be monitored to calculate net quantity of increased electricity generation as a result of the project activity
2.$EG_{total,,y}$	Total quantity of electricity generated at the project site (including project plant and any other plant) during the year y	TGSML	MWh	m	Continuously	100%	Electronic	This data is required to be monitored to calculate net quantity of increased electricity generation as a result of the project activity
3. $EF_{electricity,,\ y}$	CO_2 emission factor of the grid	TGSML/ Southern regional grid	tCO_2/ MWh	c	Yearly	100%	Paper	Reference to ACM0002, version 6, 19/05/2006. Calculated as weighted sum of OM and BM emission factors

ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording Frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
4. $EF_{OM,y}$	CO2 operating margin emission factor of the grid	-	t CO_2/ MWh	c	Yearly	100%	Paper	Reference to ACM0002, version 6, 19/05/2006 Calculated as indicated in the relevant OM baseline method above
5. $EF_{BM,y}$	CO2 build margin emission factor of the grid	-	t CO_2/ MWh	c	Yearly	100%	Paper	Reference to ACM0002, version 6, 19/05/2006 Calculated over recently built power plants defined in the baseline methodology
6. Fi,j,y	Amount of fossil fuel i, consumed by each power source/ plant j in year y	Regional grid	Tons	M	Yearly	100%	Paper	Reference to ACM0002, version 6, 19/05/2006 Obtained from power producers, dispatch centres or latest local statistics
7. COEFi,	CO2 emission factor of each fuel type i,	KPTCL	tCO2 / ton of fuel	M	Yearly	100%	Paper	Reference to ACM0002, version 6, 19/05/2006 Plant or country specific values to calculate COEF are preferred to IPCC default values
8. GENj/k/n,,y	Electricity generation of each power source / plant j, k or n	KPTCL	MWh/ annum	M	Yearly	100%	Paper	Reference to ACM0002 version 6, 19/05/2006 Obtained from power producers, dispatch centres or latest local statistics
k6. $BF_{BM,y}$	Quantity of biomass type i, combusted in the project plant during the year y	TGSML	Mass or volume unit	M	Continuously prepare annually an energy balance	100%	Paper	The quantity of biomass combusted should be collected separately for all types of biomass

ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording Frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
7. NCVi	Net calorific value of biomass or fossil fuel type I	TGSML	MWh/ mass or volume unit	M	Yearly	Sample	Paper	The net calorific value should be determined separately for all types of biomass residues
8. Plant name	Identification of power source / plant for the OM	Regional grid	-	e	yearly	100% of set of plants	electronic	Reference: ACM0002, version 6, 19/05/2006. Identification of plants (j, k, or n) to calculate Operating Margin emission factors
9. Plant name	Identification of power source / plant for the BM	Regional grid	-	e	yearly	100% of set of plants	electronic	Reference: ACM0002, version 6, 19/05/2006 Identification of plants (m) to calculate Build Margin emission Factors
10. GENj/k/ll,y IMPORTS	Electricity imports to the project electricity system	Regional grid	kWh	c	yearly	100%	electronic	Obtained from the latest local statistics.
11. COEFi,j y IMPORTS	CO2 emission coefficient of fuels used in connected electricity systems (if imports occur)	Regional grid	tCO2 / mass or volume unit	c	yearly	100%	electronic	Obtained from the latest local statistics. If local statistics are not available, IPCC default values are used to calculate.

ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording Frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
12. EG historic, 3yr	Net quantity of electricity generated during the most recent three years in all power plants at the project site, generated from firing the same type (s) of biomass as in the project plant	TGSML	MWh	m	Continiously	100%	Electronic	This data is required to be monitored to calculate net quantity of increased electricity generation as a result of the project activity

D.2.1.4. Description of formulae used to estimate baseline emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equivalent.)

>>**ACM0006 version 3, 19/05/2006 refers to calculation of baseline emission factor using ACM0002 version 6, 19/05/2006 ("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 plants and by the addition of new generation sources, in the absence of the project activity.

Step 1: Calculation of electricity baseline emission factor
As the power generation capacity of the biomass power plant is of more than 15 MW, $EF_{electricity,y}$ should be calculated as a combined margin (CM), following the guidance in the section "Baselines" in the "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (ACM0002, **version 6, 19/05/2006).**

Step 1.1. Calculate the Operating Margin emission factor(s) ($EF_{OM,y}$) – Out of four methods mentioned in the ACM0002, **version 6, 19/05/2006**, Simple OM approach has been chosen for calculations since in the Southern regional grid mix, the low-cost/must run resources constitute less than 50% of total grid generation. Simple OM factor is calculated as under.

$$EF_{OM,Simple,y} = \sum_{i,j} F_{i,j,y} \, x \, COEF_{i,j} / \sum_{j} GEN_{j,y}$$

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 imports from 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, and
$GEN_{j,y}$	- Is the electricity (MWh) delivered to the grid by source *j*

The CO_2 emission coefficient $COEF_i$ is obtained as

$$COEF_i = NCV_{i,}\ x\ EF_{CO2} xOXIDi$$

For calculations, local values of NCV_i and $EF_{CO2,i}$ have been used and a 3-year average, based on the most recent statistics available at the time of PDD submission has been used for grid power generation data.

STEP 1.2. Calculate the Build Margin emission factor (*$EF_{BM,y}$*) as the generation-weighted average emission factor (tCO_2/MWh) of a sample of power plants *m* of Southern regional grid, as follows:

$$EF_{BM,y} = \sum_{i,m} F_{i,m,y}\ x\ COEF_{i,m} / \sum_{j} GEN_{m,y}$$

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*.

Considered calculations for the Build Margin emission factor $EF_{BM,y}$ as *ex ante* based on the most recent information available on plants already built for sample group *m* of southern regional grid at the time of PDD submission. The sample group *m* consists of,
 The five power plants that have been built most recently, since it comprises of larger annual power generation.

Further, power plant capacity additions registered as CDM project activities have been excluded from the sample group *m* of Southern regional grid mix.

STEP 1.3. Calculate the electricity baseline emission factor *$EF_{electricity,y}$* as the weighted average of the Operating Margin emission factor ($EF_{OM,y}$) and the Build Margin emission factor ($EF_{BM,y}$):

Baseline emissions due to displacement of heat

In case of scenario 16, baseline emissions are calculated my multiplying the savings of fossil fuels with the emission factor of these fuels. This is not applicable to the project activity as in baseline scenario (H4) heat was being generated in boilers using biomass residues only.

Baseline emissions due to natural decay or uncontrolled burning of anthropogenic sources of biomass

In the absence of the project activity, a part of biomass of about < 1% would have been stored openly onsite for use (start up operations) during season, which sometimes results in burning of bagasse in an uncontrolled manner due to the storage area being unattended to (e.g ignition from remote sources). To account for the associated emissions from methane, the methodology assumes that the biomass would have been burned in an uncontrolled manner for both baseline scenarios (natural decay and uncontrolled burning). Thus, for scenario 16,

$$BE_{Biomass,y} = GWP_{CH4} * \sum_i BF_{i,notused,y} * NCV_i * EF_{burning,CH4,i}$$

where:

$BE_{Biomass,y}$	are the baseline emissions due to natural decay or burning of anthropogenic sources of biomass during the year y in tons of CO_2 equivalents,
GWP_{CH4}	is the Global Warming Potential for methane valid for the relevant commitment period,
$BF_{i,not\ used,y}$	is the quantity of biomass type i used as fuel in the project plant during the year y which would in the absence of the project activity not used, i.e. be dumped, left to decay or burned in an uncontrolled manner without utilizing it for energy purposes in a volume or mass unit,
NCV_i	is the net calorific value of the biomass type i in terajoules (TJ) per mass or volume of biomass,
$EF_{burning,CH4,I}$	is the CH_4 emission factor for uncontrolled burning of the biomass type i in tons CH_4 per MWh. The default CH4 emission factor of 219 kg/TJ is used as specified in the methodology

D. 2.2. Option 2: Direct monitoring of emission reductions from the project activity (values should be consistent with those in section E).

Not applicable

D.2.2.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:								
ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

Not applicable

D.2.2.2. Description of formulae used to calculate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equivalent.):

Not applicable

ID number	Data Type	Data Variable	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Comment
BF i, not used,y	Mass or Volume	Quantity of biomass type i used as fuel in the project plant during the year y, which would in absence of the project activity not used, i.e. be dumped, left to decay or burned in an uncontrolled manner without utilizing it for energy purposes	Mass or volume	m	Annually	
COEF co2,j	Emission Factor	CO2 emission factor of the most carbon intensive fuel in the calculation of the combined margin with methodology ACM0002, version 6, 19/05/2006	Volume or mass unit	M or c	Annually	Measured or local /national data should be preferred. Default values from the IPCC may be used alternatively.

D.2.3.2. Description of formulae used to estimate leakage (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

The main potential source of leakage for this project activity is the increase in emissions from fossil fuel combustion due to diversion of biomass from other uses to the project plant as a result of project activity. In the project activity, very small portion (2-3%) of bagasse being sold to the paper and cardboard industries for use as feedstock or raw material is being diverted to the project plant. To account for this leakage, for a certain type of biomass *i* used in the project activity, leakage effect for the year *y* shall be calculated as follows:

$$L_y = COEF_{CO2,j} * \sum_i BF_{i,notused,y} * NCV_i$$

where:

L_y	are the leakage emissions during the year y in tons of CO_2,
$COEF_{CO2,j}$	is the CO_2 emission coefficient (per an energy unit) of the most carbon intensive fuel used in the country,
$BF_{i,y}$	is the quantity of biomass type *i* used as fuel in the project plant during the year *y* in a volume or mass unit,
$BF_{i,not\ used,y}$	is the quantity of biomass type i used as fuel in the project plant during the year y which would in the absence of the project activity not used, i.e. be dumped, left to decay or burned in an uncontrolled manner without utilizing it for energy purposes in a volume or mass unit,
i	are the types of biomass for which leakage effects could not be ruled out with one of the approaches L_1, L_2 or L_3 above,
NCV_i	is the net calorific value of the biomass type i (per volume or mass).
$Q_{project\ plant,y}$	is the net quantity of heat generated in the cogeneration project plant from firing biomass residues during the year *y* in MWh,
ε_{boiler}	is the energy efficiency of the boiler that would be used in the absence of the project activity,

D.2.4. Description of formulae used to estimate emission reductions for the project activity (for each gas, source, formulae/ algorithm, emissions units of CO_2 equ.)

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 emission reductions through substitution of electricity generation with fossil fuels ($ER_{electricity,y}$), project emissions (PE_y), emissions due to leakage (L_y) and, where this emission source is included in the project boundary and relevant, baseline emissions due to the natural decay or burning of anthropogenic sources of biomass ($BE_{biomass,y}$), as follows:

$$ER_y = ER_{electricity,y} + BE_{biomass,y} + PE_y - L_y$$

where:

ER_y	are the emissions reductions of the project activity during the year y in tons of CO_2,
$ER_{electricity,y}$	are the emission reductions due to displacement of electricity during the year y in tons of CO_2,
$BE_{biomass,y}$	are the baseline emissions due to natural decay or burning of anthropogenic sources of biomass during the year y in tons of CO_2 equivalents,
PE_y	are the project emissions during the year y in tons of CO_2, and
L_y	are the leakage emissions during the year y in tons of CO_2.

Emission reductions from displacement of electricity

$$ER_{electricity,y} = EF_{electricity,y} \ x \ EG_y$$

where

$ER_{electricity,y}$	- Are the emission reductions due to displacement of electricity during the year y in tons of CO_2
EG_y	- Is the net quantity of increased electricity generation due to the project activity during the year y in MWh,
$EF_{electricity,y}$	- Is the CO_2 baseline emission factor for the electricity displaced due to the project activity in during the year y in tons CO_2/MWh.

For this methodology, it is assumed that transmission and distribution losses in the electricity grid are not influenced significantly by the project activity. They are therefore neglected.

Determination of EGy

Where scenario 16 applies, EG_y corresponds to the lower value between (a) the net quantity of electricity generated in the new power unit that is installed as part of the project activity and (b) the difference between the total net electricity generation from firing the same type(s) of biomass at the project site ($EG_{total,y}$) and the historical generation of the existing power unit(s), ($EG_{historic,\ 3yr}$) based on the three most recent years, as follows:

$$EG_y = MIN\left\{ \begin{array}{l} EG_{projectplant,y,} \\ \left(EG_{total,y} - \frac{EG_{historic,3yr}}{3} \right) \end{array} \right\}$$

Where:

- EG_y is the net quantity of increased electricity generation as a result of the project activity (incremental to baseline generation) during the year y in MWh,
- $EG_{total,y}$ is the net quantity of electricity generated in all power units fired with the same type of biomass at the project site, including the new power unit installed as part of the project activity and any previously existing units, during the year y in MWh,
- $EG_{historic,3yr}$ is the net quantity of electricity generated during the most recent three years in all power plants fired with the same type of biomass at the project in MWh,
- $EG_{project\ plant,y}$ is the net quantity of electricity generated in the project plant during the year y in MWh,.

D.3. Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored

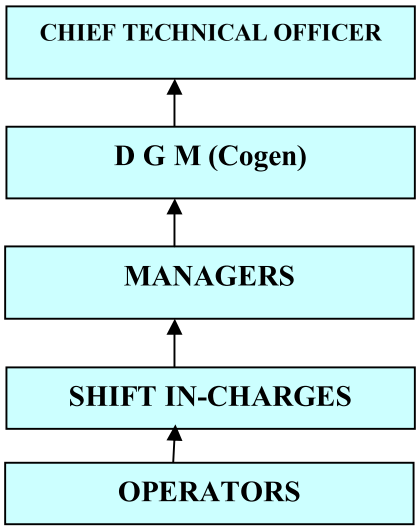
Data	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
2.1.1(1)	Low	Any direct measurements with mass or volume meters at the plant site should be cross-checked with an annual energy balance that is based on purchased quantities and stock changes
2.1.1(2)	Low	Check consistency of measurements and local / national data with default values by the IPCC. If the values differ significantly from IPCC default values, possibly collect additional information or conduct measurements.
2.1.1.(3)	Low	Check consistency of distance records provided by the truckers by comparing recorded distances with other information from other sources (e.g. maps).
2.1.1.(4)	Low	No QA/QC procedures are planned for this data
2.1.1(5,8)	Low	Check consistency of measurements and local / national data with default values by the IPCC. If the values differ significantly from IPCC default values, possibly collect additional information or conduct measurements.
2.1.1(6)	Low	If project participants determine CO2 emissions from transportation based on fuel consumption, this estimate should be cross-checked with a simple calculation based on the distance approach.

2.1.1(7)	Low	The consistency of metered fuel consumption quantities should be checked with purchase receipts.
2.1.3(1)	Low	The consistency of metered net electricity generation should be cross-checked with receipts from sales (if available) and the quantity of biomass fired (e.g. check whether the electricity generation divided by the quantity of biomass fired results in a reasonable efficiency that is comparable to previous years)
2.1.3(2)	Low	The consistency of metered net electricity generation should be cross-checked with plant consumption, receipts from sales (if available) and the quantity of biomass fired
2.1.3(3-5,8-11)	Low	Default data (for emission factors) and IEA statistics (for energy data) are used to check the local data.
2.1.3(6)	Low	The consistency of metered fuel consumption quantities should be checked with purchase receipts.
2.1.3(7)	Low	Check consistency of measurements and local / national data with default values by the IPCC. If the values differ significantly from IPCC default values, possibly collect additional information or conduct measurements.

D.4 Please describe the operational and management structure that the project operator will implement in order to monitor emission reductions and any leakage effects, generated by the project activity

D.4 Please describe the operational and management structure that the project operator will implement in order to monitor emission reductions and any leakage effects, generated by the project activity

>> Overall authority and responsibility lies with Executive Director of the TGSML. He is authorised to take decisions pertaining to registration and all related activities. He also reviews the project on periodic basis and monitors the data related to plant performance as well as coordinates with plant personnel as and when required. TGSML also has implemented a well defined operational and management structure in order to monitor emission reductions and any leakage effects, generated by the project activity. Although most of the monitored parameters required for the financial reports of the TGSML, like total power generated, total export to the grid etc, for the adequate monitoring of the emission reduction TGSML proposes the following structure of monitoring and reporting.



Roles and responsibility:

Chief Technical Officer: CTO will have the following responsibilities

- Decision on the contents of the CDM training program
- Ensuring implementation of monitoring procedures
- Internal audit and project conformance reviews

Deputy General Manager: DGM will have the following responsibilities

- Organizing and conducting training programs,
- Implementing all monitoring control procedures
- Associating with the Managers towards maintenance and calibration of monitoring equipments
- Has the overall responsibility for record handling and maintenance.

- Reviewing of records and dealing with monitored data
- Organizing internal audit for checking the data recorded
- Has the overall responsibility for closing project non-conformances and implementing corrective actions before the verification
- Managers: Manager will have the following responsibilities
- Associate with DGM in organizing and conducting training programs,
- Associate with DGM in Implementing all monitoring control procedures
- Associating with the DGM towards maintenance and calibration of monitoring equipments

Shift in change (Electrical officer): This officer will have the following responsibilities:

- Supervising and training the operators and maintaining training records.
- Has the overall responsibility of monitoring measurements and reporting
- Will assist the Manager (Operations) in record handling, records checks and review and during internal audit
- Check the data recorded by the operator in the individual sections as described in Section D.3.

Operator: The responsibility of operator to record appropriate data of the project activity represented in the monitoring tables. Based on the monitoring frequency, the operator will measure and record the data in the logbook as per the instructions of his officer.

The operational procedures for training, emergency preparedness, maintenance and calibration of monitoring equipments, monitoring measurements and reporting, record handling and maintenance, reviewing monitored data, internal audit, project performance reviews and corrective actions are available at the plant.

D.5 Name of person/entity determining the monitoring methodology:

>> The Godavari Sugar Mills Limited (TGSML), a project participant listed in Annex 1 of this document and their associated experts

SECTION E. Estimation of GHG emissions by sources

E.1. Estimate of GHG emissions by sources:

TGSML's project activity uses its own sugar mill generated bagasse as main fuel for power generation apart from this purchased bagasse/ biomass would be used.

Coal may also be used as supplementary fuel during off-season period and in very extreme cases of drought especially when in-house bagasse as well as outside biomass is insufficient to meet the power requirement. The emissions from the project are primarily from:

- Co-firing of coal in the cogeneration plant
- Transportation of biomass/ bagasse/ or coal to the project site

Coal used in the project has been about 3260 tons and 53,941 tons during April 2004 to March 05 and April 05 to March 06 respectively. It is assumed that during 2006 to 2009, a maximum of about 5,000 tons of coal would be used. The CO2 emissions from coal firing are estimated to be **129,177** tons during the 7-year crediting period (2002-09).

Transportation activities contributing to GHG emissions include transportation of saved/ wasted/ un-utilized bagasse from the cooperative sugar mills of Maharashtra and Karnataka in situations of bagasse shortage which would quantify to about **8,130** tons of CO_2 emissions for the crediting period of 7 years. Detailed calculations are provided in Enclosure III. A conservative estimate has been made which doesn't take into account the expected efficiency improvement in transportation vehicles in next few years.

E.2. Estimated leakage:

Leakage due to diversion of biomass from previous use as feedstock for paper and cardboard industries is estimated as **14,273** tCO_2 during the 7 year period.

E.3. The sum of E.1 and E.2 representing the project activity emissions:

>> Net emissions from project activity is estimated to be **151,580** tCO2 for the crediting period of 7 years.

E.4. Estimated anthropogenic emissions by sources of greenhouse gases of the baseline:

Southern regional electricity grid is considered as electricity baseline for the project activity and the grid generation mix for baseline analysis and calculation of anthropogenic emissions by fossil fuels during power generation. In the Southern regional electricity grid generation mix, coal, lignite, naphtha, diesel and gas based power projects are responsible for GHG emissions. Estimation of baseline emissions has been carried out as per the approved consolidated baseline methodology (ACM0006,version 3, 19/05/2006). The Combined Margin (CM) approach, constituting of Operating Margin (OM) and Build

Margin (BM) has been used for estimation of electricity baseline emission factor as per ACM0002, version 6, 19/05/2006.

For calculation of OM factor, approach (b), i.e. simple OM has been chosen as in Southern regional electricity grid generation mix, low-cost/must run resources constitute less than 50% of total grid generation in average of the five most recent years. Simple OM factor is calculated using a 3-year average, based on the most recent statistics available at the time of PDD submission.

BM factor is calculated ex ante based on the most recent information available on plants already built for samples group m at the time of PDD submission. Based on the guidelines for selection (larger annual generation) of sample group m, it consists of the power plants capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

Formulae used for estimation of the anthropogenic emissions by sources of greenhouse gases of the baseline are mentioned in the section D.2.1.3.

In the baseline, the use or disposal of excess biomass before the project activity implementation has to be accounted for. As biomass was stored openly on-site, the methane emissions from decay and / or uncontrolled burning of biomass needs to be calculated as per the equation mentioned in section 2.1.4

E.5. Difference between E.4 and E.3 representing the emission reductions of the project activity:

>> Following formulae are used to determine Emission reductions from the project activity

$$ER_y = ER_{electricity,y} + BE_{biomass,y} - PE_y - L_y$$

$$ER_{electricity,y} = EF_{electricity,y} \; x \; EG_y$$

EGy, the increased net electricity generation due to the project activity is calculated as per equation in Section D.2.4.as **669,686** MWh.

ER_y = (**0.850** tCO2/MWh x **669,686** MWh) +**798** tCO2 – **137,307** tCO2 – **14,273** tCO2

= **418,451 tCO2 in 7 years**

E.6. Table providing values obtained when applying formulae above:

>> Using above formulae emission reductions have been calculated for 7 years of credit period and is tabulated as under.

Table E.6-1: Certified Emission Reductions

Year	Estimation of project activity emissions (tons of CO2e)	Estimation of baseline emissions (tons of CO2e)	Estimation of Leakage (tCO_2e)	Estimation of emission reductions (tones of CO2e)
2002-03	810	23,086	2,039	20,237
2003-04	3,063	96,338	2,039	91,236
2004-05	6,255	45,848	2,039	37,554
2005-06	96,638	101,190	2,039	2,513
2006-07	10,181	101,190	2,039	88,971
2007-08	10,181	101,190	2,039	88,971
2008-09	10,181	101,190	2,039	88,971
Total tons of CO2-e	137,307	570,031	14,273	418,451

SECTION F. Environmental impacts

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

>> Assessment of Environmental Impact due to the project activity is carried out. A separate EIA summary report is available as Enclosure – I.

F.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:

>> Host party regulations requires TGSML to obtain environmental clearance in the form of "No objection Certificate" from Karnataka Pollution Control Board. The other condition is that the site of the project is to be approved from the environmental angle and that the Environmental Management Plans are to be prepared and submitted to the pollution control board. Environmental Impact Assessment has been conducted for the project activity and the study indicates that the impacts of the project are not significant. The assessment of environmental impact due to the project activity has been carried out to understand if there are any significant environmental impacts and a management plan has been prepared to minimise adverse environmental impact

SECTION G. Stakeholders' comments

>>

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

>> **Identification of Stakeholders**

The stakeholders identified for the project are as under.

- Elected body of representatives administering the local area (village *Panchayat*)
- Sugarcane cultivators
- Biomass contractors
- Transporters of procured biomass
- Project Consultants

Stakeholders are involved in the project at various stages of the project.

TGSML invited stakeholder comments through written communications.

G.2. Summary of the comments received:

>> ***Stakeholders Involvement***

The village Panchayat /local elected body of representatives administering the local area have provided their consent / permission to set up the project as per the public hearing document. Hence TGSML has already completed the necessary consultation and documented their approval for the project.

The local farmers supply raw material *i.e.* sugar cane for sugar mills and biomass (if required) for cogen plant. In addition to this, locals also include local manpower working at the plant site. Since, the project has also provided good direct and indirect employment opportunities the local populace is encouraging the project.

The project did not require any major displacement of any local population. The project has been established within the sugar plant premises and therefore no new / additional land has been procured for the project. In addition, the local population is also an indirect consumer of the power that is supplied from the power plants. This is essentially because the power sold to the grid is expected to improve the stability in the local electricity network. Since, the distance between the electrical substation for power evacuation and the plant is not very high, installation of transmission lines has not created any inconvenience to the local population.

Stakeholder comments received from the Sameerwadi Sugarcane Cultivator Society indicates that the project activity has improved the power supply stability (see Enclosure II), provided local employment, and is environmentally friendly.

Comments were also received from the biomass contractor and transporters that the project has provided opportunities to them by way of procurement of biomass/ bagasse

It can be inferred that the project has therefore not caused any adverse social impacts on local population and has rather helped in improvising their quality of life.

For setting up the cogeneration facility a number of statutory and non-statutory clearances were required which are listed below:

The Government of Karnataka has accorded permission for establishing the cogeneration facility at Sameerwadi

Karnataka State Pollution Control Board (KSPCB) and Environment Department of Government of Karnataka have prescribed standards of environmental compliance and monitor the adherence to the standards. The project has received the No Objection Certificate (NOC) from KSPCB to Operate. The cogeneration project has received the consent to operate under the Section 21 of the Air (Prevention & Control of) Pollution Act 1981 and under the Section 25/26 of the Water (Prevention & Control of) Pollution Act 1974.

The water requirement of the project shall be met from the Ghataprabha River for which TGSML approached the Irrigation Department, Govt of Karnataka for allocating 97.7 million cubic feet (MCFT) of water per year for the sugar plant and cogeneration facility and obtained clearance for the same. Groundwater is also available in the bore wells and therefore there will be no scarcity of water in the surroundings due to the project.

TGSML has obtained ‘No objection certificate’ from the Airports Authority of India for the construction of a 70 m chimney (one for each boiler) for this cogeneration project.

Karnataka Renewable Energy Development Agency Limited (KREDL) is the one who implements policies in respect of non-conventional renewable power projects in the state of Karnataka. Further, State’s apex body of power is Karnataka Electricity Regulatory Commission (KERC) and they have already issued consent for the installation of co-generation power plant of 24 MW as per section 44 of the Indian Electricity Supply Act 1948.

As a buyer of the power, the KPTCL is a major stakeholder in the project. They hold the key to the commercial success of the project. KPTCL has cleared the project and TGSML has signed Power Purchase Agreement (PPA) with KPTCL.

The government of India, through Ministry of Non-conventional Energy Sources (MNES), has been promoting energy conservation, demand side management and viable renewable energy projects including wind, small hydro and bagasse cogeneration / bio-mass power.

Project consultants were involved in the project to take care of various pre contract and post contract project activities like preparation of Detailed Project Report (DPR), preparation of basic and detailed engineering documents, preparation of tender documents, selection of vendors / suppliers, supervision of project implementation, successful commissioning and trial runs.

Equipment suppliers have supplied the equipments as per the specifications finalized for the project and were responsible for successful erection and commissioning of the same at the site.

Stakeholders' Comments

TGSML has already received the major necessary approvals and consents from various authorities, required for project implementation like Karnataka Electricity Regulatory Commission, Karnataka Power Transmission Corporation Limited, Karnataka State Pollution Control Board etc.

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

The relevant comments and important clauses mentioned in the project documents/clearances like Detailed Project Report (DPR), environmental clearances, power purchase agreement, local clearance *etc*. were considered while preparation of CDM project development document.

As per UNFCCC requirement the PDD was published at the validator's/UNFCCC web site for 30 days for public comments. No comments were received during this period from any stakeholders.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	The Godavari Sugar Mills Limited (TGSML)
Street/P.O.Box:	Fazalbhoy Building
Building / Location:	45/47, Mahathma Gandhi Road, Fort
City:	Mumbai
State/Region:	Maharashtra
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding for this project.

Annex 3

Baseline Data

Source: www.cea.nic.in
Emission Factor (Calculated using ACM0002 Version 06)

Weighted Average Emission Rate (tCO_2/MWh) (excl. Imports)

	2000-01	2001-02	2002-03	2003-04	2004-05
North	0.71	0.73	0.74	0.71	0.71
East	1.08	1.06	1.11	1.10	1.08
South	0.73	0.74	0.81	0.84	0.78
West	0.90	0.93	0.91	0.90	0.92
North-East	0.38	0.38	0.34	0.36	0.29
India	0.81	0.83	0.85	0.85	0.84

Simple Operating Margin (tCO_2/MWh) (excl. Imports)

	2000-01	2001-02	2002-03	2003-04	2004-05
North	0.96	0.98	1.00	0.99	0.98
East	1.22	1.22	1.20	1.23	1.20
South	1.01	1.00	0.99	1.00	1.00
West	0.98	1.01	0.99	0.99	1.01
North-East	0.66	0.65	0.66	0.62	0.66
India	1.01	1.02	1.02	1.03	1.03

Build Margin (tCO_2/MWh) (excl. Imports)

	2000-01	2001-02	2002-03	2003-04	2004-05
North					0.53
East					0.90
South					0.71
West					0.77
North-East					0.10
India					0.70

Combined Margin (tCO_2/MWh) (excl. Imports)

	2000-01	2001-02	2002-03	2003-04	2004-05
North	0.75	0.76	0.77	0.76	0.75
East	1.06	1.06	1.05	1.07	1.05
South	0.86	0.85	0.85	0.86	0.85
West	0.88	0.89	0.88	0.88	0.89
North-East	0.38	0.38	0.38	0.36	0.38
India	0.85	0.86	0.86	0.86	0.86

Weighted Average Emission Rate (tCO_2/MWh) (incl. Imports)

	2000-01	2001-02	2002-03	2003-04	2004-05
North	0.71	0.73	0.74	0.71	0.72
East	1.08	1.03	1.08	1.08	1.05
South	0.74	0.74	0.81	0.84	0.78
West	0.90	0.92	0.91	0.90	0.92
North-East	0.38	0.38	0.34	0.36	0.46
India	0.81	0.83	0.85	0.85	0.84

Simple Operating Margin (tCO2/MWh) (incl. Imports)

	2000-01	2001-02	2002-03	2003-04	2004-05
North	0.96	0.98	1.00	0.99	0.98
East	1.22	1.19	1.17	1.20	1.18
South	1.02	1.00	0.99	1.00	1.00
West	0.98	1.01	0.99	0.99	1.01
North-East	0.66	0.65	0.66	0.62	0.81
India	1.01	1.02	1.02	1.02	1.02

Build Margin (tCO2/MWh) (not adjusted for imports)

	2000-01	2001-02	2002-03	2003-04	2004-05
North					0.53
East					0.90
South					0.71
West					0.77
North-East					0.10
India					0.70

Combined Margin in tCO2/MWh (incl. Imports)

	2000-01	2001-02	2002-03	2003-04	2004-05
North	0.75	0.76	0.77	0.76	0.75
East	1.06	1.05	1.04	1.05	1.04
South	0.86	0.85	0.85	0.86	0.85
West	0.88	0.89	0.88	0.88	0.89
North-East	0.38	0.38	0.38	0.36	0.45
India	0.85	0.86	0.86	0.86	0.86

GENERATION DATA

Gross Generation Total (GWh)

	2000-01	2001-02	2002-03	2003-04	2004-05
North	144,287	151,185	155,327	165,706	168,414
East	58,314	63,585	65,314	75,249	85,776
South	128,796	131,747	136,742	138,153	143,932
West	159,864	165,501	173,403	172,682	183,955
North-East	5,206	5,243	5,486	5,880	7,904
India	496,467	517,260	536,270	557,670	589,981

Net Generation Total (GWh)

	2000-01	2001-02	2002-03	2003-04	2004-05
North	135,225	141,415	144,685	155,015	157,267
East	52,794	57,681	58,992	68,315	77,968
South	120,964	123,468	127,617	128,032	134,551
West	148,033	152,834	160,592	159,723	170,730
North-East	5,085	5,126	5,372	5,758	7,776
India	462,100	480,525	497,257	516,843	548,292

20% of Net Generation (GWh)

	2000-01	2001-02	2002-03	2003-04	2004-05
North	27,045	28,283	28,937	31,003	31,453
East	10,559	11,536	11,798	13,663	15,594
South	24,193	24,694	25,523	25,606	26,910
West	29,607	30,567	32,118	31,945	34,146

North-East	1,017	1,025	1,074	1,152	1,555
India	92,420	96,105	99,451	103,369	109,658

Share of Must-Run (Hydro/Nuclear) (% of Net Generation)

	2000-01	2001-02	2002-03	2003-04	2004-05
North	25.9%	25.7%	26.1%	28.1%	26.8%
East	10.9%	13.5%	7.6%	10.3%	10.5%
South	28.1%	25.5%	18.3%	16.2%	21.6%
West	8.3%	8.5%	8.4%	9.1%	8.8%
North-East	43.1%	42.4%	48.4%	41.8%	55.4%
India	19.3%	18.9%	16.4%	17.1%	18.0%

Net Generation in Operating Margin (GWh)

	2000-01	2001-02	2002-03	2003-04	2004-05
North	100,184	105,076	106,884	111,421	115,128
East	47,014	49,893	54,527	61,265	69,746
South	86,920	91,941	104,277	107,263	105,444
West	135,693	139,882	147,033	145,207	155,735
North-East	2,892	2,952	2,774	3,350	3,469
India	372,702	389,745	415,495	428,506	449,522

Net Generation in Build Margin (GWh)

	2000-01	2001-02	2002-03	2003-04	2004-05
North					32,067
East					15,818
South					27,195
West					34,587
North-East					2,052
India					111,718

IMPORT DATA

Net Imports (GWh) - Net exporting grids are set to zero

	2000-01	2001-02	2002-03	2003-04	2004-05
North	0	0	0	0	3,616
East	489	555	357	1,689	0
South	1,162	1,357	518	0	0
West	321	0	797	962	285
North-East	0	0	0	0	2,099

Share of Net Imports (% of Net Generation)

	2000-01	2001-02	2002-03	2003-04	2004-05
North	0.0%	0.0%	0.0%	0.0%	2.3%
East	0.9%	1.0%	0.6%	2.5%	0.0%
South	1.0%	1.1%	0.4%	0.0%	0.0%
West	0.2%	0.0%	0.5%	0.6%	0.2%
North-East	0.0%	0.0%	0.0%	0.0%	27.0%

Annex 4

Description of the Monitoring Plan

The Monitoring and Verification (M&V) procedures define a project-specific standard against which the project's performance (i.e. GHG reductions) and conformance with all relevant criteria will be monitored and verified. It includes developing suitable data collection methods and data interpretation techniques for monitoring and verification of GHG emissions with specific focus on technical / efficiency / performance parameters. It also allows scope for review, scrutinize and benchmark all this information against reports pertaining to M & V protocols.

The M&V Protocol provides a range of data measurement, estimation and collection options/techniques in each case indicating preferred options consistent with good practices to allow project managers and operational staff, auditors, and verifiers to apply the most practical and cost-effective measurement approaches to the project. The aim is to enable this project have a clear, credible, and accurate set of monitoring, evaluation and verification procedures. The purpose of these procedures would be to direct and support continuous monitoring of project performance/key project indicators to determine project outcomes, greenhouse gas (GHG) emission reductions.

The project revenue is based on the units exported as measured by power meters at plant and check meters at the high-tension substation of the KPTCL. The monitoring and verification system would mainly comprise of these meters as far as power export is concerned. The bagasse input is also to be monitored. The export of electricity will be through invoices to KPTCL. The invoices, based on meter readings will also be covered in the regular finance audit.

The measurement of the quantity of bagasse used will produce evidence that the energy is being generated with zero net CO2 emissions.

The project employs latest state of art monitoring and control equipment that will measure, record, report, monitor and control various key parameters. Parameters monitored will be quantity and quality of bagasse fuel used, total power generated, power exported to the grid, particulate matter emissions from the project, etc.(Details enclosed in the tables given below). All monitoring and control functions will be done as per the internally accepted standards and norms of TGSML.

The instrumentation system for the project comprises microprocessor-based instruments of reputed make with desired level of accuracy. All instruments will be calibrated and marked at regular intervals so that the accuracy of measurement can be ensured all the time.

The quantity of emission reduction units claimed by the project will be only a fraction of the total generated emissions, which depends on the actual generation mix of the grid in a particular year. KPTCL publishes yearly reports regarding the performance of all power generation units (which include private sector generation units and KPTCL's own generation units). Hence, authentic data related to the measurements, recording, monitoring and control of the generation mix of the KPTCL network is ensured.

The KPTCL report contains all information regarding type of generation like hydro, thermal, nuclear, renewable etc., installed capacity, de-rated capacity, performance of generating unit, actual generation, capacity additions during the year, etc. which can be used for verification of generation mix and emission factors for baseline calculation for a particular year.

Project Parameters affecting Emission Reduction

Monitoring Approach

The general monitoring principles are based on:

- Frequency
- Reliability
- Registration and reporting

As the emission reduction units from the project are determined by the net increase in power generation it becomes important for the project to monitor the net increased in power generation on a real time basis.

Frequency of monitoring

The project developer will install all metering within the plant premises. The measurement will be recorded and monitored on a continuous basis by both KPTCL and the project developer through electronic tri vector meter from which presently readings are being taken.

Reliability

The amount of emission reduction units is proportional to the net increased power generation from the project. All measurement devices will be of microprocessor based with best accuracy and will be procured from reputed manufacturers. Since the reliability of the monitoring system is governed by the accuracy of the measurement system and the quality of the equipment to produce the result all power measuring instruments must be calibrated once a year for ensuring reliability of the system. All instruments carry tag plates, which indicate the date of calibration and the date of next calibration. Therefore the system ensures the final generation is highly reliable.

Registration and reporting

Registration of data is on-line in the control cabin through a microprocessor. However, hourly data logging will be there in addition to software memory. Daily, weekly and monthly reports are prepared stating the generation. In addition to the records maintained by the TGSML, KPTCL also monitors the power exported to the grid and certify the same.

The other major factors, which need to be ensured and monitored are: the use of only bagasse (and if required biomass) fuel for power generation and the parameters that would ensure smooth and regular operation of the cogen. No other project specific indicators are identified that affect the emission reductions claims.

Bagasse Requirement and Utilization

Availability of Bagasse

The major fuel proposed to be used by the cogen power plant is bagasse, generated and saved by TGSML and a part of it procured from nearby sugar plants. The bagasse saved by these sugar mills, after meeting the sugar plant requirement will be supplied to cogen plant. Hence, production of electricity is mainly depending on the bagasse received from these sugar mills. The receipt of bagasse to cogen plant mainly depends on the following parameters.

- Total cane crushed by the sugar mills
- Variety / fiber content of the sugar cane crushed
- In-house bagasse consumption by sugar mills

The sugar plant would run for 210 days and the balance cogeneration plant operation days of around 130 days, the cogen plant would use procured bagasse till the 9,800 TCD sugar plant would be commissioned by 2008.

Quantity of the Bagasse fuel used in the boiler

The total amount of bagasse received by the cogeneration unit from the TGSML sugar unit will be based on the total sugar cane crushed, bagasse generated and use for internal consumption.

The crushed bagasse from the existing mill house shall be fed to the existing bagasse elevators, which in turn through the existing cross conveyor shall feed the bagasse to the existing chain slat conveyor to feed the existing boilers. The existing chain slat conveyor is suitably augmented in the form of a single conveyor with intermediate discharge provision to divert the bagasse to existing boilers as well as new boiler.

The conveyors which feed the bagasse fuel from processing machinery to boiler bunkers consists of a metal detector, tramp iron detector, magnetic separator and online weighing system. Metal detector, tramp iron separator etc. will prevent any metal particles entering into the boiler and ensure that only fuel is conveyed to the boiler. An online weighing system provided to the conveyors measures, records and transmits the actual quantity of the fuel entering into the boiler for online monitoring in the DCS. The weighing system will be calibrated regularly to ensure the accuracy of the measurement. The data will be recorded for further verification. Online fuel measurement is possible only by local meter for bagasse weighing and the accuracy is likely to be poor during varying moisture and uneven feeding conditions. In such situations bagasse consumption can be crosschecked by determining the bagasse consumption (fuel use) by using details of bagasse generated from laboratory reports and balance bagasse saved in the yard.

Since it is mandatory for sugar industries to submit yearly performance record (RT-8C form), which also includes above parameters, to the government, these figures are to be crosschecked from this record. The amount of bagasse purchased, if any, will be based on invoices / receipts from farmers and/ or fuel contractors. In case any fossil fuel would be purchased this will also become evident from the audit report. However the DPR clearly indicates that the bagasse generated at TGSML and that procured from nearby sugar mills will be sufficient for 210 days of cogeneration plant operation during season and 130 days during off season.

Quantity of the additional biomass fuel purchased

TGSML will maintain proper records of additional bagasse if procured for additional operation of the cogen project and will be kept open for verification. The quantity of the fuel received / purchased will be measured, recorded and monitored from starting point in the project i.e. at the entry of the project premises. The project developers will install a computerized weighing system through which each truck of the fuel will pass through. Promoters will monitor the information of each truck of bagasse/biomass fuel regularly, through computerized management information systems. No truck with bagasse/biomass fuel will be able to enter into the plant without weighing the fuel. The weighing system will be calibrated and sealed regularly as per the prevailing practices.

Bagasse used in the boiler

The main type of fuel proposed for the power generation is only bagasse. The properties of the bagasse fuels like ultimate analysis, calorific value, ash composition etc. are already established and will be consistent in the region. However, it is proposed to monitor various properties of bagasse fuels by taking samples at random from the fuel lots from the processed fuel so that in case of any drastic change in the properties, corrective actions can be taken. The measurement of fuel properties like ultimate analysis, calorific value etc. will be done at reputed laboratories as per international practices and data or documents will be kept open for verifiers. The data will also be computerized and monitored through management information system.

Operational Parameters of the Cogen Unit

Total Power Generated

The total power generated by the power project will be measured in the plant premises to the best accuracy and will be recorded, monitored on a continuous basis through electronic tri vector meters. All measurement devices will be microprocessor based with best accuracy and will be procured from reputed manufacturers. All instruments will be calibrated at regular intervals. All instruments carry a tag plate, which indicates the date of calibration and the date of next calibration. The parameter will substantiate the smooth operations of the cogen. During verification the total power generated would be verified as compared to the power exported to the grid.

Power consumed by the plant auxiliaries

The power consumed by plant auxiliaries will be recorded in the plant premises to the best accuracy. This will be recorded monitored on a continuous basis through electronic tri vector meters. All measurement devices will be microprocessor based with best accuracy and will be procured from reputed manufacturers. All instruments will be calibrated at regular intervals. All instruments carry tag plates, which indicate the date of calibration and the date of next calibration. The total quantum of power consumed by the auxiliaries would affect the total power to the exported to the grid and therefore the amount of GHG reductions. Therefore any increase in the consumption pattern of the auxiliary system would be attended to.

Power exported to the grid

The project developer will install all metering and check metering facilities within the plant premises as well as in the grid substation where exported power is connected to the grid. The measurement will be recorded and monitored on a continuous basis by both KPTCL and the project developer through electronic tri vector meters. In addition to the records maintained by the promoter, KPTCL also monitors the actual power exported to the grid and certifies the same. All measurement devices will be of microprocessor based with best accuracy and will be procured from reputed manufacturers. All instruments will be calibrated at regular intervals. All instruments carry tag plates, which indicate the date of calibration and the date of next calibration.

All the above parameters/ factors will demonstrate the performance of the project at any point of time.

Verification

The performance of the bagasse based power project leads to CO2 emission reductions. In other words, the longer the cogen power plant runs and exports power to the grid, the greater would be the emission reductions. The project control system comprises a state-of-the-art sophisticated control and monitoring system like Distributed Control System which measures, collects the information about various process parameters, records, monitors and controls on a continuous basis. A fully functional management information systems will be built in DCS and SAP so that accessing and verification of actual data are possible at any point of time. The major activities to be verified are as under:

- Verification of various measurement and monitoring methods
- Verification of instrument calibration methods
- Verification of data generated by DCS/SAP
- Verification of measurement accuracy

Like above activities, following major project parameters which affects the emission claims need to be verified, based on the available operating data is as under

- Cane crushing by TGSML sugar unit
- Quantity of the bagasse fuel purchased from nearby sugar industries
- Total generation of power and captive & auxiliary power requirements.
- Power exported to the grid

Enclosure I

Report on Environmental Impact

The environmental impacts are categorized as primary or secondary impacts. Primary impacts are those that can be attributed directly to the project itself and secondary impacts are those, which are induced indirectly because of the development activity or may be triggered by the primary impact. The secondary impacts usually include investment and changes in socio-economic activity by the project activity.

The impact of the project on the environment occurs during two stages:

1. Construction phase
2. Operational phase

The project activity of TGSML has been set up adjacent to the existing sugar manufacturing unit at Sameerwadi.

The infrastructure for the project included land, fuel (bagasse) storage and transfer facilities, switchyard, greenbelt and other support systems. A 15 m wide corridor of land between the Ghataprabha river side and the pump house was also required to lay the raw water pipeline, electrical power line and service road

Impacts during construction phase

The impacts due to the construction of the project activity are as given below:

Air quality impacts:

- Particulate emissions from site clearing
- Particulate emissions from offsite quarrying operations
- Vehicular emissions (NOx, SO2, SPM) from transportation of raw materials such as cement, sand, gravel etc
- Dust emissions due to vehicular movements
- Particulate emissions from various construction activities including pre-casting, fabrication, welding etc

Noise level increase:

- From earth moving equipments used for site clearing
- From offsite quarrying operations
- From transporting raw materials including cement, sand, gravel etc
- From onsite construction activities

Land and soil impacts:

- From change/ replacement of previous land-use by site clearing

- From soil erosion due to vegetation removal
- From solid wastes disposed on land from construction activities

Water environment impacts

- From consumption of water for construction purposes

Impacts on ecology

- Removal of vegetation at the site

Impacts on socioeconomic environment

- Employment opportunities to local people

The above represents a broad range of environmental impacts that occurred during the construction phase of the cogeneration plant. The environmental impacts from the above activities were minimized by implementing the mitigation measures during the construction.

It should be noted that the impacts due to construction activities are usually short-term and cease to exist beyond the construction phase.

Impacts during operational phase

The operational phase of the project activity involves power generation from bagasse used as fuel. The cogeneration plant feeds surplus power to the grid and indirectly prevents the pollutants that would otherwise have been released into the atmosphere from the thermal power plants (coal, gas and diesel based) of the State grid. Also bagasse being a biomass (a renewable fuel) does not add any net CO_2 to the atmosphere as the carbon gets recycled during cane growth.

The optimal utilization of bagasse by the cogeneration plants, avoids and prevents the pollution from other alternative methods of bagasse disposal practiced in sugar plants i.e. inefficient burning of bagasse in boilers or allowing it to decompose, which would lead to more dust and GHG emissions when compared to the present project activity. The impacts during operational phase of the project activity are as given here:

Air quality impacts:

The project activity discharges the following pollutants into the air:

- Suspended Particulate Matter (SPM) from fly ash in the flue gas
- Oxides of Nitrogen (NOx) in the flue gas
- Carbon dioxide (CO_2)

The combustion gases are discharged through a stack of 70 m height, which meets the requirement for minimum stack height prescribed by the Central Pollution Control Board (CPCB)

The ash content in bagasse is about 1.4 %. As the pollution control regulations limit the particulate matter emissions from bagasse fired steam generators to 150 mg/ Nm3, electrostatic precipitators (ESP's) of 95% efficiency are provided in the project activity. The NOx emissions are restricted to 400 ppm by proper controls at the combustion stage.

The 24 hr incremental ground level concentrations (GLCs) of NOx and SPM[8] respectively due to the project activity are 14.9 and 250 $\mu g/m^3$. The maximum concentrations occur under atmospheric stability class B and wind speed of 5 m/s at 1.3 km from source and the 24-hr maximum background concentrations in the study area are 21 and 401 $\mu g/m^3$. respectively for NOx and SPM. The predicted GLCs are within the National Ambient Air Quality Standards (NAAQS) for the industrial area. The SO_2 level is not anticipated increase from the power plant operations.

To reduce to ground level air contaminants, a 70 m stack was suggested for baggase-fired boiler, which has helped in faster dispersion of air pollutants into the atmosphere thus reducing the impact on the project surroundings.

During off-season and during shortage of bagasse in-house, the bagasse is transported from nearby cooperative sugar factories (bagasse is wasted/ un-utilized considering very low pressure boilers in these sugar mills) to the project site. However, the air emissions would be very negligible.

The air quality parameters released such as NOx, CO and SPM emissions from the stacks attached to the boiler of the cogeneration plant are to be monitored as per the Section 21 of the Air (Prevention & Control of) Pollution Act 1981.

Noise level increase:

The major noise generating units in power plants are the turbines, turbo generators, compressors, pumps and fans where the noise is continuously generated from such sources. For a turbine noise level of 92 dBA at 1 m from source at a height of 1.2 m, the noise level impact would be about 35 dBA at a distance of 500 m from source. The operation of the project is not likely to increase the ambient noise levels in the vicinity as the ambient noise levels recorded in the nearby areas at a distance of about 1 km from the project activity are below 25 dBA

The noise level impact of vehicular transport of bagasse from nearby sugar factories to the project activity location would be negligible

The green belt has been provided around the plant area for noise attenuation. Also the workers are instructed to wear ear masks to reduce noise level impacts.

[8] Source: Rapid Environmental Impact Assessment (EIA) for the 24 MW cogeneration power plant at TGSML by Desein Private Limited

Water quality impacts:

The effluents generated from the project activity are being treated in the effluent treatment plant before final discharge. This is to ensure that there is no environmental deterioration by following the mitigation measures as given below:

- The demineralization plant waste is neutralized in the neutralization plant to bring the pH level in the range of 5.5 – 9 as per regulatory standards
- Treated wastewater is used for greenbelt development within and around the plant and remaining is used for irrigation
- Wastewater for irrigation meets the respective standards

The characteristics of effluents from the cogeneration plant are maintained so as to meet the requirements of KSPCB and minimum national standards from thermal power plants.

Ecological impacts:

The ecological impacts are primarily from emission of air pollutants and as the peak concentrations of pollutants are expected to be within NAAQS limits, there is no significant impact on the ecological system

No ecological impacts are envisaged from wastewater discharge as they are treated appropriately before final disposal.

Also as trees have been planted around the plant, it gives a cool atmosphere in the operational area and provides as a barrier for air emissions and noise level increase.

Land use impacts:

The project activity has not resulted in significant impacts on the land use

Socio-economic impacts

The project activity has contributed to socio economic growth in the following ways;

- Generation of employment to 50 technical experts in various fields like mechanical, electrical, electronics, instrumentation, chemical engineering etc
- Project is supplying power to TGSML and therefore its smooth operation
- Feeding of surplus power to the grid thereby bridging the gap between demand and supply in a power deficit State
- Offering environmentally friendly solution for additional power generation without using fossil fuels
- Improvement of financial position of the sugar plant
- Reduction in fuel transportation costs

- Reduction in transmission losses
- Self reliance of power in rural areas

Environmental Management Plan (EMP)

The EMP has been prepared to basically manage the various impacts arising from construction and operational phases of the project activity.

Construction phase

Air environment

The following mitigative measures were undertaken during construction phase

- Spraying of water at regular intervals to control fugitive dust emissions from construction activities
- Closing materials in trucks with tarpaulin during transportation of raw materials to the site to prevent dust emissions
- Regular and periodic emission check for transportation vehicles
- Use of personal protective equipment (PPE) like goggles and nose masks to reduce impact of dust emissions during construction activities

Noise environment

- Periodic noise control checks on transportation vehicles
- Provision of ear plugs, work rotation, adequate training

Operational phase

Air environment

- Electrostatic precipitators (ESP) with an efficiency of 95% have been installed to control particulate emissions so that it does not exceed 150 mg/ Nm^3
- For good dispersion of pollutants a stack of 70 m height has been constructed as per applicable standards
- NOx levels will be controlled at combustion stage to 400 ppm
- Regular and periodic emission check for transportation vehicles
- Use of personal protective equipment (PPE) like goggles and nose masks to reduce impact of dust emissions
- Periodic monitoring of boiler stack emissions for NOx and particulate matter to be carried out twice a month
- Ambient air quality monitoring are carried out for NOx, SO_2 and SPM twice a month at three locations by high volume samplers

Noise environment

- Periodic noise control checks on vehicles
- Provision of ear plugs, work rotation, adequate training
- Proper encasing of noise generation sources
- Regular noise level monitoring at the plant and surrounding area
- Plantation of green belt which acts as a attenuator of noise

Land and soil environment

- Improvement of soil quality and plantation of suitable tolerant species in the study area.

Water environment

- Wastewater is treated to meet the Minimum National Standards (MINAS) and general standards for effluents
- Periodic monitoring of water quality parameters

Ecological environment

- Plantation of greenbelt for attenuating the noise levels and air pollutants along the plant boundary, roadside, office buildings, and stretches of open land
- A curtain of trees around the plant complex has also been provided

Socioeconomic Environment

- Training to cane growers and farmers in order to improve productivity

Post project monitoring

- The effluent characteristics are being monitored so as to meet the requirements of the Karnataka State Pollution Control Board (KSPCB) under the Section 25/26 of the Water (Prevention & Control of) Pollution Act 1974 and the minimum national standards (MINAS) for effluent from thermal power plants
- Air quality monitoring is being undertaken in order to meet the requirements of the Karnataka State Pollution Control Board under the Section 21 of the Air (Prevention & Control of) Pollution Act 1971
- The air quality parameters being monitored from the stack emissions are SPM and NOx

Enclosure II

Stakeholder comments

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॥ ಶ್ರೀ ಸಹಕಾರ ॥

ಸಮೀರವಾಡಿ ಕಬ್ಬು ಬೆಳೆಗಾರರ ಸಂಘ, ರಾಯಬಾಗ, ಗೋಕಾಕ ಮುಧೋಳ, ಜಮಖಂಡಿ ತಾಲೂಕು, ಫ್ಯಾಕ್ಟರಿ ಸರ್ಕಲ್

SAMEERWADI SUGARCANE CULTIVATOR SOCIETY RAIBAG, GOKAK, MUDHOL, JAMKHANDI TQ. FACTORY CIRCLE

ಕ್ರಮಾಂಕ : ____________ ದಿನಾಂಕ : ____________

Date: 8th March, 2006

TO WHOM SOEVER IT MAY CONCERN.

This is concerned with the 24 MW Cogen Project of The Godavari Sugar Mills Limited at Sameerwadi, Mudhol Taluk, Bagalkot District, we feel to express our views in terms of benefits, interest of how the surrounding villages are being benefited.

1. Due to implementation of this project approximately 10% load of Mahalingpur Sub-Station is shared by GSML. Due to this power supply stability is improved.

2. This project also has benefited by providing employment to the people of local and surrounding villages to some extent.

3. This project does not have much more negative imparts like more noise and Air Pollution as compared to other industries.

SHANKARGOUDA S PATIL
VICE-PRESIDENT
SUGARCANE GROWERS ASSOCIATION
SAMEERWADI

Enclosure III: Emission Reduction Calculations

CALCULATION OF BASELINE EMISSION FACTORS AND EMISSION REDUCTIONS OF THE 24 MW BAGASSE BASED POWER PROJECT OF THE GODAVARI SUGAR MILLS LTD								
Baseline calculations using Modified Combined Margin Approach								
Year	Crediting period (2002-09)	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09
Estimation of baseline emissions								
On-Site Project Emission Reductions								
EGy (Net Quantity of Increased Electricity Generation as a result of Project Activity) in MWh	**669686**	27025.45	113,204	53,804	118,913	118,913	118,913	118,913
EFelectricty,y (Southern Grid Emission factor considered, tCO_2/MWh)		0.850	0.850	0.850	0.850	0.850	0.850	0.850
ERelectricity,y (tCO2)	**569233**	22971.6	96223.6	45733.6	101075.8	101076.1	101076.1	101076.1
Estimation of methane emissions from biomass decay and uncontrolled burning								
GWPch4		21.000	21.000	21.000	21.000	21.000	21.000	21.000
BF i,not used, y (Quantity of biomass type i not used as fuel in the project plant during the year y, but left for decay/ uncontrolled burning) in Kg		3299000	3299000	3299000	3299000	3299000	3299000	3299000
NCV i(Net calorific value of the biomass type I in MWh per kg)		0.0021	0.0021	0.0021	0.0021	0.0021	0.0021	0.0021
EF burning,CH4,i(CH4 emission factor for uncontrolled burning of the biomass in tons of CH4/MWh)		0.00079	0.00079	0.00079	0.00079	0.00079	0.00079	0.00079
BE biomass.y (Baseline emissions due to natural decay of biomass in tCO2 equiv)	**798**	114.1	114.1	114.1	114.1	114.1	114.1	114.1

Leakage								
COEF CO2,j (CO2 emission coefficient of the most carbon intensive fuel) in tCO2/TJ		96.100	96.100	96.100	96.100	96.100	96.100	96.100
BF I, not used,y (Quantity of biomass type I used as fuel in project plant during the year y) in tons		2829	2829	2829	2829	2829	2829	2829
NCVi (Net calorific value of the biomass type i in TJ/ton)		0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075
Ly (Leakage emisisons during the year y in tons of CO2)	**14273**	2039.0	2039.0	2039.0	2039.0	2039.0	2039.0	2039.0
Project emissions from co-firing coal in cogen plant	129177	0	0	5833	96507	8946	8946	8946
Project emissions from transportation by vehicles	8130	810	3063	422	131	1235	1235	1235
Total project emissions	**137307**	810	3063	6255	96638	10181	10181	10181
Net Emission Reductions by project								
CO2 emission reductions (tons CO2)	**418451**	20237	91236	37554	2513	88971	88971	88971
Commitment period	2002-2009							
No. of years of delivery of CERs	7							
Total number of CERs for credit period	418451							

Emission leakage from trucks transporting biomass/bagasse to the 24 MW power plant

		2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09
Biomass to be transported by trucks	MT/year	36064	136415	18793	5830	55000	55000	55000
Capacity of each truck	MT	10	10	10	10	10	10	10
Truck trips	per year	3606	13642	1879	583	5500	5500	5500

Distance of procurement	Km	300	300	300	300	300	300	300
Distance covered	Kms/year	1081920.00	4092450.00	563790.00	174900.00	1650000.00	1650000.00	1650000.00
Mileage	Km/litre	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Total diesel consumption	litres/year	309120.00	1169271.43	161082.86	49971.43	471428.57	471428.57	471428.57
Diesel consumption/year	kg/year	275117	1040652	143364	44475	419571	419571	419571
Density of diesel	kg/l	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Calorific value of diesel	Kcal/Kg	9600	9600	9600	9600	9600	9600	9600
	Kcal/year	2641121280	9990255086	1376291931	426955885.7	4027885714	4027885714	4027885714
1 Kcal	joules	4179	4179	4179	4179	4179	4179	4179
	Joules/year	1.10E+13	4.17E+13	5.75E+12	1.78E+12	1.68E+13	1.68E+13	1.68E+13
	TJ/year	11.04	41.75	5.75	1.78	16.83	16.83	16.83
CO2 emissions from diesel considering IPCC's oxidation factor of diesel as 0.99 tCO2/TJ	TCO2/ TJ	73.359	73.359	73.359	73.359	73.359	73.359	73.359
Annual GHG emissions	**tonnes/year**	**810**	**3063**	**422**	**131**	**1235**	**1235**	**1235**

Project emissions from coal usage

Year	Coal Quantity (tonnes)	Emission factor (tCO_2/ton of coal)	CO_2 emissions due to combustion of coal (tons of CO_2)
2002-03	0	1.8	0
2003-04	0	1.8	0
2004-05	3260	1.8	5833
2005-06	53940.74	1.8	96507
2006-07	5000	1.8	8946
2007-08	5000	1.8	8946
2008-09	5000	1.8	8946
2002-2009	72200.74		**129177**

Standard IPCC emission factor for Coal	96.1	tCO_2/TJ
Calorific value of coal	4500	kcal/kg
Oxidation factor (conservative estimate)	0.99	
CO_2 emission factor (tCO_2/ton of coal)	1.79	tCO_2/ton of coal