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

CONTENTS

Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

Title : 16 MW bagasse based cogeneration project at Ahmadnagar, Maharashtra by M/s Mula Sahakari Sakhar Karkhana Ltd.
Version : 2
Date : 04/02/2008

A.2. Description of the project activity:

The 16 MW cogeneration project at M/s. Mula Sahakari Sakhar Karkhana Ltd (MSSKL), Sonai, Maharashtra has integrated existing sugar mill operations with enhanced energy efficiency measures and optimum usage of bagasse. During crushing season, which begins in October and generally lasts till March, the bagasse generated in the mill is transferred to the new cogeneration plant situated in the premises of the mill. The cogeneration plant in turn meets the heat and power requirements of the sugar mill and evacuates excess power to the state grid. During off-season, which starts after the crushing season and lasts till next crushing season, the plant uses saved bagasse for power generation.

Pre-Project Scenario
Prior to the implementation of the project activity, a 4 MW cogen plant (4 boilers of 2X25, 1X35 and 1X10 (distillery boiler) TPH and 2 turbines of 1.5 and 2.5 MW installed capacity) was fulfilling the steam and electricity requirements of the sugar plant and the distillery during season's operation. During off season the distillery boiler was meeting its steam requirement.

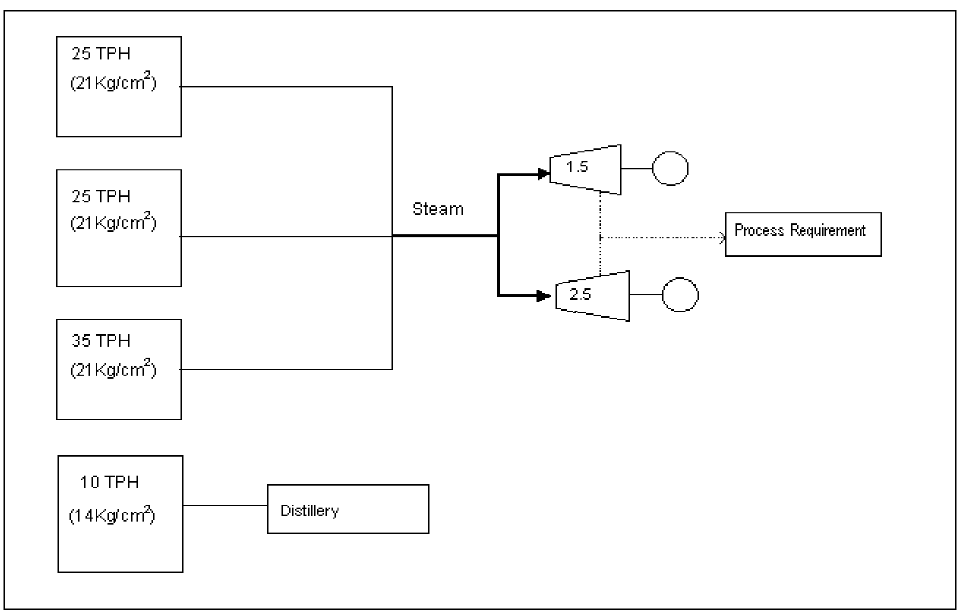

Figure no 1

Post- Project Scenario

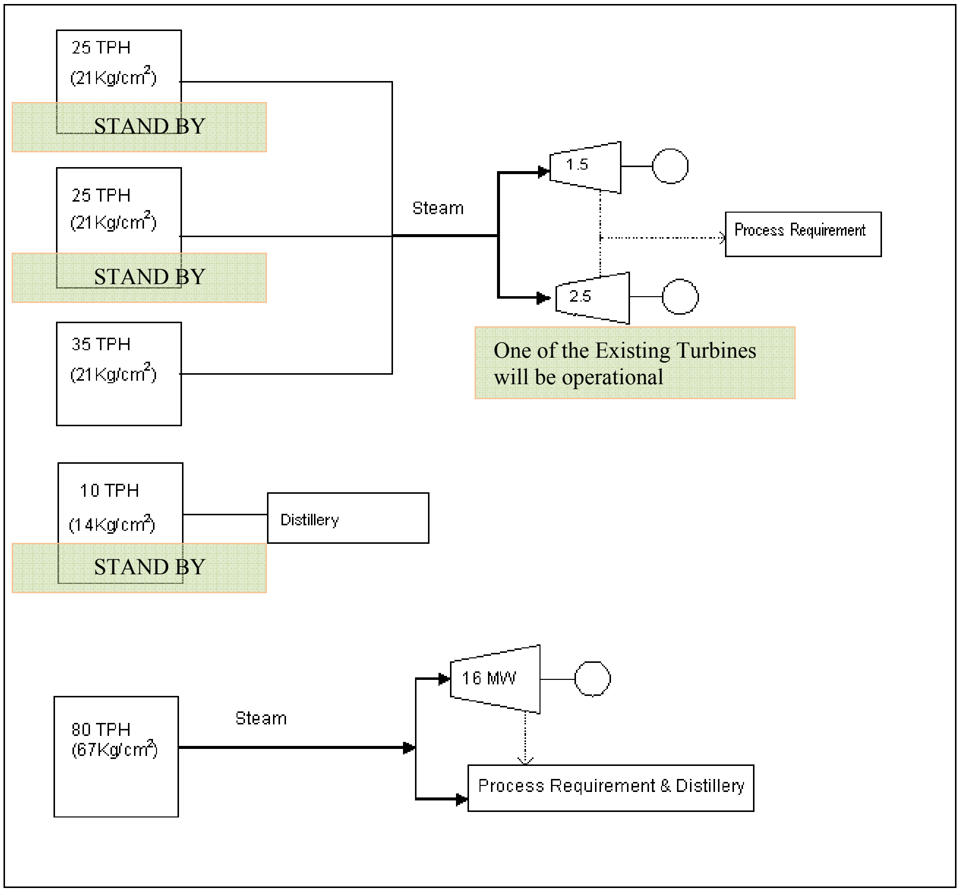

Figure no 2

Post project the existing boilers and turbines have been put on stand-by and instead the 80 TPH, 67 Kg/cm^2 high pressure boiler and 16 MW TG set has been installed. One of the existing boilers and turbines will continue operating alongside the new unit depending on the mill's requirements.

About The Project

M/s MSSKL is a cooperative[1] sugar mill. It started sugar production in the year 1977-78 in Ahmadnagar district of Maharashtra. The plant is presently in its 30th crushing season.

CHRONOLOGY

[1] The cooperative structure has a democratic framework that allows the election of its governing board. Cane is purchased from farmers who are members of the co-operative. It is processed and sold in the market as white sugar by the sugar mill. The profits after deducting processing charges, is distributed to member farmers in form of cane price. http://www.indiatogether.org/2007/apr/agr-sugarcoop.htm

2nd April 2001	Purchase order placed for the boiler.
3rd March 2002	Installation of the 80 TPH boiler
11th December 2006[2]	Commissioning of the 16 MW turbine and synchronization with the grid.

The proposed cogeneration unit caters to the plant's need in terms of steam and power requirement, during both crushing and non-crushing season. The surplus power is supplied to Maharashtra State Electricity Distribution Company Limited (MSEDCL). The biomass requirement for the cogeneration plant to run for 180 days during the crushing season is approximately 1,72,000 tonnes, which is supplied by the sugar mill complex. In addition, to run this plant for about 15 days during the off-season, MSSKL needs approximately 9788 tonnes of biomass. The biomass for off season operations is acquired from season's savings.

At designed capacity levels, the project is able to generate 47.125 million KWh/year. Both in-season and off-season operations of the project is restricted to the use of non-fossil fuels, i.e. bagasse only. The break up of season and off-season generation has been tabulated below. Plant load factor of 90% has been considered.

Mode of Operation	Days per Year	Generation (MW)	Auxiliary Consumption (MW)	Net Generation (MW)	Annual Generation (MWh)
Project Plant					
Season (22 hrs/day)	180	13.5	1.50	12.00	42768.0
Off season (24 Hrs/day)	15	15.0	1.55	13.45	4357.8
Total					**47125.8**
Existing Plant					
Season (22 hrs/day)	180	1.294	0.1294 (@10%)	1.1646	**4150.6344**

Contribution of Project Activity to Sustainable Development:
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. This results in immense stress on the environment. Changing coal consumption patterns will require a multi-prolonged strategy focusing on demand, reducing wastage of energy and the optimum use of Renewable Energy (RE) sources.

Government of India has stipulated the following indicators for sustainable development in the interim approval guidelines[3] for CDM projects.

1. Social well being:

[2] The delay in commissioning of the entire cogeneration setup was caused because sugar production plummeted in 2003-04 and 2004-05 because of drought and infestation by woolly aphids in the major producing States.

http://www.thehindubusinessline.com/bline/2005/09/22/stories/2005092200701000.htm

[3] Ministry of Environment and Forest web site: http://envfor.nic.in:80/divisions/ccd/cdm_iac.html

- During civil works, a lot of construction work took place, and for this local populace was employed.
- Other than these, there are various kinds of mechanical work, which has generated employment opportunities on temporary and permanent basis.

2. Economic well being:

- The project activity has lead to increased opportunities of employment in the local area.
- The project has created business opportunities for local stakeholders such as bankers, consultants, suppliers, manufacturers, contractors etc.
- The plant has attached commercial value to agricultural residues enabling the farmers to get better price out of their produce augmenting their income. Also electricity supply has improved in the area.

3. Environmental well being:

- A cogeneration plant based on renewable energy source (bagasse) as fuel does not affect the ecology. The project also reduces pollution in general.
- The proposed project ensures resource sustainability. Instead of utilizing more polluting and scarce fossil fuel for power generation, it uses environment friendly resource. Thus, the fossil fuels can be conserved for other important processes.

4. Technological well being:

- The technology selected for the proposed project was more energy efficient as compared to what is commonly used in the country. The cogeneration plant uses boilers that can work at the higher temperature and pressure – 67 Kg/cm^2; 495 ºC. This leads to a lot of fuel being saved and thus is helping in resource sustainability.

In light of the above factors, the project participants consider that the project activity genuinely contributes to sustainable development of society.

A.3. Project participants:

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Name of the party involved ((host) indicates a host party)	Private and/or public entity (ies) project participants (as applicable)	Kindly indicate if the party involved wishes to be considered as project participant (Yes/No)
India	M/s Mula Sahakari Sakhar Karkhana Ltd.	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.:

Maharashtra

A.4.1.3. City/Town/Community etc:

Village : Sonai
Taluka : Nevasa
District : Ahmednagar

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

Located on the bank of the river Pravara, Nevasa khurd, popularly known as Nevasa, is the head-quarters of the taluka bearing the same name. It covers an area of 13.2 square miles. Nevasa is twenty miles from Shrirampur railway station and is connected with it by road. The location of Village Sonai in this Taluka is 19°39' 43.41″ north latitude and 74°81' 63.60″ east longitude

Figure 3: Map of India

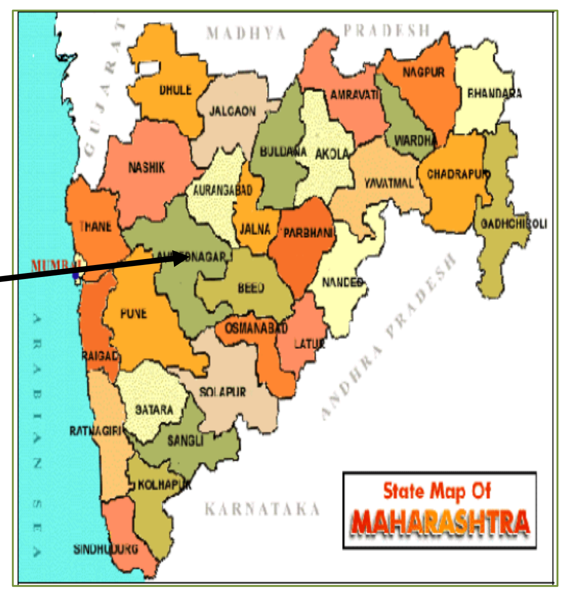

Figure 4: Map of Maharashtra showing Ahmadnagar

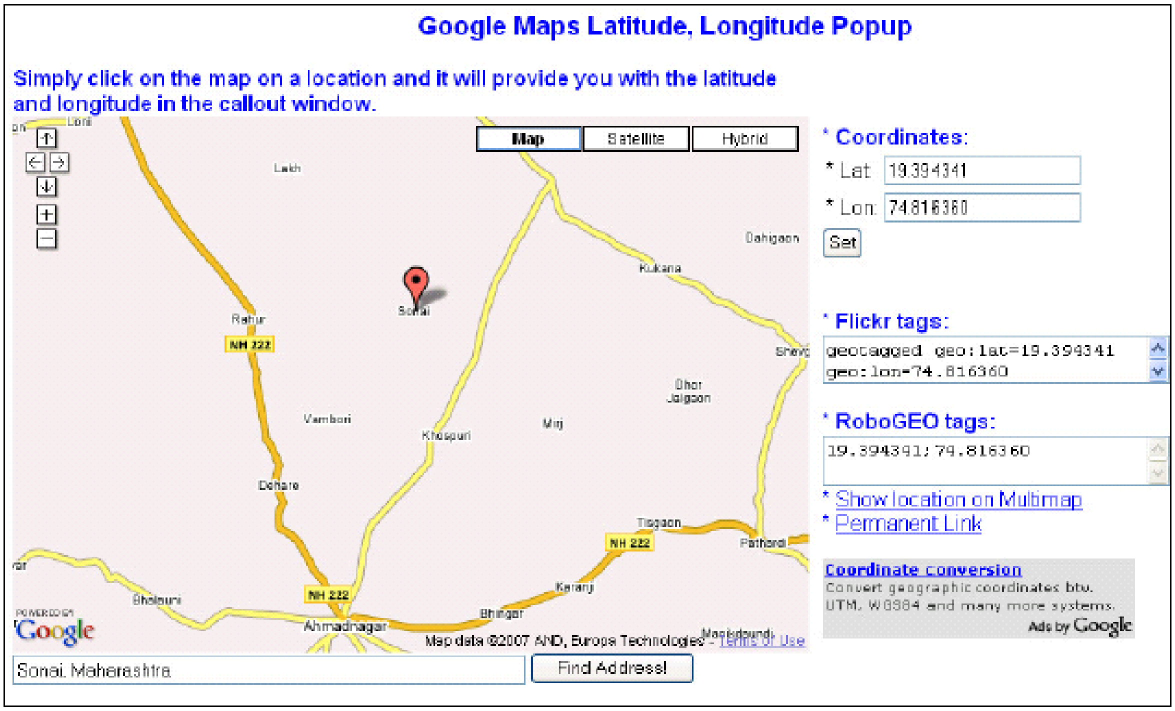

Figure 5: Sonai[4] in Ahmadnagar District

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

Sectoral Scope: 1-Energy Industries (renewable - / non-renewable sources)

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

The co-generation plant is expected to operate for approximately 195 days in a year and is based on regenerative Rankine cycle. It consists of the following major components:

1. Boiler & its Auxiliaries
2. Steam Turbine & Generator
3. Condenser
4. The Main Transformer

[4] http://www.gorissen.info/Pierre/maps/googleMapLocation.php?lat=19.394341&lon=74.816360&setLatLon=Set

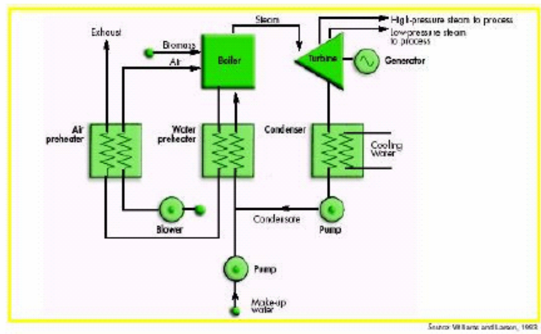

Figure 6: General Plan of a Rankine Cycle

(Source: Williams & Larson, 1993 apud Kartha & Larson, 2000 p.101)

- **Boiler:** The plant has one 80 TPH boiler for meeting the low and medium pressure process steam requirements. Steam is generated at 67-kg/cm² pressure in travelling grate type, bagasse fuelled boiler. The steam generated at 67 kg/cm² from the boiler is used to drive the power turbine. The exhaust steam of the power turbine at 8 & 2.5 kg/cm² pressure is supplied for sugar processing. The medium pressure steam required for centrifugal washing, sulphur burner, etc. at about 8-kg/cm² pressure is supplied from the medium pressure steam header, from the Steam Turbo Generator (STG). Also, about 6-TPH steam at medium pressure is supplied to the distillery. Required steam for sugar and feed water heating at 8 kg/cm^2 is extracted from the uncontrolled extraction. Depending on the crushing rate, the controlled extraction at 2.5 kg/cm^2 supplies steam to the boiling house and for de-aeration. Balance steam generated is passed through the condensing stage to maximize power generation.

- **Steam Turbine Generator:** A double extraction cum condensing turboset has been installed at the plant site. All high pressure steam generated, except a minor quantity required for soot blowing & ejectors, is supplied to this STG for maximum power generation.
- **Condensate System**: The condensate system includes a surface condenser, which condenses exhaust steam from the steam turbine, as well as other in-plant sources. Condensate from the sugar mill (process steam condensate) is piped directly to the deaerator.

The steam turbine exhausts steam to the condenser. In the condenser, the latent heat of vaporization is extracted from the steam/water mixture by transferring heat to the cooling tower via the circulating water system. The condensate is collected in the condenser hot well.

In addition to condensing boiler-produced steam, the condenser receives flow from main steam dumps, various vents and drains, such as steam turbine shell drains, turbine extraction piping drains, and feed water drains.

The condensate system is made up of the following major mechanical equipments:

- ➢ One shell-and-tube, main condenser, with steam jet air ejector system.
- ➢ Three 50% Can type vertical, centrifugal, motor-driven condensate extraction pumps. The condensate pumps take suction from the condenser hot well and discharge to the deaerator.

- **Transformer:** The MSSKL complex in-houses one power turbine generator at 11 KV, to meet the electrical power requirements of the complex and export the balance to Maharashtra State Electricity

Distribution Company Ltd. (MSEDCL). Power is stepped down to 433 V for supplying to sugar mill and cogen auxiliaries. Where as for export to the grid, it is stepped up to 132 KV. In normal mode, the STG operates in synchronisation with the MSEDCL grid. In event of any undesirable disturbance in the grid, the plant will island from the grid & continue supplying home load.

Technical Specifications of the New Cogeneration Plant		
	Season	off season
Cane Crushing	3500 TCD	
Design pressure and temperature of steam generation	67 Kg/cm², 495ºC ± 10ºC	
Steam quantity at design conditions	80 TPH capacity (100%)	
Inlet steam condition for TG	64 Kg/cm^2, 490°C	64 Kg/cm^2, 490°C
Pressure & quantity of uncontrolled extraction of DEC turbine	11.5 TPH at 8 Kg/cm^2	10 TPH at 8 Kg/ cm^2
Pressure & quantity of controlled extraction of DEC turbine	61.5 TPH at 2.5 Kg/ cm^2	6.5 TPH at 2.5 Kg/ cm^2
Steam to be condensed	7.0 TPH	46 TPH

Specifications of the old cogen plant that will operate along with the new plant:

Design pressure and temperature of steam generation	21 Kg/cm², 340ºC
Steam quantity at design conditions	35 TPH
Steam to turbine	17.8 TPH
Exhaust temperature	177 °C
Pressure & Quantity of Steam from back pressure turbine	17.80 TPH at 2.5 kg/cm^2
Process Requirement	16.8 TPH at 2.5 kg/cm^2
Condensate for de-superheating	0.6 TPH

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

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The total estimated emission reduction over the entire crediting period of ten years has been given below:

Years	Annual estimation of emission reductions in tonnes of CO_2 e
2008-09[5]	26,010.092
2009-10	26,010.092
2010-11	26,010.092
2011-12	26,010.092
2012-13	26,010.092
2013-14	26,010.092
2014-15	26,010.092
2015-16	26,010.092
2016-17	26,010.092
2017-18	26,010.092
Total estimated reductions	26,0100.92
Total number of crediting years	**10**
Annual average over the crediting Period	26,010.092

A.4.5. Public funding of the project activity:

The project does not involve any public funding from Annex I countries.

SECTION B. Application of a baseline and monitoring methodology

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

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

Reference: Approved consolidated baseline methodology ACM0006 (Version 06)

The methodology also refers to ACM0002 "*Consolidated baseline methodology for grid-connected electricity generation from renewable sources*" (Version 07, 14th Dec 2007) and the "*Combined tool to identify the baseline scenario and demonstrate additionality" (Version 02.1)*

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

The selected methodology ACM0006 (Version 06) is applicable to grid-connected and biomass residue fired electricity generation project activities, including cogeneration plants.

Under this methodology, following project activities are included:

- The installation of a new biomass residue fired power generation plant at a site where currently no power generation occurs (Greenfield power projects); or

[5] The crediting period shall be taken from the date of registration.

- The installation of a new biomass residue fired power generation unit, which replaces or 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); or
- The improvement of energy efficiency of an existing power generation plant (energy efficiency improvement projects), e.g. by retrofitting the existing plant or by installing a new plant that replaces the existing plant; or
- The replacement of fossil fuels by biomass residues in an existing power plant (fuel switch projects).

As MSSKL is partly replacing the existing low pressure configuration, leading to an increase in power/heat generation capacity, it is covered under the second category that is, 'Power Capacity Expansion Projects'. The plant also meets the applicability conditions specified under ACM0006 (Version 06), namely:

- No other biomass types other than biomass residues, as defined in the methodology, are used in the project plant and these biomass residues are the predominant fuel used in the project;
- The implementation of the project has not resulted in an increase of the processing capacity of raw input or in other substantial changes;
- The biomass residues used by the project facility is not stored for more than a year;
- No significant energy quantities, except from transportation or mechanical treatment of the biomass residues, are required to prepare the biomass residues for fuel combustion;

In essence, the project is applicable under ACM0006 (Version 06) as it is a biomass residue based cogeneration plant located in an agro industrial unit, utilizing bagasse supplied by the sugar mill during the season and off-season operation. The electricity produced, after meeting in house demands is supplied to MSEDCL where it displaces electricity produced from thermal power plants.

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

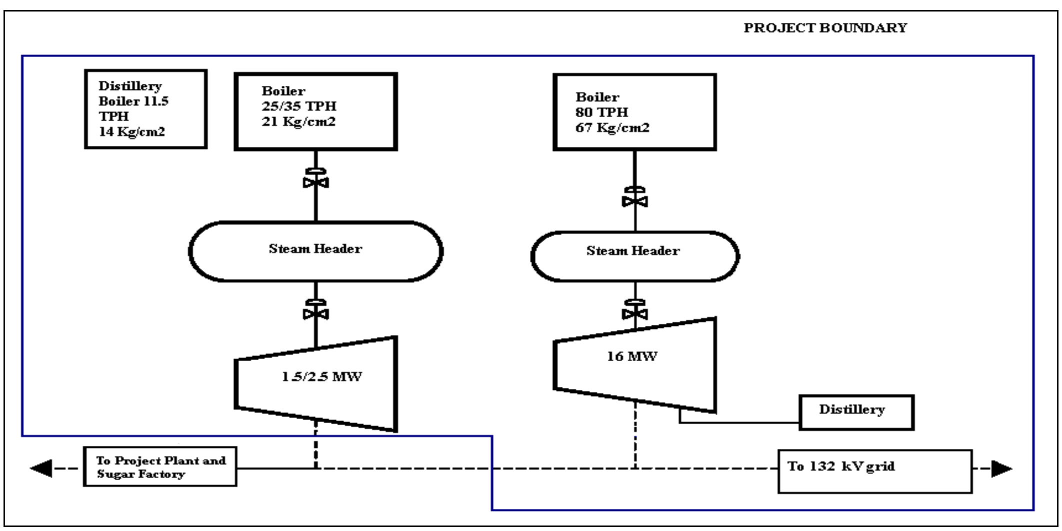

Figure 7: Sources included Within the Project Boundary

For the purposes of the project activity the relevant grid is the power generating units serving the same grid as the project activity. In India there are regional grids through which there is transfer of electricity between states and from the central power stations operating in the region. Maharashtra is part of the Western Region (along with Gujarat, Madhya Pradesh, Chhattisgarh and Goa).

Gases included within the Project Boundary

	Source	Gas	Status	Justification/Explanation
Baseline	Grid electricity generation	CO_2	Included	Main emission source
		CH_4	Excluded	Excluded for simplification. This is conservative
		N_2O	Excluded	Excluded for simplification. This is conservative
	Heat generation	CO_2	Excluded	It is assumed that CO_2 emissions from surplus biomass residues do not lead to changes of carbon pools in the LULUCF sector.
		CH_4	Excluded	Excluded for simplification. This is conservative
		N_2O	Excluded	Excluded for simplification. This is conservative
	Uncontrolled burning or decay of surplus biomass residues	CO_2	Excluded	Excluded for simplification. This is conservative
		CH_4	Excluded	The biomass prior to the project activity was being used in the existing boilers. It was not burnt or left to decay naturally.
		N_2O	Excluded	Excluded for simplification. This is conservative

Project activity	On-site fossil fuel and electricity consumption due to the project activity (stationary or mobile)	CO_2	Included	In the event of firing fossil fuels or use of electricity, this forms the main emission source.
		CH_4	Excluded	Excluded for simplification. This emission source is assumed to be very small.
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be very small.
	Off-site transportation of biomass residue	CO_2	Excluded	The Project does not import fuel from outside hence not required.
		CH_4	Excluded	Excluded for simplification. This emission source is assumed to be very small.
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be very small.
	Combustion of biomass residues for electricity generation and/or heat generation	CO_2	Excluded	It is assumed that CO_2 emissions from surplus biomass do not lead to changes of carbon pools in the LULUCF sector.
		CH_4	Excluded	Excluded for simplification.
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be small.
	Storage of biomass residues	CO_2	Excluded	Excluded for simplification. Since the biomass is stored for not longer than 1 year, this emission source is assumed to be small.
		CH_4	Excluded	Excluded for simplification. Since the biomass is stored for not longer than 1 year, this emission source is assumed to be small.
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be very small

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

The 16 MW cogeneration plant generates electricity from biomass residue that was previously being combusted in low pressure boilers to produce steam and electricity for plant's requirement. The new unit has partly replaced this low configuration plant with higher pressure and temperature configuration resulting in increased electricity production. It is thus able to cater to plant's needs as well as export the surplus to state grid. The MSSKL sugar mill complex supplies the required biomass (bagasse) during the crushing season as well as during the off-season. The electricity generated is partially used for own consumption and partially sold to the state grid, i.e. MSEDCL.

- **Identification of Baseline Scenario**

  The identification of baseline as per ACM0006 (Version 06) methodology requires determination of realistic and credible alternatives regarding:

– How power would be generated in the absence of the CDM project activity;
– What would happen to the biomass residues in the absence of the project activity; and

– In case of cogeneration projects, how the heat would be generated in the absence of the project activity.

For **power** generation, the realistic and credible alternatives may include, *inter alia*:

Baseline Scenario for power generation	Description	Comments
P1	The proposed project activity not undertaken as a CDM project activity	This can be considered as one of the alternatives
P2	The continuation of power generation in an existing biomass residue fired power plant at the project site, in the same configuration, without retrofitting and fired with same type of biomass residues as co-fired in the project activity.	The existing cogeneration plant is in working condition and can meet the electricity and steam requirement of the sugar mill complex hence this can be considered as plausible baseline scenario.
P3	The generation of power in an existing captive power plant, using only fossil fuels	This is not the common practice in the sugar sector. In general sugar plants meet their electricity requirement through cogeneration plant during season and import electricity from the grid for off-season requirements. Hence this does not form a viable option.
P4	The generation of power in the grid.	In absence of project activity, an equivalent amount of power, which is exported by project activity, would be generated in existing and/or new grid-connected power plants. Hence this may be considered as a possible baseline scenario
P5	The installation of a new biomass residue fired power plant that is fired with the same type and with the same annual amount of biomass residues as the project activity, but with a lower efficiency of electricity generation (e.g. an efficiency that is common practice in the relevant industry sector) than the project plant and therefore with a lower power output than in the project case.	This can be considered as a possible scenario.
P6	The installation of a new biomass residue fired power plant that is fired with the same type but	This could have been a viable option in the absence of

	with a higher annual amount of biomass residues as the project activity and that has a lower efficiency of electricity generation (e.g. an efficiency that is common practice in the relevant industry sector) than the project plant. Therefore the power output is the same as in the project case.	proposed project activity.
P7	The retrofitting of an existing biomass residue fired power, fired with the same type and with the same annual amount of biomass residues as the project activity, but with a lower efficiency of electricity generation (e.g. an efficiency that is common practice in the relevant industry sector) than the project plant and therefore with a lower power output than in the project case.	Retrofitting of the existing plant could have improved the efficiency slightly; hence this may be a viable option.
P8	The retrofitting of an existing biomass residue fired power plant that is fired with the same type but with a higher annual amount of biomass residues as the project activity and that has a lower efficiency of electricity generation (e.g. an efficiency that is common practice in the relevant industry sector) than the project activity.	This can be considered as a possible option.
P9	The installation of a new fossil fuel fired captive power plant at the project site.	This is not the common practice in the sugar sector. In general sugar plants meet their electricity requirement through cogeneration plant during season and import electricity from the grid for off-season requirements. Hence this does not form a viable option.

Hence credible options for power generation are:
P1, P2, P4, P5, P6, P7, P8

For **heat** generation, realistic and credible alternative(s) may include, *inter alia:*

Baseline Scenario for Heat generation	Description	Comments
H1	The proposed project activity not undertaken as a CDM project activity	This can be considered as one of the alternatives
H2	The proposed project activity (installation of a cogeneration power plant), fired with the same type of biomass residues but with a different efficiency of heat generation (eg. an efficiency	This can be considered as a credible option.

	that is common practice in the relevant industry sector)	
H3	The generation of heat in an existing captive cogeneration plant, using only fossil fuels	This is not common practice in the sugar industry.
H4	The generation of heat in boilers using the same type of biomass residues.	Can be considered as a possible option in absence of project activity.
H5	The continuation of heat generation in an existing biomass residue fired cogeneration plant at the project site, in the same configuration, without retrofitting ad fired with the same type of biomass residues as in the project activity.	In the absence of the project activity, heat would continue to be generated in the existing plant until the expiry of its technical lifetime which is 13-17 years. Hence this option can form a credible baseline scenario.
H6	The generation of heat in boilers using fossil fuels	Use of fossil fuels exclusively, for heat generation in sugar industries is not the common practice in this region and will also lead to higher baseline emissions. Hence, it cannot be taken as baseline scenario.
H7	The use of heat from external sources, such as district heat	There is no district heating system in the region; hence it cannot be taken as baseline scenario.
H8	Other heat generation technologies (e.g. heat pumps or solar energy)	Installation of other technologies for heat generation only, would be economically unattractive; hence it cannot be taken as baseline scenario.

Hence credible options for heat generation are:
H1, H2, H4, H5

For the use of **biomass**, the realistic and credible alternative(s) may include, *inter alia*:

Baseline Scenario for Biomass generation	**Description**	**Comments**
B1	The biomass residues are dumped or left to decay under mainly aerobic conditions. This applies, for example, to dumping and decay of biomass residues on fields.	Bagasse generated by sugar mills in the region is a useful resource and is not dumped or left to decay in fields. Hence, it cannot be taken as baseline

		scenario.
B2	The biomass residues are dumped or left to decay under clearly anaerobic conditions. This applies, for example, to deep landfills with more than 5 meters. This does not apply to biomass residues that are stock piled or left to decay on fields.	As stated above bagasse is a useful resource and is not left to decay in landfills. Hence this option is not financially viable.
B3	The biomass residues are burnt in an uncontrolled manner without utilizing it for energy purposes.	This option is not viable because bagasse is a useful resource and is not burnt in uncontrolled manner without utilizing it for energy purposes.
B4	The biomass residues are used for heat and/or electricity generation at the project site	In absence of project activity, biomass would have been used for heat and electricity generation in the existing co-generation plant hence this forms a viable baseline scenario.
B5	The biomass residues are used for power generation, including cogeneration, in other existing or new grid connected power plants	SDSSKL was previously selling surplus bagasse in the market and will continue to do so even after the installation of the proposed project activity. The same quantity of bagasse that was being used prior to project activity will be used post project activity. Hence this option will have to be ruled out.
B6	The biomass residues are used for heat generation in other existing or new boilers at other sites.	The biomass was used in the boilers at site for process steam and electricity generation prior to implementation of the project activity. Whatever surplus amount that was sold prior to project activity will continue to be available in the market post project as well. Hence, it cannot be considered as one of the credible baseline scenario.
B7	The biomass residues are used for other energy purposes, such as the generation of biofuels	Generation of biofuels from bagasse is not the prevalent use of bagasse in this region hence this option cannot be considered as a plausible scenario.

B8	The biomass residues are used for non-energy purposes, eg as fertilizer or as feedstock in processes (eg in pulp and paper industry)	Whatever amount of bagasse the mill was using for its cogen plant in the pre project scenario will be required for post project operations as well. Even in the absence of the project activity the mill would have required at least this amount of bagasse hence this cannot be considered as a possible option.

Hence the only credible option for use of biomass in the absence of project activity is:
B4

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

The proposed project activity is utilising bagasse to generate steam, steam to generate power and exhaust steam to meet plant process steam requirements. The power that is generated in the project activity would otherwise have been generated by either operating power plants connected to the grid or the new power plants proposed to be built, resulting in GHG emissions.

In the absence of the project activity following scenarios would have occurred –

- The same quantum of power would have been generated by the existing plant and since power generation by the project activity is more, partly in either the operating power plants connected to the grid or the new power plants proposed to be built,
- The biomass /bagasse, would have been burnt in low efficiency boilers,
- Use of bagasse for steam generation to meet the plant requirements producing power less efficiently.

In all the above cases, or any combination of these, the emission of GHGs, per unit of electricity generated, is more than that in the case of proposed project activity.

Justification for Additionality[6]:

6 http://64.233.183.104/search?q=cache:Aba9LgD5uY4J:www.thegef.org/Documents/Project_Proposals_for_Endorsem/India_-_Removal_of_Barriers_to_Biomass_Power_Generation_Part_I.pdf+The+Government+of+Maharashtra+has+been+active+in+establishing+a+policy+framework+which+will+be+conducive+since+1993-94,+mostly+in+line+with+Ministry+of+Non+-+Conventional+Energy+Sources+(MNES)+guidelines.&hl=en&ct=clnk&cd=3&gl=in

To test whether the project is additional or not, the chosen baseline methodology includes "Combined tool to identify the baseline scenario and demonstrate additionality (Version 02.1) developed by the Meth Panel and approved by the CDM Executive Board in its 28th meeting. The proposed additionality test consists of a number of requirements the project must fulfill, in order to be considered additional and therefore, not part of the baseline scenario.

As will be shown in the following paragraphs, it is clear that without the incentives derived from the CDM, the benefits generated by the project itself are not enough to overcome the risks associated with the project.

Step 1 Identification of alternative scenarios

Step 1a. Define alternative scenarios to the proposed CDM project activity

The alternative scenarios for proposed project activity are:

For power generation – P1, P2, P4, P5, P6, P7, P8
For heat generation – H1, H2, H4, H5
For use of biomass – B4

Sub step 1b. Consistency with mandatory applicable laws and regulations:

All the alternatives are in compliance with all mandatory applicable legal and regulatory requirements.

Step 2. Barrier Analysis

Sub-step 2a. Identify barriers that would prevent the implementation of alternative scenarios:

Scenario	*Investment Barrier*	*Technological Barrier*	*Lack of prevailing practice*	*Other Barriers*
***P1**- The proposed project activity not undertaken as a CDM project activity*	*The main barrier for any sugar mill to undertake cogeneration with high-pressure configuration (which is more capital intensive as compared to low pressure configuration) is access to finance. The co-operative[7] sugar mills typically distribute their profits as dividends through the cane price to members (sugar cane farmers). In Maharashtra, a majority of the cooperative sugar mills have limited potential to raise loans because of poor financial and liquidity positions[8]. This results in little equity available to mills to undertake investments. The mills*	• *The main operational risks are related to the high-pressure boiler. The problems associated with these boilers are linked to water quality and more complex safety features. The quality of feed water for a high-pressure boiler must be stringently adhered to due to the potential for scaling. To combat this problem, the water has to be de-mineralized and undergoes strict chemical dosing which requires constant monitoring and laboratory analysis again leading to higher*	*Typical of sugar mills in India, SDSSKL was until now using low-pressure boilers to generate steam and backpressure turbo-alternators to provide for electricity within the plant. The standard specifications recommended by Indian Sugar Mills Association (ISMA)[10] were for low pressure boilers and turbines in the sugar industry. The 2003-04 report of MNES[11] mentions that as late as 2004, 67 kg/cm^2 boilers*	*When MSSKL took the decision in the year 2001 to proceed with the cogeneration project for exporting surplus power to the State Utility, there was no clear cut policy of either the state government or the state utility with respect to wheeling, banking, and buy-back of power generated by the cogenerating industries. In addition to this – non remunerative tariff and imposition of electricity duty on self generated power, played deterrent to wide scale generation of electricity from renewable sources.*

[7] The cooperative structure has a democratic framework that allows the election of its governing board. A major problem being faced by the cooperative sugar sector is unprofessional management, lack of foresightedness and absence of decision-making process. The decision-making is delayed because of the high number of people involved in the process. http://www.thehindubusinessline.com/bline/2005/09/16/stories/2005091600371000.htm

[8] Standing Committee on Energy (2005-06), Eighth report Non-conventional energy sources biomass power/co-generation programme an –evaluation.(Ministry of non-conventional energy sources). (Paragraph 2.6) http://164.100.24.208/ls/CommitteeR/Energy/8rep.pdf

	find it especially difficult to accumulate equity given this underlying structure. This situation is compounded by the fact that the returns on the bagasse cogeneration projects are not immediate.[9] *So generating equity for co-operative sugar mills is a big problem.*	*operating costs.* • *As high-pressure co-generation configurations are not widely used in the sugar industries, the required technical staff to operate these systems is also in short supply. MSSKL have faced considerable trouble and risk in recruiting such staff. In order to recruit such technically qualified staff higher remunerations and other incidental facilities would have to be paid leading to higher unit cost of production*	*were still being implemented on trial basis in Cooperative sugar industries. However, departing from the conventional practice at that time when high pressure (67 kg/cm^2) and double extraction cum condensing turbines were being used for bagasse based co-generation only in few cooperative sugar mills in the country, SDSSKL decided to proceed with this high pressure technology, and became only the third mill in Maharashtra in the co-operative sector (as per data from Vasantdada Sugar Institute, Pune, India) to have opted for and commissioned this high-pressure cogeneration technology.*	*The only guidelines available for tariff determination were those that were issued by the Ministry of Non-conventional Energy Sources (MNES) which was also adopted by the state of Maharashtra. In nut shell the policy consisted of following initiatives:* • *The promoter can sell surplus energy to Maharashtra State Electricity Board (MSEB) at the rate of Rs. 2.25 per unit considering 1994-95 as base year and the same will be escalated at the rate of 5% per year for first ten years, for next three years, no change in tariff and for balance seven years again 5% escalation permitted;* • *For co-generation based on bagasse, conventional fuel pass through up to 25% of generation is permitted;*

[10] Specifications included in Annex 5

[11] http://mnes.nic.in/annualreport/2003_2004_English/ch5_pg8.htm

[9] (Source: Agrinergy, July 2005, page 6 http://agrinergy.com/gof_2nd%20quarter%20report_july%202005.pdf)

				• *Evacuation arrangement will be made by MSEB; and* • *.Exemption from electricity duty.* *However these policy measures were only executive guidelines issued by State Governments to respective electricity boards and lacked legislative backbone as a result only six sugar factories in Maharashtra had set up cogeneration units with the aim of supplying power to grid by the end of March 1999*[12] *as opposed to the vast potential available.* ***MERC Tariff Order*** *As the Maharashtra State Electricity Regulatory Commission was in its formative stage, its 1st Tariff Order of 5th May 2000 stated "the Commission will look into the matter of sale of surplus*

[12] www.powermin.nic.in/research/pdf/tariff.pdf

				power by captive power plants to the MSEB at a later stage[13] *……"* *Even though the commission encouraged the state utility to purchase power from renewable sources, it did not mention any specific scheme to fix the rate of such procurement. It was only in the second Tariff Order dated 16th August 2002 that the tariff scheme was laid down.* ***Conflicting claims made by stakeholders in Maharashtra Bagasse based cogeneration case*** *The principal issue that needed to be resolved was what should be the rational tariff that will attract investment for development of non fossil fuel projects and at the same time it will not have adverse impact on retail tariff of the utility - MSEB. Various stakeholders made its*

[13] In the matter of determination of tariff applicable to various categories of consumers of the Maharashtra state electricity board. Date of Order: May 5, 2000. (Page 145) http://www.mercindia.org.in/orders.htm

				resolution difficult on account of conflicting claims. For example: • *MSEB from the very beginning was of the opinion that they do not need this 'infirm' power and should be compensated either through government subsidy or 100% pass through in tariff*[14]*;* • *The project developers maintained that the tariff fixed by MNES is not giving them adequate return in the initial years of the project life;* • *The consumer representatives argued that RE promotion should be undertaken at government's costs and not at the cost of consumers;* • *Energy experts would not agree on the costing methodology – opinions varied from cost plus to long run marginal cost; and* • *The MNES admission that the basis for tariff fixation at*

[14] (Source: MERC Order of August 16th 2002 http://www.mercindia.org.in/pdf/16082002.pdf

				Rs.2.25 (Rupees two and paisa twenty-five only) per unit of electricity sold to SEB for the base year 1994-95 was the tariff of Rs. 2.50 (Rupees two and paisa fifty only) per unit worked out for the Independent Power Producer (IPP) projects in that year. *Therefore, keeping in view the recommendations of the State Advisory Committee, and after careful consideration of all the objections, the views of technical consultants and experts, issues raised during the public hearing, submissions made by Project Developers, consumer representatives, and after carrying out detailed project analysis for a group of proposals received by MSEB, the Commission passed its order in 2002 which became applicable to all cogeneration plants supplying electricity to MSEB.*
Hence this option has to be ruled out				
***P2**- The continuation of*	*The existing cogen plant is in operating condition and **no***	*The low pressure technology that is currently being used is*	*The prevailing practice in sugar mills in India is use*	*None*

power generation in an existing biomass residue fired power plant at the project site, in the same configuration, without retrofitting and fired with same type of biomass residues as co-fired in the project activity.	***investment** will be required to continue operating this plant.*	*well established and as such the continuation of existing facility would not have faced any technical barrier.*	*of low pressure boilers.*	
This is a viable option				
***P4**- The generation of power in the grid.*	***No investment** would be required.*	*None*	*Not Applicable*	*None*
This is a viable option				
***P5**- The installation of a new biomass residue fired power plant that is fired with the same type and with the same annual amount of biomass residues as the project activity,*	*The life of the existing plant is 12-18[15] and it can meet the power and steam needs of the mill. To scrap this plant and invest in a new plant with similar or slightly higher efficiency as compared to existing plant cannot be justified. Although the investment in this case will be less than the project activity, it will still be a*	*None*	*Not applicable*	*None*

15 Assessed and certified by Milind Sangwikar and Associates (Chartered Engineers and Govt. Reg. Valuers.) vide: MSA/CE/MSSK/2007/45 dated 03/07/2007.

but with a lower efficiency of electricity generation (e.g. an efficiency that is common practice in the relevant industry sector) than the project plant and therefore with a lower power output than in the project case.	*considerable amount and uncalled for.*			
This is not a viable option				

P6- *The installation of a new biomass residue fired power plant that is fired with the same type but with a higher annual amount of biomass residues as the project activity and that has a lower efficiency of electricity generation (e.g. an efficiency that is common practice in the relevant industry sector) than the project plant. Therefore the power output is the same as in the project case.*	*The existing cogen plant is in working condition. To scrap this plant and invest in a new plant with similar or slightly higher efficiency as compared to existing plant cannot be justified.* *Although the investment in this case will be less than the project activity, it will still be a considerable amount and uncalled for. Moreover for firing higher annual amount of fuel, bagasse will have to be bought from the market and this will increase the operating costs further.*	*None*	*Not applicable*	*Availability of bagasse will depend on its demand and supply in the market which can fluctuate from year to year.*
This cannot be considered a viable option				
P7- *The retrofitting of an existing biomass residue fired power, fired with the same type and with the same*	*Since the existing cogeneration plant is in working condition, the cost incurred to do the retrofitting which will improve the efficiency marginally cannot be justified. Although this amount will be much less than*	*None*	*Not applicable*	*None*

annual amount of biomass residues as the project activity, but with a lower efficiency of electricity generation (e.g. an efficiency that is common practice in the relevant industry sector) than the project plant and therefore with a lower power output than in the project case.	*the total cost of proposed project activity, it will not lead to generation of revenue in terms of sale of surplus power as in the case of project activity. Hence instead of investing in retrofitting the cogen plant which will result in no returns, the member farmers will be more interested in investing in the expansion of sugar mill to increase sugar production. Hence investment barrier does exist for this option.*			
This cannot be considered a viable option				
***P8-** The retrofitting of an existing biomass residue fired power plant that is fired with the same type but with a higher annual amount of biomass residues as the project activity and that has a lower efficiency of electricity*	*Since the existing cogeneration plant is in working condition, the cost incurred to do the retrofitting which will improve the efficiency marginally cannot be justified. Although this amount will be much less than the total cost of proposed project activity, it will not lead to generation of revenue in terms of sale of surplus power as in the case of project activity. Hence instead of investing in retrofitting the cogen plant*	*None*	*Not applicable*	*Availability of bagasse will depend on its demand and supply in the market which can fluctuate from year to year.*

generation (e.g. an efficiency that is common practice in the relevant industry sector) than the project activity.	*which will result in no returns, the member farmers will be more interested in investing in the expansion of sugar mill to increase sugar production. Hence investment barrier does exist for this option. Moreover the mill will have to make additional investment for procuring bagasse.*			
This option cannot be considered as a credible alternative				

Scenario	*Investment Barrier*	*Technological Barrier*	*Lack of prevailing practice*	*Other Barriers*
***H1-** The proposed project activity not undertaken as a CDM project activity*	*The barriers are same as compared to P1*			
Hence this option has to be ruled out				
***H2-** The proposed project activity (installation of a cogeneration power plant), fired with the same type of biomass*	*Capital investment will be lower than the proposed project activity but still considerably higher considering the structure of co-operative sugar mills and their difficulty in arranging for finances.*	*None*	*The common practice in sugar factories in India is to go for a 35 - 45*[16] *Kg/cm*^{2} *pressure boiler which takes care of the mill's electricity and process steam*	*None*

[16] www.cogenrio.com.br/Prod/arquivos/bagasse_based_cogeneration.doc

residues but with a different efficiency of heat generation (eg. an efficiency that is common practice in the relevant industry sector)			*requirements. The cogen plant at SDSSKL already has 6 low pressure boilers that are taking care of the mill's steam requirements. If they are replaced with a 45 Kg/cm^2 pressure boiler, the steam generated would be just enough to take care of mill's requirement without export to grid.*	
Not a viable option				
***H4-** The generation of heat in boilers using the same type of biomass residues.*	*High capital investment required for installing a boiler exclusively for heat generation.*	*None*	*This is not the common practice in the sugar industry in India.*	*None*
This option involves more cost as compared to project activity. Moreover this is not usually followed in the Indian Sugar industry				
***H5-** The continuation of heat generation in an existing biomass residue fired cogeneration plant at the project site, in the same configuration,*	*No investment will be required.*	*None*	*Not applicable*	*None*

without retrofitting ad fired with the same type of biomass residues as in the project activity.				
This option can be considered as a credible option				

Scenario	*Investment Barrier*	*Technological Barrier*	*Lack of prevailing practice*	*Other Barriers*
***B4**- The biomass residues are used for heat and/or electricity generation at the project site*	*None*	*None*	*Not applicable*	*None*

Sub-step 2b. Eliminate alternative scenarios which are prevented by the identified barriers:

After eliminating the alternatives that are prevented by one or more barriers listed above, the following are the alternatives that are not prevented by any of the barriers- P2, P4, H5 and B4

Thus in light of P4, P2, H5 and B4 being the probable alternatives for baseline, **Scenario 11** fits the present project activity most appropriately as-

- *The project activity involves the installation of a new biomass residue fired power unit, which is operated next to existing biomass residue fired power generation unit(s).*
- *After the implementation of the project activity, the existing unit(s) continues to operate next to the new power unit as back-up plant.*
- *The biomass residues in the absence of the project activity were being used in the existing power plant(s) at the project site.*
- *The power generated by the new power unit in the absence of the project activity was being generated (a) in the existing plant(s) and – since power generation is more efficient in the project plant than in the existing plant(s) – (b) partly in power plants in the grid.*
- *The efficiency of electricity generation is higher in the new power unit than in the existing unit(s).*
- *The heat generated by the project plant, in the absence of the project activity was being generated in the existing unit(s)*

- *The heat generated per biomass residue input in the project plant is smaller or the same compared to the existing unit(s)*

As demonstrated, there is only one alternative scenario that is not prevented by any barrier, and this alternative is not the proposed project activity undertaken without being registered as a CDM project activity, hence this is the identified baseline scenario.

Registration of the Project activity as CDM project will have following effects

Scenario	*Investment Barrier*	*Technological Barrier*	*Lack of prevailing practice*
Registration of Project activity as CDM project	*As funds will be available from selling of carbon credits investment will not be a barrier anymore.*	*As technological barrier arises from difficulty in operation and handling of high pressure system, with extra funds available the mill can hire more qualified staff for operating the high pressure cogen system.*	*Fiscal incentive by way of CDM funds will attract other sugar mills to adopt this technology which is not only more efficient but will also reduce the usage of conventional fuels for power generation.*

Step 3 Investment Analysis

Investment Analysis has not been carried out for this project

Step 4 Common Practice Analysis

The potential from about 575[17] operating sugar mills spread over 9 major States has been identified at 3,500 MW of surplus power by using bagasse as the renewable source of energy. This involves employment of extra high-pressure boiler configurations of above 60 kg/cm2 (against the conventional 32 kg/cm2 or 42 kg/cm2 pressure boilers used in the sugar mills).

However due a number of factors this potential has not been exploited adequately. The following analysis of MNES schemes states clearly that in spite of subsidies and other schemes to help enhance cogeneration facilities in sugar industries, the potential remained marginalized in the co-operative sugar mill sector.

Biomass Market Segment	MNES Schemes	Brief Review
I. Bagasse Cogen in cooperative sugar mills	• Capital grant / soft loan scheme for 12 demo projects, 1994-99, with 23% grant in aid, 43% soft loan @ 9% & 8% state share capital • Interest subsidy scheme, 1999-2003, equivalent to 2-4% based on pressure configuration, with ceiling of 11% for interest • Capital grant / soft loan scheme for IPP – co-op. / joint sector model for 4 projects in focused states • Prevailing interest subsidy scheme, 4-6% based on pressure configuration, 6% ceiling for interest and US $ 0.85 M upper limit	• 7 projects sanctioned, only one commissioned due to barriers • Very few co-ops. were able to avail this scheme, against large beneficiaries in the private sector, due to financial barriers • No concrete proposals were submitted due to non-availability of standard PDAs and financial, policy & regulatory & structural barriers • Financing barriers still continue, hence the success will be limited No high efficiency cogen plant has been installed in co-op. / joint sectors till date, either on own investment or IPP model, despite large potential

Source: United Nations Development Program, Global Environment Facility[18]

[17] www.cogenrio.com.br/Prod/arquivos/bagasse_based_cogeneration.doc

[18] APPENDIX 5-1

http://www.thegef.org/Documents/Project_Proposals_for_Endorsem/India_-_Removal_of_Barriers_to_Biomass_Power_Generation_Part_I.pdf

An analysis of some of the cases as stated in MERC Order[19] dated August 16, 2002 reflect the status of cogeneration with evacuation of surplus power to state utility in cooperative sugar sector in Maharashtra.

Promoter	Status of PPA as in August 2002	Capacity of the Project	Boiler capacity	Steam Parameters
M/s Kay Pulp Paper Mills Ltd. (Paper Manufacturing company)	Signed on 7th June 2000	6000 KW	32 TPH	45 kg/Sq Cm and 435oC.
M/s Globe Cogeneration Power Limited (Generating Company) in understanding with M/s Ajinkyatara Sahakari Sakhar Karkhana	Pending	30000 KW	120 TPH	105 kg/Sq Cm and 520oC.
M/s Pravara Power Private Limited M/s NUCON Energy Corporation in understanding with Padamshri. Dr. Vittalrao Vikhe Patil SSK Ltd.	Signed on 7th June 2000	35000 KW	2 x 95 TPH	67 kg/Sq Cm and 487oC.
M/s Vaidyanath Sahakari Sakhar Karkhana Ltd. (Cooperative Sugar Factory)	Pending	15000 KW	60 TPH	60 kg/Sq Cm and 480oC.
M/s Jawahar Sahakari Sakhar Karkhana Ltd. (Cooperative Sugar Factory)	Pending	17000 KW	90TPH	45 kg/Sq Cm and 435oC.

Of the five cases, only two are cooperatives and that too the pressure of boiler is less than 67 kg/Sq Cm. All others who have installed boilers working at higher pressure are Electricity generating companies that have entered in an understanding with the sugar mills for supply of raw material. In short, cogeneration in cooperative sugar sector using advanced high pressure boilers was still in its initial stages and not many sugar mills in Maharashtra had gone for it at the time when MSSKL decided to set up its cogeneration unit.

The following table gives an overview of the potential for Bagasse-based Cogeneration in Major Sugar Producing States in India and the installed capacity till December 2002.

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[19] In The Matter of Maharashtra State Electricity Board's (MSEB) Application dated 16th August 2001 And Case Nos. 8/9/10/15/17/18/19/20/21 of 2001 for Purchase of Power from Bagasse based Co-generation Projects and in the matter of aiding the State Government in formulation of Policy. (Page 89-108) http://mercindia.org.in/ORDERS2002.htm#

State	Potential (in MW)[20]	Commissioned till December 31, 2002 (in MW)
Maharashtra	1,000	24.50
Uttar Pradesh	1,000	46.50
Tamil Nadu	350	106.00
Karnataka	300	109.38
Andhra Pradesh	200	160.05
Bihar	200	0
Gujarat	200	0.50
Punjab	150	22.00
Others	100	15.00
Total	3,500	467.93

Thus generation of bagasse based electricity for export to grid is not a common practice in India or in Maharashtra. Sugar mills do employ low pressure boilers for generation of steam and electricity however these are just enough to meet the in-house requirements of the mill and no electricity is exported to the grid. The present activity employs high pressure boiler which enables them to evacuate surplus power to the grid. The only other similar activity to that of the Project activity which has come up in Maharashtra is that of Pandurang SSKL which was commissioned in July 2006 and is in the process of availing CDM benefits. However, at the time when MSSKL took a decision to proceed with the project activity there were no other sugar factories in Maharashtra which had high pressure grid-connected cogeneration facilities.

This clearly shows that investing in projects of this nature is not a common practice and the project activity of MSSKL is additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

The project activity mainly reduces CO_2 emissions through substitution of power generation from fossil fuels by energy generation with biomass. The emission reduction $\boldsymbol{ER_y}$ by the project activity during a given year $\boldsymbol{y}$ is -:

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

Where

ER_y - is the emissions reduction of the project activity during the year y in tons of CO_2,

$ER_{electricity,y}$ - is the emission reduction due to displacement of electricity during the year y in tons of CO_2,

[20] http://mnes.nic.in/business%20oppertunity/pgtbp.htm

$ER_{heat,y}$ -	is the emission reduction due to displacement of heat during the year y in tons of CO_2,
$BE_{biomass,y}$ -	is 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 -	is the project emissions during the year y in tons of CO_2, and
L_y -	is the leakage emissions during the year y in tons of CO_2.

➢ **Emission reductions due to displacement of electricity**

$$ER_{electricity,y} = EG_y * EF_{electricity,y}$$

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 as a result of the project activity (incremental to baseline generation) during the year *y* in MWh,
$EF_{electricity,y}$ -	is the CO_2 emission factor for the electricity displaced due to the project activity during the year *y* in tons CO_2/MWh.

Determination of $EF_{electricity,y}$

The determination of the emission factor for displacement of electricity $EF_{electricity,y}$ depends on the type of project activity and the baseline scenario identified. For ***Scenario 11*** the project activity displaces electricity from other grid-connected sources and the emission factor for the displacement of electricity should correspond to the grid emission factor ($EF_{electricity,y} = EF_{grid,y}$) and $EF_{grid,y}$ shall be determined as follows –

- If the power generation capacity of the biomass power plant is of more than 15 MW, $EF_{grid,y}$ 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).

- If the power generation capacity of the biomass power plant is less or equal to 15 MW, project participants may alternatively use the average CO_2 emission factor of the electricity system, as referred to in option (d) in step 1 of the baseline determination in ACM0002.

Since the power generation capacity is more than 15 MW, option 1 is followed.

For calculation of operating margin four options are available:

(a) Simple operating margin;
(b) Simple adjusted operating margin;
(c) Dispatch data analysis operating margin;

(d) Average operating margin.

According to ACM0002 / version 06, dispatch data analysis should be the first choice but for the MSSKL project dispatch data analysis cannot be used because of unavailability of data.

The simple OM method was used as the low-cost/must run resources constitute less than 50% of the total grid generation of Western Grid in average of the five most recent years.

1. Calculation of operating margin emission factor for the region based on simple OM

The simple OM emission factor ($EF_{OM,\ simple,\ y}$) is calculated as the generation-weighted average emissions per electricity unit (tCO_2/MWh or MU) of all generating sources serving the system, not including low-operating cost and must-run power plants.

$$EF_{OM,y} = \frac{\sum F_{i,j,y} * COEF_{i,j\,y}}{\sum GEN_{j,y}}$$

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 to the grid,

$COEF_{i,j\,y}$ -is the CO_2 emission coefficient of fuel i (tCO_2 / mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources j and the percent oxidation of the fuel in year(s) y, and

$GEN_{j,y}$ -is the electricity (MWh or MU) delivered to the grid by source j.

The CO_2 emission coefficient $COEF_i$ is obtained as

$$COEF_i = NCV_i * EF_{CO2,i} * OXID_i$$

Where:

NCV_i - is the net calorific value (energy content) per mass or volume unit of a fuel *i*,

$OXID_i$ - is the oxidation factor of the fuel.

$EF_{CO2,I}$ - is the CO_2 emission factor per unit of energy of the fuel *i*.

2. Calculation of build margin factor for the region (ex ante):

Build margin can be calculated as the generation weighted average emission factor (tCO_2/MWh or MU) of a sample of power plant *m, as follows:*

$$EF_{BM,y} = \frac{\sum F_{i,m,y} * COEF_{i,m}}{\sum GEN_{m,y}}$$

Where,

$F_{i,m,,y}$, $COEF_{i,m}$ are analogous to the variables described for the simple OM method for plants *m.*

The project developer has adopted option 1 (Ex- ante), which requires calculating the build margin emission factor $EF_{BM,y}$ ex-ante based on the most recent information available on plants already built for sample *m* at the time of PDD submission.

Baseline emission factor (EF y)

The baseline emission factor EFy is calculated as the weighted average of the operating margin emission factor ($EF_{OM,simple,y}$) and the build margin emission factor ($EF_{BM,y}$), where the weights w_{OM} and w_{BM}, by default, are 50% (i.e., $w_{OM} = w_{BM} = 0.5$), and $EF_{OM,y}$ and $EF_{BM,y}$ are calculated as described in Steps 1 and 2 above and are expressed in tCO_2/MWh or MU.

$$EF_{GRID,Y} = 0.5(EF_{OM,y} + EF_{BM,y})$$

➢ **<u>Determination of EG_y</u>**

Electricity generation by the project activity is determined as the difference between

- 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 by the new power unit and the existing power units and the historical generation of the existing power units, based on the three most recent years, and
- The quantity of electricity that could be generated by other power plant(s) using the same quantity of biomass residues that are fired in the project plant,

$$EG_y = MIN \begin{pmatrix} EG_{project\ plant,y} - \varepsilon_{el,other\ plant(S)} * 1/3.6 * \sum BF_{k,y} * NCV_k \\ EG_{total,y} - \frac{EG_{historic,3yr}}{3} \end{pmatrix}$$

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

$EG_{project\ plant,\ y}$ is the net quantity of electricity generated in the project plant during the year y in MWh

$\varepsilon_{el,\ otherplants}$ is the average net efficiency of electricity generation in (the) other power plant(s) that would use the biomass residues fired in the project plant in the absence of project activity, expressed in $MWh_{el}/MWh_{biomass}$

$EG_{total,y}$ is the net quantity of electricity generated in all power units at the project site, generated from firing the same type of biomass residues as in the project plant, including the new power unit installed as part of the project activity and any previously existing units, during the year y (MWh/yr)

$EG_{historic,3yr}$ is the 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 residues as in the project plant. (MWh)

$BF_{k,y}$ is the quantity of biomass residue type k combusted in the project plant during the year y (tons of dry matter or liter)

NCV_k is the net calorific value of the biomass type k (GJ/ton of dry matter or GJ/liter)

- **Emission reductions due to displacement of heat:**

For baseline scenario 11 - $ER_{heat,y} = 0$ as thermal efficiency pre project and post project is same.

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

For the given project activity $BE_{biomass,y} = 0$ as prior to the project activity, the same amount of biomass was being fired in low pressure boilers for generation of steam.

- **Project emissions**

Project emissions include CO_2 emissions from transportation of biomass to the project site (PET_y) and CO_2 emissions from on-site consumption of fossil fuels due to the project activity ($PEFF_y$) and, where this emission source is included in the project boundary and relevant, CH_4 emissions from the combustion of biomass ($PE_{Biomass,CH4,y}$):

$$PE_y = PET_y + PEFF_{CO2,y} + PE_{EC,y} + (GWP_{CH4} * PE_{biomass,CH4,y})$$

Where,

PET_y is the CO_2 emissions during the year y due to transport of the biomass to the project plant in tons of CO_2,

$PEFF_{CO2,y}$ are the CO_2 emissions during the year y due to fossil fuels co-fired by the generation facility in tons of CO_2,

GWP_{CH4} is the Global Warming Potential for methane valid for the relevant commitment period,

$PE_{Biomass,CH4,y}$ is the CH_4 emissions from the combustion of biomass during the year y.

$PE_{EC,y}$	is the CO_2 emissions during the year y due to electricity consumption at the project site that is attributable to the project activity (t CO_2/yr)

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

the cogen plant will use bagasse that's produced in the mill and does not intend to purchase bagasse from outside hence estimation of emission as a result of transportation of bagasse from outside is not required.

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

The project does not propose to use fossil fuels hence emissions as a result of use of fossil fuels is 0. However in the event of use of fossil fuels (either coal for co firing or diesel for power generation) $\mathbf{PEFF_{CO2,y}}$ shall be calculated as

$$PEFF_y = \Sigma(FF_{Project\ plant,\ i,y} + FF_{project\ site,\ i,y}) * NCV_i * COEF_i$$

Where

$FF_{Project\ plant,\ i,y}$	=	Quantity of fossil fuel type i combusted in the biomass residue fired power plant during the year y(mass or volume unit per year)
$FF_{project\ site,\ i,y}$	=	Quantity of fossil fuel type I combusted at the project site for other purposes that are attributable to the project activity during the year y(mass or volume unit per year)
NCV_i	=	Net calorific value of fossil fuel type I (GJ/mass or volume unit)
$COEF_i$	=	CO_2 emission factor for fossil fuel type I (t CO_2/GJ)

c) CO_2 emissions from electricity consumption ($PE_{EC,y}$)

This emission is taken as 0 as there is no electricity consumption as a result of the project activity.
In case electricity is imported from the grid, $PE_{EC,y}$ shall be calculated as

$$PE_{EC,y} = EC_{PJ,y} * EF_{grid,y}$$

$PE_{EC,y}$	=	CO_2 emissions from on-site electricity consumption attributable to the project activity (t CO_2/yr)
$EC_{PJ,y}$	=	On-site electricity consumption attributable to the project activity during the year y (MWh)
EF_{gri}	=	CO_2 emission factor for grid electricity during the year y (t CO_2/MWh)

d) Methane emissions from combustion of biomass residues ($PE_{Biomass,\ CH4}$)

This source has not been included in the project boundary

Leakage

According to methodology ACM0006 (version 06), where the most likely baseline scenario is the use of the biomass residues for energy generation (scenarios 1, 4, 6, 8, 9, 11, 12, 13 and 14), the diversion of biomass residues to the project activity is already considered in the calculation of baseline reductions. In this case, leakage effects do not need to be addressed.

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

(Copy this table for each data and parameter)

Data / Parameter:	**EF_{OM}**
Data unit:	T CO_2/MWh
Description:	Simple Operating Margin Emission Factor
Source of data used:	Baseline CO_2 Emission Database[21] (Version 3.0)
Value applied:	2004-05 -1.01 2005-06 -0.99 2006-07 -0.99
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data is prepared by Central Electricity Authority, GOI.
Any comment:	Average of 3 years data has been considered.

Data / Parameter:	**EF_{BM}**
Data unit:	T CO_2/MWh
Description:	Build Margin Emission Factor
Source of data used:	Baseline CO_2 Emission Database (Version 3.0)
Value applied:	2006-07 - 0.59
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data is prepared by Central Electricity Authority, GOI.
Any comment:	Value for the year 2006-07

Data / Parameter:	**EF_{CM}**
Data unit:	T CO_2/MWh
Description:	Combined Margin Emission Factor
Source of data used:	Baseline CO_2 Emission Database[22] (Version 3.0)

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

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

Value applied:	0.79
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data is prepared by Central Electricity Authority, GOI.
Any comment:	Value for the year 2006-07

Data / Parameter:	**$EG_{Historic, 3 yr}$**
Data unit:	MWh
Description:	The 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 residues as in the project plant.
Source of data to be used:	Calculated from MSSKL log books
Value of applied:	9555.085
Justification of the choice of data or description of measurement methods and procedures actually applied :	This data is submitted to the Electricity Engineer, Government of Maharashtra. Values were recorded from the tri vector meter reading for each of the turbines.
Any comment:	

Data / Parameter:	**$COEF_{coal}$**
Data unit:	Kg/TJ
Description:	CO_2 emission factor for fossil fuel type coal
Source of data to be used:	Default value from 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2
Value of applied:	96100
Justification of the choice of data or description of measurement methods and procedures actually applied :	The value has been taken from 2006 IPCC Guidelines for National Greenhouse Gas Inventories.
Any comment:	Sub bituminous grade of coal has been considered

B.6.3 Ex-ante calculation of emission reductions:

Electricity generated by the project (net electricity generated is calculated by deducting auxiliary consumption from gross generation.)

$$EG_{y} = MIN \left\{ \begin{array}{l} EG_{project\ plant,\ y} - \varepsilon_{el,\ other\ plant(S)} * 1/3.6 * \sum BF_{k,y} * NCV_{k} \\ EG_{total,\ y} - \frac{EG_{historic,\ 3\ yr}}{3} \end{array} \right\}$$

$EG_{project\ plant,y}$ = **47125.8** MWh

Year	Bagasse consumption MT	Gross Electricity Generated MWh	Net electricity Generation (auxiliary consumption @ 10%) MWh
2001-02	172027.142	9592.27	8633.039
2002-03	183823.61	10277.60	9249.840
2003-04	133934.30	5075.38	4567.842
2004-05[23]	40054.76	4166.42	3749.778
2005-06	177398.46	11980.42	10782.378

$\frac{EG_{historic,3\ yr}}{3}$ = 28665.257/3 = 9555.085 MWh

EG $_{Project\ plant}$ = **47125.8** MWh

EG_{Total} = 47125.8 + 4150.6344

= **51276.4344** MWh

$$EG_{total,y} - \frac{EG_{historic,3\ yr}}{3} = 51276.4344 - 9555.085$$

= **41721.3494 MWh**

[23] Although according to the methodology, data for most recent three years should be considered for calculation of $EG_{historic,3\ yr}$, in the present case because of 2003-04 and 2004-05 being drought years, the electricity generation was very less in these years and hence they are not being considered for any calculation in order to get most conservative value.

$$EG_{project\ plant,\ y} - \varepsilon_{el,\ other\ plant(S)} * 1/3.6 * \sum BF_{k,y} * NCV_k$$

$\varepsilon_{el,\ otherplant}$ - for Scenario 11 $\varepsilon_{el,\ otherplant}$ corresponds to the average net efficiency of electricity generation in the existing power plant(s) fired with the same type of biomass residue at the project site.

$$\varepsilon_{el,\ existing\ plant} = \frac{EG_{existing\ plant}}{NCV_k * BF_{k.y}}$$

Where,

$EG_{existing\ plant}$ = net quantity of electricity generated in the existing plant
NCV_k = net calorific value of biomass residue type k (MWh/ton)
$BF_{k,y}$ = quantity of biomass residue type k combusted in the project plant during the year y(tons)

εel, existing plant

Year	Total heat content (MWh)	Net Electricity Generated (MWh)	Efficiency of electricity generation (MWh electricity)/(MWh heat content)
2001-02	353412.242	8633.039	0.024427675
2002-03	377646.886	9249.840	0.024493357
2003-04	275154.382	4567.842	0.016601015
2004-05	82288.42888	3749.778	0.045568715
2005-06	364447.0733	10782.378	0.029585580
Average	**365168.73**	**9555.085**	**0.026168871**

Therefore $\mathbf{EG_y}$

= 47125.8 - 0.026168871*146198/2 * 4.108796

= **39266.00 MWh**

Minimum of these two values is hence 39266.00 MWh

$$EG_y = EG_{project\ plant,\ y} - \varepsilon_{el,\ otherplant} * 1/3.6 * \sum BF_{k,y} * NCV_k$$

Simple Operating Margin Emission factor = 0.99 tons of CO_2/MWh

Build Margin Emission factor = 0.59 tons of CO_2/MWh

Baseline emission factor = $w_{OM} * EF_{OM} + w_{BM} * EF_{BM}$

Where w_{OM} & w_{BM} = 0.5 (Default Values)

Baseline Emission Factor = 0.79 tons of CO_2/MWh

$ER_{electricity} = EG * EF_{electricity}$

$ER_{electricity}$ = 39266 (MWh)/year * 0.79 tons of CO_2/MWh

= 31020.14 tons of CO_2/year

Project emissions
Carbon dioxide emission from coal consumption

$$PEFF_y = \Sigma(FF_{Project\ plant,\ i,y} + FF_{project\ site,\ i,y}) * NCV_i * COEF_i$$

Though the project activity does not propose to use any fossil fuel for co firing in the boiler, however as a conservative approach, the emission from fossil fuel consumption (in the distillery boiler –pre project scenario) of last six years has been considered.

Average FF = 407.72066 MT

$PEFF_y$ = 407.72066 ton/yr * 0.0189 TJ/Ton * 96.1 Ton CO_2/TJ
= 740.539 t CO_2/yr

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

= 0 + 31020.14 + 0 – 740.539 – 0
= **30279.601 tons of CO_2/year**

The values of Operating Margin and Build Margin have been taken from CEA User Guide

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

Year	Total baseline Emissions (tonnes CO_2e /yr.)	Project activity emission (tonnes CO_2e /yr.)	Leakage (tonnes CO_2e / yr.)	Emission reduction (tonnes CO_2e /yr.)
2007-08 Year	31020.14	740.539	0	30279.601
2008-09 Year	31020.14	740.539	0	30279.601
2009-10 Year	31020.14	740.539	0	30279.601
2010-11 Year	31020.14	740.539	0	30279.601
2011-12 Year	31020.14	740.539	0	30279.601

2012-13 Year	31020.14	740.539	0	30279.601
2013-14 Year	31020.14	740.539	0	30279.601
2014-15 Year	31020.14	740.539	0	30279.601
2015-16 Year	31020.14	740.539	0	30279.601
2016-17 year	31020.14	740.539	0	30279.601
Total (tons CO2e)	**310201.4**	**7405.39**	**0**	**302796.01**

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

The approved consolidated monitoring methodology ACM0006 (Version 06): "Consolidated monitoring methodology for grid-connected electricity generation from biomass residues" is used.

The monitoring approach involves, where possible, the direct measurements of the variables required to monitor baseline and project emissions. Commercial data will be collected and archived for the purpose of double-checking the measured data. In one case where direct measurement is not possible, commercial data will be used as the primary data, with an appropriate quality control measure.

Because collection of the relevant data is possible, this approach is applicable to the proposed project activity.

The monitoring methodology involves monitoring of the following:

- Biomass supply and demand for the biomass sources used by the proposed project
- Baseline emissions from grid electricity generation
- Power generated by the plant

Project participants shall establish a system to monitor the amount of all types of biomass combusted. If the amount of biomass combusted is estimated from the amount of biomass delivered to the project site, a procedure shall be established to undertake an energy balance for the verification period, considering the stocks of biomass at the beginning and end of each verification period

B.7.1 Data and parameters monitored:

(Copy this table for each data and parameter)

Data / Parameter:	$EG_{total, y}$
Data unit:	MWh/yr
Description:	Net quantity of electricity generated in all power units at the project site, generated from firing the same type(s) of biomass residues as in the project plant, including the new power unit installed as part of the project activity and any previously existing units, during the year *y*
Source of data to be used:	onsite measurement
Value of data applied for the purpose of	51276.4344

calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Separate metering instruments are attached to each of the generating units to measure the electricity generation separately for each TG set.
QA/QC procedures to be applied:	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)
Any comment:	Will be archived according to internal procedures, until 2 years after the end of the crediting period.

Data / Parameter:	$\mathbf{BF_{k,,y}}$
Data unit:	Tons
Description:	Quantity of biomass residue type k combusted in the project plant during the year y
Source of data to be used:	onsite measurement
Value of data applied for the purpose of calculating expected emission reductions in section B.5	146198
Description of measurement methods and procedures to be applied:	Online measurement of bagasse is carried out. The weight is adjusted for moisture content in order to determine the quantity of dry biomass.
QA/QC procedures to be applied:	The quantity will be crosschecked with the quantity of electricity (and heat) generated and any fuel purchase receipts (if available)
Any comment:	Will be archived according to internal procedures, until 2 years after the end of the crediting period.

Data / Parameter:	$\mathbf{FF_{Project\ plant,\ coal,y}}$
Data unit:	Tons
Description:	Quantity of fossil fuel type coal combusted in the project plant during the year y
Source of data to be used:	On-site measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	407.7207
Description of measurement methods	The quantity is measured using weigh bridge. The quantity should be cross checked with the quantity of electricity (and heat) generated any fuel purchase

and procedures to be applied:	receipts.
QA/QC procedures to be applied:	Cross check the measurements with an annual energy balance that is based on the purchased quantities and stock changes.
Any comment:	Will be archived according to internal procedures, until 2 years after the end of the crediting period.

Data / Parameter:	**NCV_k**
Data unit:	Kcal/kg
Description:	Net calorific value of biomass residue type k (bone dry) fired in existing power plants
Source of data to be used:	Values provided by Thermax Limited
Value of data applied for the purpose of calculating expected emission reductions in section B.5	3550
Description of measurement methods and procedures to be applied:	Measurements will be carried out at reputed laboratory and according to relevant international standards.
QA/QC procedures to be applied:	Check the consistency of the value by comparing it with measurement results as well as its comparison with relevant data sources (eg values in the literature, values used in the national GHG inventory) and default values by the IPCC.
Any comment:	The NCV will be determined for each year during the crediting period.

Data / Parameter:	**NCV_{coal}**
Data unit:	TJ/Ton
Description:	Net calorific value of fossil fuel type coal
Source of data to be used:	Default value from 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.0189
Description of measurement methods and procedures to be applied:	The value has been taken from 2006 IPCC Guidelines for National Greenhouse Gas Inventories. However the calorific value will be determined in reputed laboratory for each year when coal is used.
QA/QC procedures to be applied:	Sub bituminous grade of coal has been considered
Any comment:	The NCV will depend on grade of coal used.

Data / Parameter:	**$FF_{Project\ site,\ i,\ y}$**
Data unit:	Mass or volume unit per year
Description:	Quantity of fossil fuel type *i* combusted at the project site for other purposes that are attributable to the project activity during the year *y*
Source of data to be used:	onsite measurement
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0
Description of measurement methods and procedures to be applied:	Direct measurement of the weight or volume as the case may be.
QA/QC procedures to be applied:	Cross-check the measurements with an annual energy balance that is based on spurchased quantities and stock changes.
Any comment:	Will be archived according to internal procedures, until 2 years after the end of the crediting period.

Data / Parameter:	**$EC_{PJ,\ y}$**
Data unit:	MWh
Description:	On-site electricity consumption attributable to the project activity during the year *y*
Source of data to be used:	onsite measurement
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0
Description of measurement methods and procedures to be applied:	Use of electricity meters. The quantity will be cross checked with power purchase receipts.
QA/QC procedures to be applied:	Cross-check measurement results with invoices for purchased electricity if available.
Any comment:	Will be archived according to internal procedures, until 2 years after the end of the crediting period.

Data / Parameter:	**moisture**

Data unit:	percentage
Description:	Moisture content of the bagasse used in project activity
Source of data to be used:	On-site measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	50
Description of measurement methods and procedures to be applied:	Moisture content will be measured each year in sugar laboratory.
QA/QC procedures to be applied:	Cross check the measurements with previous values to check discrepancies.
Any comment:	Will be archived according to internal procedures, until 2 years after the end of the crediting period.

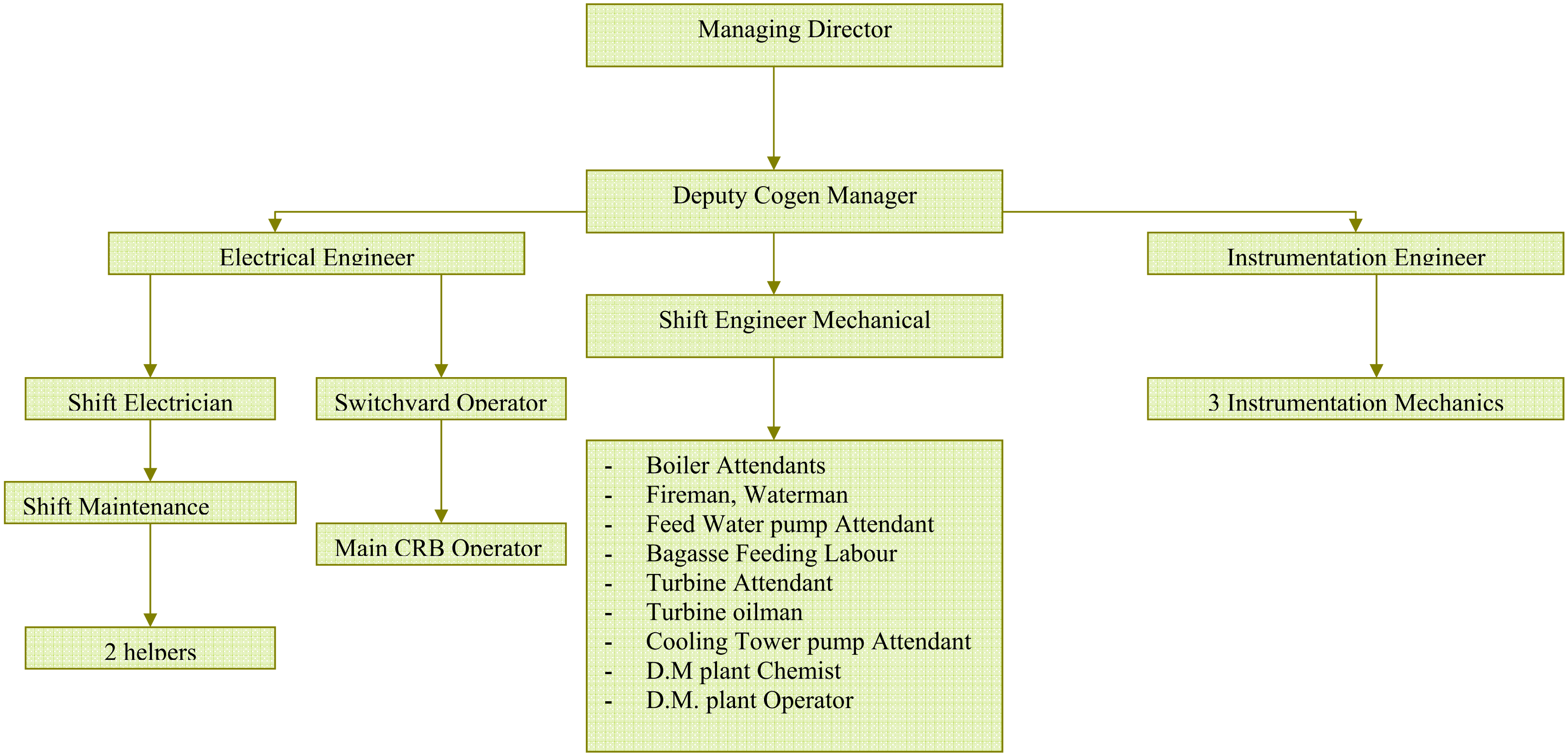
B.7.2 Description of the monitoring plan:

Monitoring Plan

The management of the plant will designate one person to be responsible for the collection of data as per the monitoring methodology. The designated person will collect all data to be monitored as mentioned in this project design document (PDD) and will report to the Managing Director (MD) of the plant. The overall CDM project management responsibility will remain with the MD. The Cogeneration plant will be managed by Deputy Cogen Manager. All records pertaining to electricity generation and bagasse procurement will be maintained by the electrical engineer. The hourly recording of data will be done by shift operators that will be checked and verified by the shift in-charge at the end of each shift. This data will be compiled as a daily report in the formats developed at the site by the Deputy Cogen Manager. This daily report will be sent to the Chief Chemist for verification. The daily reports will be used collectively to prepare a monthly report. The monthly report will be prepared by Deputy Cogen Manager and send to plant MD for verification. The monthly reports will become a part of the Management Information System (MIS) and will be reviewed by the management during the quarterly review meeting.

The meters used for data recording will be calibrated annually as per the current practice and they will be maintained as per the instructions provided by their suppliers. Hence there are no uncertainties or adjustments associated with data to be monitored. The calibration and maintenance of equipments will be looked over by the Instrument Engineer.

An internal audit team, comprising of personnel from the factory but from a department other than Cogeneration, will review the daily reports, monthly reports, procedure for data recording and maintenance reports of the meters. This team will check whether all records are being maintained in a proper manner. All the data and reports will be kept at the offices of the sugar mill until 2 years after the end of the crediting period or the last issuance of CERs for the project activity, whichever occurs later.



Operation and Management Structure

For monitoring the project activity, the approved consolidated monitoring methodology ACM0006 (Version 06): "Consolidated monitoring methodology for grid-connected electricity generation from biomass residues" is used.

The monitoring methodology requires monitoring of the following:

- *Electricity generation from the proposed project activity* – Applicable for the given project
- *Electricity generation from the Existing plants* - Applicable for the given project
- *Data needed to calculate the operating margin emission factor* - Not applicable for the project
- *Data needed to calculate the build margin emission factor* – Not applicable for the project

  Data needed to calculate, if applicable, carbon dioxide emissions from fuel combustion due to co-firing fossil fuels used in the project plant or in boilers operated next to the project plant or in boilers used in the absence of the project activity – Applicable for the given project
- *Data needed to calculate methane emissions from the natural decay or burning of biomass in the absence of the project activity* – Not applicable for project activity
- *Data needed to calculate carbon dioxide emissions from the transportation of biomass to the project plant* – Not applicable for the project
- *Data needed to calculate methane emissions from the combustion of biomass in the project plant* – Not applicable for project activity
- *Data needed to calculate leakage effects from the fossil fuel consumption outside the project boundary*- The project does not lead to any leakage hence not applicable.

All the data collected will be archived electronically or manually or both for a period of two years after the end of crediting period. The storage will be on site in the Deputy Cogen Manager's office.

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

The baseline studies were prepared on 7 / 12 / 2007 by M/s Mula Sahakari Sakhar Karkhana and their consultant, MITCON Consultancy Services Ltd., Pune, Maharashtra

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:

02/04/2001 (based on Boiler Purchase Agreement)

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

20 years 0 months

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

C.2.1. Renewable crediting period

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

Not opted for

C.2.1.2. Length of the first crediting period:

Not applicable

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

The starting date of the crediting period shall be 01/06/2008 or a date not earlier than the date of registration.

C.2.2.2. Length:

10 years 0 months

SECTION D. Environmental impacts

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

Environment Impact Assessment Notification[24] dated 27th January, 1994 (Incorporating amendments made on 04/05/1994, 10/04/1997, 27/1/2000, 13/12/2000, 01/08/2001, 21/11/2001, 13/06/2002, 28/02/2003, 7/5/2003, 4/8/2003, 22/9/2003 and 7/7/2004.) states that "expansion or modernization of any activity (if pollution load is to exceed the existing one), or new project listed in Schedule I to this notification, shall not be undertaken in any part of India unless it has been accorded environmental clearance by the Central Government in accordance with the procedure hereinafter specified in this notification"

Hence all new projects or Expansion and modernization of existing projects or activities listed in Schedule I to the notification have to obtain prior EIA clearance. Cogeneration projects in sugar industries have not been included in this schedule and thus are exempted from conducting environmental

[24] http://www.cseindia.org/programme/industry/eia/existing_notification.pdf

impact assessment prior to their installation. However MSSKL conducted a rapid EIA for its sugar mill expansion as well as cogen plant to ensure that they do not cause negative impact on the environment.

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

Project impacts:

1. Impact due to project location:

Impact on Ecology:

A power plant based on renewable energy source as the fuel does not effect ecology if adequate precautions are taken. There is no threat to bio diversity in the region as a result of this activity. Moreover all the necessary measures are planned to be taken in the design and operation of the plant to minimize the environmental impacts.

2. Impact due to project operation:

Air Pollution:

Atmospheric emissions arise primarily from the by-products of combustion process (SO_2, NOx, particulate fly ash, volatile organic compounds (VOC) and some trace quantities of other materials and are exhausted from the stack. A second source of air emission is the cooling tower and the associated thermal rise plume, which contains heat and some trace materials along with the water vapor.

- Particulate Matter and Gases-

The pollution control regulations limit the particulate matter emission from solid fuel fired steam generators as 115 mg/Ncum. For the proposed plant at MSSKL sugar mill, electrostatic precipitator has been proposed to control the dust emission from the plant to a level less than 115 mg/Ncum. The height of the stack for the 80 TPH boiler has been fixed at 72 meters.

- SO_2 and NO_x Emission-

There is very little sulfur in bagasse and hence the criteria for fixing stack height based on SO_2 emissions is not applicable here.

The temperatures encountered in the steam generator while burning bagasse and biomass are low enough to minimize the nitrogen oxides production.

- Dry ash and Furnace Bottom Ash-

Ash collected from ESP hoppers, air heater hoppers and the ash collected from the furnace bottom hoppers can be used as landfill, during the seasonal operation of the plant. The ash content in bagasse is less than 2% and that in cane trash is 8.19%. The high potash content in the bagasse ash makes it a good soil conditioner.

Water Pollution:

Aqueous discharges arise from a number of sources. These include cooling tower blow-down, sluice water from the bottom ash handling system, boiler chemical cleaning solutions, as well as a variety of low volume wastes including ion exchange regeneration solutions from the de-mineralizing water plants and boiler blow-down.

- Effluent from water treatment plant-

Hydrochloric acid and sodium hydroxide will be used as re-generants in the proposed mixed bed polisher of the water treatment plant. However the quantity of these chemicals used will be low and the frequency very less. The acid and alkali effluents generated during the regeneration process of the ion exchangers would be drained into an epoxy lined underground neutralizing pit. From here the effluents will be pumped into the effluent treatment ponds, which form part of the sugar plants effluent disposal system.

- Steam generator blow down-

The steam generator blow-down has high pH and high temperature. The pH is usually in the range of 9.8 to 10.3 and temperatures are of the order of 100° C. It is proposed to treat the blow-down in the effluent pond after bringing down its temperature.

- Waste water treatment-

Wastewater treatment involves clarification and filtration. Oil or grease is removed by skimming. Finally the effluent is treated for pH control.

SECTION E. Stakeholders' comments

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

MSSKL conducted the local stakeholder consultation meeting for their "16 MW grid – connected electricity generation from biomass residues" on November 29th 2005, 3:00 pm at their Karkhana office.

Stakeholder Consultation:

The local stakeholders are immediately affected by the activities of the project. The effect is manifested mainly in the local environment and socio-economic life of the people. All individuals as well as organizations, which may be affected by the aforementioned project are perceived as stakeholders. They can be within the boundaries of the village, district, state or nation. MSSKL checked out the opinion of the stakeholders on the project, through consultation of stakeholders.

Local Population:

The people living in the vicinity of the project are the ones who will be most affected by the upcoming project activity. As the sugar plant receives its cane supply from the adjoining areas, a good relationship between the project promoters and locals is essential. This is beneficial not only for the project proponents but also for the local population as the cogen plant will lead to demand of manpower right from the construction phase to its day to day operation. Thus a direct result of the project will be increase in employment opportunities in the region. Moreover since the fuel required for the cogen plant is bagasse, the project attaches commercial value to agricultural waste thereby increasing the income of farmers. Because of these factors, the local populace is encouraging the project.

The project did not require displacement of any local population. Thus, the project will not cause any adverse social impacts on local population rather helps in improvising their quality of life.

The project has also secured a no – objection certificate from the Gram Panchayat, Sonai, Taluka – Newasa, Ahmednagar for establishing the power project.

Licensing and Regulatory Authorities:

MPCB has prescribed standards of environmental compliance and monitors the adherence to the standards. The project has already received No Objection Certificate (NOC) from MPCB towards establishing a 16 MW biomass based co-generation project.

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.

The project has sought all the requisite legal and regulatory clearances for establishing this project. These are –

- Maharashtra State Electricity Board – Consent to install generating sets of capacity of 16 MW to generate the electricity and feed to the grid (Letter no. – Co.ord. Cell/Cogen/11444 dated 24.4.2003)
- Maharashtra Pollution Control Board –Consent to establish (Consent no. BO/RONK/A'NAGAR-71/E/312-02/CC-150 dated 7.05.2003)
- Maharashtra Energy Development Agency – Consent to establish (REF: BCP-044/2003-2004/5428 dated 20.10.2003)
- Government of Maharashtra – Environment Clearance (Ref: No. ENV(NOC) 2003/606/CR.95/D.I dated 30.03.2004)

E.2. Summary of the comments received:

No negative comments have been received in context of the project. All stakeholders welcome the project as it is environmentally benign, it generates income and jobs, it supports the development of the nearby rural areas and the state, it helps bridging the gap between the demand and supply of electricity and empowers the local community.

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

No negative comments were received and hence, there was no need to take due account of the comments.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Mula Sahakari Sakhar Karkhana Ltd.
Street/P.O.Box:	Sonai, Taluka – Newasa, District Ahmednagar
Building:	--
City:	Sonai
State/Region:	Maharashtra
Postfix/ZIP:	414105
Country:	India
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Salutation:	Mr.
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

The project has not received any public funding and official development assistance (ODA).

Annex 3

BASELINE INFORMATION

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

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
North	0.98	0.98	1.00	0.99	0.98	1.00	1.00
East	1.22	1.19	1.17	1.20	1.17	1.13	1.09
South	1.02	1.00	1.01	1.00	1.00	1.01	1.00
West	0.98	1.01	0.99	0.99	1.01	1.00	0.99
North-East	0.74	0.71	0.74	0.74	0.90	0.70	0.70
India	1.01	1.02	1.02	1.02	1.02	1.02	1.01

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

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
North					0.53	0.60	0.63
East					0.90	0.97	0.93
South					0.70	0.71	0.71
West					0.77	0.63	0.59
North-East					0.15	0.15	0.23
India					0.69	0.68	0.68

Combined Margin in tCO2/MWh (incl. Imports)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
North	0.76	0.76	0.77	0.76	0.76	0.80	0.81
East	1.06	1.05	1.04	1.05	1.04	1.05	1.01
South	0.86	0.85	0.86	0.85	0.85	0.86	0.85
West	0.87	0.89	0.88	0.88	0.89	0.82	0.79
North-East	0.44	0.43	0.44	0.44	0.52	0.42	0.46
India	0.85	0.86	0.86	0.86	0.86	0.85	0.84

Table B: Values for all regional grids for FY 2000-01 until FY 2006-07, including inter-regional and cross-border electricity transfers.

Calculation of Baseline Emission Factor: Combined margin			
Parameter	**Unit**	**Value**	**Reference**
Simple operating margin(2004-05)	tCO_2/MWh	1.01	CEA CO_2 Baseline database
Simple operating margin(2005-06)	tCO_2/MWh	0.99	CEA CO_2 Baseline database
Simple operating margin(2006-07)	tCO_2/MWh	0.99	
Average Operating Margin (OM)	tCO_2/MWh	0.9967	CEA CO_2 Baseline database
Build Margin (2006-07) (BM)	tCO_2/MWh	0.59	CEA CO_2 Baseline database
Weight of OM (w_{OM})		0.5	ACM0002
Weight of BM (w_{BM})		0.5	ACM0002
Combined Margin (BEF)	tCO_2/MWh	**0.79**	

ELECTRICITY GENERATED BY THE PROJECT

Quarters→ Years↓	March	June	September	December	Total (KWh)
2006	6856040	38950	0	5085430	11980420
2005	460200	0	0	4166420	4166420
2004	3401480	0	0	1673900	5075380
2003	6289090	0	0	3988510	10277600
2002	4508462	1256754	0	3827050	9592266
2001	4734332	2096746	0	3582624	10413702
2000	4778587	4665955	0	2833600	12278142

$\mathbf{EG_{project\ plant,y} = 47125.8\ MWh}$

Year	Bagasse consumption MT	Gross Electricity Generated MWh	Net electricity Generation (auxiliary consumption @ 10%) MWh
2001-02	172027.142	9592.27	8633.039
2002-03	183823.61	10277.60	9249.840
2003-04	133934.30	5075.38	4567.842
2004-05[25]	40054.76	4166.42	3749.778
2005-06	177398.46	11980.42	10782.378

$$\frac{EG_{historic,3\ yr}}{3} = 28665.257/3 = 9555.085\ \text{MWh}$$

$\mathbf{EG_{Project\ plant}}$ = **47125.8** MWh

EG_{Total} = 47125.8 + 4150.6344

= **51276.4344** MWh

$$\mathbf{EG_{total,y} - \frac{EG_{historic,3\ yr}}{3} = 51276.4344 - 9555.085}$$

[25] Although according to the methodology, data for most recent three years should be considered for calculation of $EG_{historic,3\ yr}$, in the present case because of 2003-04 and 2004-05 being drought years, the electricity generation was very less in these years and hence they are not being considered for any calculation in order to get most conservative value.

= **41721.3494 MWh**

$$\mathbf{EG_{project\ plant,\ y} - \varepsilon_{el,\ other\ plant(S)} * 1/3.6 * \Sigma\ BF_{k,y} * NCV_k}$$

$\varepsilon_{el,\ otherplant}$ - for Scenario 11 $\varepsilon_{el,\ otherplant}$ corresponds to the average net efficiency of electricity generation in the existing power plant(s) fired with the same type of biomass residue at the project site.

$$\varepsilon_{el,\ existing\ plant} = \frac{EG_{existing\ plant}}{NCV_k * BF_{k.y}}$$

Where,

$EG_{existing\ plant}$ = net quantity of electricity generated in the existing plant
NCV_k = net calorific value of biomass residue type k (MWh/ton)
$BF_{k,y}$ = quantity of biomass residue type k combusted in the project plant during the year y(tons)

εel, existing plant

Year	Total heat content (MWh)	Net Electricity Generated (MWh)	Efficiency of electricity generation (MWh electricity)/(MWh heat content)
2001-02	353412.242	8633.039	0.024427675
2002-03	377646.886	9249.840	0.024493357
2003-04	275154.382	4567.842	0.016601015
2004-05	82288.42888	3749.778	0.045568715
2005-06	364447.0733	10782.378	0.029585580
Average	**365168.73**	**9555.085**	**0.026168871**

Therefore $\mathbf{EG_y}$

= 47125.8 - 0.026168871*146198/2 * 4.108796

= **39266.00 MWh**

Minimum of these two values is hence 39266.00 MWh

$$EG_y = EG_{project\ plant,\ y} - \varepsilon_{el,\ otherplant} * 1/3.6 * \Sigma\ BF_{k,y} * NCV_k$$

Simple Operating Margin Emission factor = 0.99 tons of CO_2/MWh
Build Margin Emission factor = 0.59 tons of CO_2/MWh

$$\text{Baseline emission factor} = w_{OM} * EF_{OM} + w_{BM} * EF_{BM}$$

Where w_{OM} & $w_{BM} = 0.5$ (Default Values)

Baseline Emission Factor = 0.79 tons of CO_2/MWh

$$ER_{electricity} = EG * EF_{electricity}$$

$ER_{electricity}$ = 39266 (MWh)/year * 0.79 tons of CO_2/MWh

= 31020.14 tons of CO_2/year

Project emissions
Carbon dioxide emission from coal consumption

$$PEFF_y = \Sigma(FF_{Project\ plant,\ i,y} + FF_{project\ site,\ i,y}) * NCV_i * COEF_i$$

Though the project activity does not propose to use any fossil fuel for co firing in the boiler, however as a conservative approach, the emission from fossil fuel consumption (in the distillery boiler –pre project scenario) of last six years has been considered.

Average FF = 407.72066 MT

$PEFF_y$ = 407.72066 ton/yr * 0.0189 TJ/Ton * 96.1 Ton CO_2/TJ
= 740.539 t CO_2/yr

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

= 0 + 31020.14 + 0 – 740.539 – 0
= **30279.601 tons of CO_2/year**

Annex 4

MONITORING INFORMATION

The data needs to be monitored separately for In-season and Off-season.

Project participants shall establish a system to monitor the amount of all types of biomass combusted. If the amount of biomass combusted is estimated from the amount of biomass delivered to the project site, a procedure shall be established to undertake an energy balance for the verification period, considering the stocks of biomass at the beginning and end of each verification period.

The methane emission factor for combustion of biomass in the project plant may be measured if easily available or default values will be used. Monitoring of this parameter is only required where this emission source is included in the project boundary. For the default values or the measurements, project participants shall also determine and document the uncertainty range of the measurement and apply the respective conservativeness factors, as described in the baseline methodology.

For Monitoring of Baseline Emissions:

Data / Parameter:	$EG_{Total, y(gross)}$
Data unit:	MWh
Description:	Gross electricity generated in all power units at the project site, generated from firing the same type(s) of biomass residues as in the project plant, including the new power unit installed as part of the project activity and any previously existing units, during the year *y*
Source of data	On site measurement
Measurement procedures (If any):	Data is monitored through meters and through the electricity bill by the distribution company
Monitoring Frequency:	Continuously
QA/QC procedures:	The consistency of metered gross 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)
Any comment:	Will be archived according to internal procedures, until 2 years after the end of the crediting period.

Data / Parameter:	$EG_{Total, y (auxiliary)}$
Data unit:	MWh
Description:	The auxiliary consumption during the year y.
Source of data	Measured
Measurement procedures (If any):	Data is monitored through meters and through the electricity bill by the distribution company
Monitoring Frequency:	Continuously

QA/QC procedures:	The consistency of auxiliary electricity generation should be cross checked to find whether its comparable to previous years
Any comment:	Will be archived according to internal procedures, until 2 years after the end of the crediting period.

Data / Parameter:	**$EG_{Existing\ Plant,\ y}$**
Data unit:	MWh
Description:	Net electricity generation in the existing plants at the project site fired with same type of biomass residues as in the project activity.
Source of data	On site measurement
Measurement procedures (If any):	Data is monitored through meters.
Monitoring Frequency:	Continuously
QA/QC procedures:	The consistency of electricity generation should be cross checked to find whether its comparable to previous years
Any comment:	Will be archived according to internal procedures, until 2 years after the end of the crediting period.

Data / Parameter:	**NCV_k**
Data unit:	Kcal/kg
Description:	Net calorific value of biomass residue type k
Source of data	Measurements
Measurement procedures (If any):	Measurements to be carried out at reputed laboratory and according to relevant international standards.
Monitoring Frequency:	Every month, taking at least three samples for each measurement
QA/QC procedures:	Check the consistency of the measurements by comparing the measurement results with measurements from previous years, relevant data sources (eg values in the literature, values used in the national GHG inventory) and default values by the IPCC. If the measurement results differ significantly from previous measurements or other relevant data sources, conduct additional measurements.
Any comment:	---

Data / Parameter:	**$BF_{k,y}$**
Data unit:	Tons
Description:	Quantity of biomass residue type k combusted in the project activity
Source of data:	Calculation as well as onsite measurement
Measurement procedures (If any):	During season operation the quantity is back calculated using steam generation from each boiler. This is the practice in all sugar industries in India as on line measurements are not possible. The quantity should be cross checked with the quantity of electricity (and heat) generated any fuel purchase receipts. However during off-season, the quantity is weighed in weigh bridge and fired in

	the boiler.
Monitoring Frequency:	Continuously
QA/QC procedures:	Cross check the measurements with an annual energy balance that is based on the purchased quantities and stock changes.
Any comment:	Will be archived according to internal procedures, until 2 years after the end of the crediting period.

Data / Parameter:	**$FF_{Project\ plant,\ i,y}$**
Data unit:	Tons
Description:	Quantity of fossil fuel type i combusted in the project plant during the year y
Source of data:	On-site measurements
Measurement procedures (If any):	The quantity is measured using weigh bridge. The quantity should be cross checked with the quantity of electricity (and heat) generated any fuel purchase receipts.
Monitoring Frequency:	Continuously
QA/QC procedures:	Cross check the measurements with an annual energy balance that is based on the purchased quantities and stock changes.
Any comment:	Will be archived according to internal procedures, until 2 years after the end of the crediting period.

Data / Parameter:	**$FF_{Project\ site,\ i,y}$**
Data unit:	Mass or volume unit per year
Description:	Quantity of fossil fuel type *i* combusted at the project site for other purposes that are attributable to the project activity during the year *y*
Source of data:	On-site measurements
Measurement procedures (If any):	Weight or volume meter will be used for measurement
Monitoring Frequency:	Continuously
QA/QC procedures:	Cross check the measurements with an annual energy balance that is based on the purchased quantities and stock changes.
Any comment:	This does not include fossil fuels co-fired in the project plant but any other fuel consumption at the project site that is attributable to the project activity (e.g. use of DG sets for emergency purposes)

Data / Parameter:	**Moisture content of the biomass residues**
Data unit:	% water content
Description:	Moisture content of each biomass residue type k
Source of data:	Lab measurement
Measurement procedures (If any):	The instrument used is bomb calorimeter.
Monitoring Frequency:	Twice every year

QA/QC procedures:	Cross check with the average values of the relevant sector.
Any comment:	

Data / Parameter:	**$EC_{PJ,y}$**
Data unit:	MWh
Description:	On-site electricity consumption attributable to the project activity during the year *y*
Source of data:	On-site measurements
Measurement procedures (If any):	Import will be measured using same meter that is used for measurement of export to MSEDCL.
Monitoring Frequency:	continuously
QA/QC procedures:	Cross-check measurement results with invoices for purchased electricity if available.
Any comment:	This value is only with respect to the import for use in project plant and not the sugar plant.

Instrument Specification:

Data Description	Procedure for monitoring	Traceability of instrument calibration	Service and Technical description of instrument	Make of Instrument	Location	Calibration method	LC & Range of instrument	Accuracy class
Bagasse Consumption	On line measurement	Third Party	**Service-** weighing of bagasse	In the commissioning [26] phase	Between the Mill and cogen plant	Calibrated by third party using Standard procedures.	L.C. - Kgs Range: Not Available	Not Available
Electricity Generation	Energy monitoring system, Log Books	Calibration by third party in presence of State Utility	**Service-** Measurement of electricity generation from the T.G. set **Tech. Des.-** Trivector meter	M/s Larson & Tubro Limited	Turbine generation Control room	The metering equipment is sealed and seal is broken only on occasions when the meters are to be inspected, tested or calibrated before the representative of MSEB. Calibration is performed once a year.	LC- 0.5	I
Moisture Content	moisture meter	in house calibration	**Service-** Measurement of moisture content in bagasse	Raidbavi, New Delhi	Sugar lab	calibrated using standard procedures	0-100%	1%
NCV (biomass)	Bomb calorimeter	Third party calibration	**Service-** Measurement of	NA	Accredited Lab	Calibrated by testing compound of known	NA	NA

[26] MSSKL Management has decided to install direct on-line measurement procedure for estimation of quantity of bagasse. As of now the company has invited quotations from various service providers

			heat content in bagasse			calorific value.		
Energy meter for 1.5 MW turbine	Metering	Calibration by third party in presence of State Utility	**Service-** Measurement of electricity generation from the T.G. set **Tech. Des.-** Trivector meter	A.E. Automatic Electric limited Sr no - 09/06/148114/05	1.5 MW control panel	The metering equipment is sealed and seal is broken only on occasions when the meters are to be inspected, tested or calibrated before the representative of MSEB. Calibration is performed once a year.	11KV 800 amp	2.0%
Energy meter for 2.5 MW turbine	Metering	Calibration by third party in presence of State Utility	**Service-** Measurement of electricity generation from the T.G. set **Tech. Des.-** Trivector meter	A.E. Automatic Electric limited Sr no - 09/06/148114/06	2.5 MW control panel	The metering equipment is sealed and seal is broken only on occasions when the meters are to be inspected, tested or calibrated before the representative of MSEB. Calibration is performed once a year.	11KV 800 amp	2.0%

Annex 5

ISMA STANDARD SPECIFICATIONS OF CANE SUGAR PLANTS 2500 TCD EXPANDABLE TO 5000 TCD

continuous capacity at 11 KV at 0.8 power factor at an ambient temp. of 45°C. It shall be designed for a suitable short circuit rating as per State Electricity Board requirement. The alternator end connections shall be made of copper for vertical run for mounting of CTs, etc. Other details as per para (b) (1) above.

(ii) **HT Panel for Main Distribution**

One main distribution panel designed for continuous rating of 9375 KVA at 11 KV at an ambient temp. of 45°C and connected through bus bars to the 11 KV alternator breaker panel. This distribution panel to have one no. draw out type motorised vaccum circuit breaker of 630 amps., 11 KV continuous rating with necessary protective devices, synchronising panel, etc. for supplying electric power to the State Electricity grid. This main distribution panel shall be coupled through bus bar trunking to the HT panel mentioned at b (iii) above for the 4500 KVA turbo set through a 400 amps, 11 KV vaccum circuit breaker. The panel to be complete with ammeters, indicating lamps, interlock, etc.

Alternative No. 3	-	Turbo alternator sets with extraction cum condensing turbines.
For 2500 TCD	-	One turbo alternator set of 12500 KVA (10,000 KW at 0.8 power factor).
For 5000 TCD	-	Addition of one similar turbo alternator set.

The turbo-alternator set shall be suitable for developing continuously 12,500 KVA (10,000 KW at 0.8 power factor) at alternator terminals, three phase, four wire, 50 HZ at normal voltage of 11 KV. The alternator shall be coupled to a multi stage steam turbine having two extraction-cum-condensing stages (having a programmable microprocessor based digital control governor capable of operating as speed or load control) through enclosed reduction gear box. Both the extraction stages shall be fully controlled. The turbine shall have first extraction at a preset pressure of 7 kg/cm2g and second stage at 1 to 1.5 kg/cm2g. The quantity of steam from the two extraction stages may vary from 0-7 tonnes/hour for the first tage and 0-48 tonnes/hr. for the second stage depending upon the process steam requirement. The balance of the steam shall go to the condensing system.

The condensation of the unextracted steam shall be at a pressure of 0.14 kg/cm2 absolute.

The turbine shall be suitable for operation at the following ranges of steam parameters :

INLET STEAM PRESSURE

Maximum	-	45 kg/cm2g
Normal	-	42 kg/cm2g
Minimum	-	37 kg/cm2g

INLET STEAM TEMPERATURE

Maximum	-	440°C
Normal	-	415°C
Minimum	-	390°C

First Extraction stage	-	7 kg/cm2g
Second Extraction stage	-	
Maximum	-	1.5 kg/cm2g

Annex 6

ABBRIVIATIONS

MSSKL	Mula Sahakari Sakhar Karkhana Limited
MSEDCL	Maharashtra State Electricity Distribution Company Limited
KWh	Kilo Watt Hour
GHG	Green House Gas
MSEB	Maharashtra State Electricity Board
MNES	Ministry of Non Conventional Energy Sources (now MNRE)
ISMA	Indian Sugar Mills Association
CEA	Central Electricity Authority
GOI	Government of India
EIA	Environment Impact Assessment
MPCB	Maharashtra Pollution Control Board

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