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

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Annexes

SECTION A. General description of project activity

A.1. Title of the project activity:

>>
18MW bagasse project by Daund Sugar Limited
Version1.1
20/08/2010

A.2. Description of the project activity:

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The proposed CDM project activity is undertaken by Daund Sugar Limited and involves the establishment of a new bagasse based co-generation power plant at a new 3500tcd sugar factory. The project activity is located in Village Alegaon, Taluka Daund, District Pune in the state of Maharashtra, India. The purpose of the project activity is to generate electricity by the combustion of bagasse and use a part of it for captive consumption while the surplus would be exported to the regional NEWNE grid through sale to the Maharashtra State Electricity Board (MSEB).

The proposed plant comprises of a 100 tonnes per hour boiler and a turbo generator set of 18 MW installed capacity. The boiler would generate steam at 87 kg/cm^2 pressure and 515 $\pm$5^{o}C temperature. The turbo generator set is of the double extraction cum condensing type.

The plant is located about 5 km from the nearest 132 kV grid sub-station at Daund. The power will be generated at 11kV and will be stepped up to 132 kV and exported to the MSEB grid. The power for consumption at the adjacent sugar factory will be stepped down to 415V using step down transformer. The necessary transmission lines from the power plant to the substation would be laid by the project owner.

The turbine generator will be powered by the combustion of bagasse, a co-product of the sugar production process, and will therefore be a renewable source of electricity. The project thus proposes to reduce GHG emissions by displacing the existing fossil fuel dominated grid based electricity with biomass based renewable electricity. In the absence of the project activity, the project proponent would install a low pressure boiler firing the same quantity of bagasse and the power generated by the project plant would in the absence of the project activity be generated partly in the reference plant and partly in the power plants in the grid.

As described in Section B.4, the baseline for the project activity is scenario four of the methodology which states that:
"*The project activity involves the installation of a new biomass residue fired power and heat plant at a site where no power was generated prior to the implementation of the project activity. In the absence of the project activity, a new biomass residue fired power and heat plant (in the following referred to as "reference plant") would be installed instead of the project activity at the same site and with the same thermal firing capacity but with a lower efficiency of electricity generation as the project plant (e.g. by using a low-pressure boiler instead of a high-pressure boiler). The same type and quantity of biomass residues as in the project plant would be used in the reference plant. Consequently, the power generated by the project plant would in the absence of the project activity be generated (a) in the reference plant and – since power generation is larger in the project plant than in the reference plant – (b) partly in*

power plants in the grid. In case of cogeneration projects, the following conditions apply: The reference plant would also be a cogeneration plant; the heat generated by the project plant would in the absence of the project activity be generated in the reference plant."

The production of renewable energy contributes to sustainable development through the reduction of GHG emission in the region. The project will also provide direct and indirect employment opportunities to the local community.

The sustainable development potential of the project activity is highlighted through the following broad categories:

Contribution to socio-economic well-being:
The project makes a significant contribution to the development of local community as it provides an important source of direct and indirect employment to the surrounding area. The plant is expected to create employment in the area, a number of whom will be skilled boiler and turbine operators and engineers.

Contribution to environmental well-being:
The generation of renewable electricity will also reduce the dependence on existing and planned fossil fuel based generation. This will have a positive impact not only through the reduction in emissions of greenhouse gases associated with such generation, which is predominantly fossil fuel based in this region, but also through a reduction in the emissions of other harmful gases (NO_x and SO_x) that arise from the combustion of coal. This not only helps in conserving coal (a non renewable energy resource) but also lead to a reduction in ash generation since ash content in bagasse (3-4%) is lower than that of Indian coal (30-40%)[1]

Contribution to technological well-being:
The CDM project activity will lead to transfer of environmentally safe and sound technologies that are comparable to best practices in order to assist in up gradation of the technological base. The transfer of technology is within the country.

A.3. Project participants:

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Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	If Party wishes to be considered as a project participant
India (host)	Daund Sugar Limited	No
United Kingdom of Great Britain and Northern Ireland	Agrinergy Pte Ltd	No
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.		

The contact details are listed in Annex I.

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[1] www.coal.nic.in

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

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A.4.1.1. Host Party(ies):

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India

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

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Maharashtra

A.4.1.3. City/Town/Community etc.:

>>
Village Alegaon, Taluka Daund, District Pune

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

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The project activity is located in Village Alegaon, Taluka Daund, District Pune in Maharashtra. The geographical co-ordinates of the site are:

Latitude	19°8’ North
Longitude	77°9’ East

The following map shows the exact location of the project activity:

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

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Category 1: Energy industries (renewable - / non - renewable sources)

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

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There was no power generation on the site prior to the implementation of the project activity. However as described in Section B.4, in the absence of the project activity the following equipments would have been installed which is taken as the conventional reference plant for a sugar factory of 3500tcd cane crushing capacity.

Boiler

Steam output: 80 tons per hour

Steam pressure: 45 kg/cm^2

Steam temperature: 450 $\pm$5 ^oC

Turbine

Type: Backpressure type

Capacity: 5MW
Steam pressure: 43 kg/cm^2
Steam temperature: 440$\pm$5 ^{o}C

The reference plant has been chosen based on the conventional system put in place in sugar factories and reflects the captive requirements of the sugar factory without any excess electricity for export to the grid. In the absence of requirement for export to the grid, the sugar factory co-generation power system would only be required to produce power for the sugar factory during the season and hence a backpressure turbine would have been set up.

The project activity produces renewable energy from the combustion of bagasse, a renewable biomass. The project activity comprises of a new boiler of 100 tph capacity and a turbo generator set of 18 MW. The boiler is designed to operate at 87 kg/cm^2 pressure and 515 $\pm$5^{o}C temperature. The technical specifications of the equipments are given below:

Boiler:
Steam output: 100 tons per hour
Steam pressure: 87 kg/cm^2
Steam temperature: 515 $\pm$5 ^{o}C

Turbine
Type: double extraction cum condensing type
Capacity: 18MW
Steam pressure: 87 kg/cm^2
Steam temperature: 515 $\pm$5 ^{o}C

Bagasse would have been the only biomass residue used in the baseline and will also be the only biomass residue used in the project activity. As defined in Section B.4, the quantity of bagasse burned under the baseline is equal to the quantity of bagasse burned in the project activity. The power generated at 11KV is stepped upto132 KV and exported to MSEB grid. The transmission line from the power plant to the substation would be laid by the project owner. The power for consumption at the adjacent sugar factory will be stepped down to 415V using step down transformer. The project activity will supply power to the grid and captive consumption in the below ratio:

	MW
Captive	
Season	4.96
Off-season	1.94
Export to grid	
Season	12.54
Off-season	16.06

The technology employed will comply with industry standards and all national environmental legislation. Prior to commissioning, an electrical and boiler inspection will be undertaken by the state agencies. Hence it would be ensured that the project activity would install environmentally safe technology.

There is no transfer of technology to the host country since the technology is available in and supplied from India.

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

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A 10 year fixed crediting period has been chosen.

Years	**Annual estimation of emission reductions in tonnes of CO_2e**
Year 1	43,518
Year 2	47,257
Year 3	47,257
Year 4	47,257
Year 5	47,257
Year 6	47,257
Year 7	47,257
Year 8	47,257
Year 9	47,257
Year 10	47,257
Total estimated reductions (tonnes of CO_2e)	**468,831**
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	**46,831**

A.4.5. Public funding of the project activity:

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There is no public funding involved in the project activity.

SECTION B. Application of a baseline and monitoring methodology

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

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The project activity follows the following methodology:
Version 10.1 of ACM0006 "Consolidated methodology for electricity generation from biomass residues in power and heat plants"

In line with the application of the methodology the project draws on element of the following tools and methodology:
Version 02.2 **"**Combined tool to identify the baseline scenario and demonstrate additionality"
Version 2 "Tool to calculate the emission factor for an electricity system"

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

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The methodology is applicable under the following conditions:

"This methodology is applicable to biomass residue fired electricity generation in power and heat plants, including cogeneration plants. This methodology is not applicable to power-only plants."
The project activity is the combustion of bagasse, a renewable biomass, to produce power and heat in a cogeneration process. Bagasse is considered a biomass residue since it is a residue from sugar manufacturing process which utilizes a agricultural product, sugarcane. Hence the methodology is applicable to the project activity.

"The installation of a new biomass residue fired power and heat plant at a site where currently no power generation occurs (Greenfield power projects)"
The project activity is a new power plant and hence meets the criteria (Greenfield power project).

"No other biomass types other than biomass residues are used in the project plant and these biomass residues are the predominant fuel used in the project plant"
All the biomass used at the site qualifies under the definition of biomass residues as outlined in the methodology, i.e. the bagasse is a residue of sugar manufacturing process and no other types of biomass will be used. In the case of the project the biomass will be bagasse which is generated from the crushing of sugar cane. The project activity thus satisfies the criteria.

"For projects that use biomass residues from a production process (e.g. production of sugar or wood panel boards), the implementation of the project shall not result in an increase of the processing capacity of raw input (e.g. sugar, rice, logs, etc.) or in other substantial changes (e.g. product change) in this process"
The implementation of the project does not result in an increase in the processing capacity of the raw input or any other changes in the sugar manufacturing process as the adjacent sugar factory is new. The project is being set up along with a Greenfield sugar factory and it will be ensured that there are no process changes which would increase the raw input capacity of the sugar factory.

"The biomass residues used by the project facility should not be stored for more than one year"
The biomass used by the project will not be stored for more than one year.

"No significant energy quantities, except from transportation or mechanical treatment of the biomass residue, are required to prepare the biomass residues for fuel combustion, i.e. projects that process the biomass residues prior to combustion (e.g. esterification of waste oils)"
The bagasse is not prepared prior to its use in the boilers, the bagasse is transferred from the crushing process directly to the boiler and thus the project activity is applicable under the criteria. The remaining bagasse during the season will be stored and used during off-season. No bagasse will be brought from outside.

From the above it is concluded that the project activity meets all the applicability conditions of the methodology ACM0006 version 10 "Consolidated methodology for electricity generation from biomass residues in power and heat plants".

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

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As per the applied version of the methodology, for the purpose of determining GHG emissions of the project activity, the following emission sources are to be included:

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

There is no fossil fuel combustion at the project activity site and no off site transportation as the project activity would be utilising the bagasse from the adjacent sugar factory at the project site itself and hence these have not been included in the boundary.

For the purpose of determining baseline emissions, the following emission sources need to be included:

- *CO_2 emissions from fossil fuel fired power plants at the project site and/or connected to the electricity system;*

- *CO_2 emissions from fossil fuel based heat generation that is displaced through the project activity.*

Since there is no displacement of fossil fuel based heat generation by the project activity, the CO_2 emissions from the fossil fuel fired power plants connected to the electricity system have been neglected.

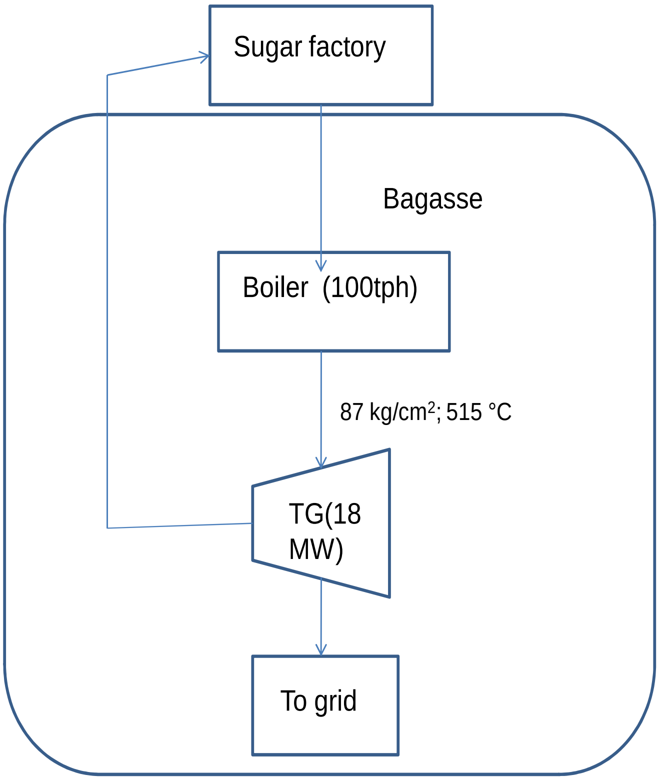
- *Where the most likely baseline scenario for biomass is that the biomass would be dumped or left to decay or burned in an uncontrolled manner project participants may decide whether to include CH_4 emissions in the boundary*

As the bagasse is not dumped or left to decay or burned in an uncontrolled manner without utilizing it for energy purposes so CH_4 emissions arising from the same have not been considered in the baseline emissions.

Also as per the methodology –
"*The **spatial extent** of the project boundary encompasses:*

- *The power plant at the project site;*
- *The means for transportation of biomass residues to the project site (e.g. vehicles);*
- *All power plants connected physically to the electricity system that the CDM project power plant is connected to. The spatial extent of the project electricity system, including issues related to the calculation of the build margin (BM) and operating margin (OM), is further defined in the "Consolidated baseline methodology for grid-connected electricity generation from renewable sources. (ACM0002);"*

The project boundary is clearly depicted in the below diagram:



Project boundary

Therefore the spatial extent of the project boundary encompasses the power plant at the project site and all the power plants connected physically to the electricity system that the project activity is connected to.

The project boundary includes the equipments installed for the operation of a new power plant, the elements of which are boiler, turbine, condenser, step up plant/transformers, transmission lines and the grid. The project activity would be using the bagasse generated from the adjacent sugar factory owned by the project owners and hence no transportation occurs.

For the purpose of the project activity the relevant grid is defined by the power generating units serving the same grid as the project activity. In line with the tool to calculate the grid emission factor, which states that "*If the DNA of the host country has published a delineation of the project electricity system and connected electricity systems, these delineations should be used*", we have considered the regional NEWNE grid that is delineated by the Central Electricity Authority of India.
In the case of India there are regional grids which facilitate the transfer of electricity between states and which are supplied by central sector power stations operating in the region. The Indian power system is divided into two grids for the purposes of calculating the grid emission factor, namely the integrated Northern, Eastern, Western, and North-Eastern regional grids (NEWNE) and the Southern grid. Maharashtra is a part of the Western Region as per the grid definitions outlined by the CEA and we have therefore analyzed the NEWNE grid as given by the CEA in order to determine the baseline emission factor for electricity generation. This includes a complete analysis of the power plants that the project activity will affect. The description of the sources included in the project boundary as per Table 3 of the applied methodology is summarized below:

	Source	**Gas**	**Included?**	**Justification /Explanation**
Baseline	Grid electricity generation	CO_2	Yes	Main emission source
		CH_4	No	Excluded for simplification as per the methodology. This is conservative
		N_20	No	Excluded for simplification as per the methodology. This is conservative
	Heat generation	CO_2	Yes	Main emission source
		CH_4	No	Excluded for simplification as per the methodology. This is conservative
		N_20	No	Excluded for simplification as per the methodology. This is conservative
	Uncontrolled burning or decay of surplus biomass residues	CO_2	No	As per the methodology 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	No	Emissions from

				uncontrolled burning or decay of biomass are not included in the application of the methodology to the particular baseline scenario identified and therefore these sources are therefore not accounted for in project activity emissions.
		N_20	No	Excluded for simplification as per the methodology. This is conservative
Project activity	On site fossil fuel and electricity consumption due to the project activity	CO_2	No	There is no fossil fuel due to the project activity and hence has been excluded.
		CH_4	No	Excluded for simplification as per the methodology. This is conservative
		N_20	No	Excluded for simplification as per the methodology. This is conservative
	Off-site transportation of biomass residues	CO_2	No	The bagasse to be used for power generation is supplied by the sugar mill itself and hence there is no emissions arising from the transport of bagasse.
		CH_4	No	Excluded for simplification as per the methodology. This emission is assumed to be very small
		N_20	No	Excluded for simplification as per the methodology. This emission is assumed to be very small
	Combustion of biomass residues for heat/electricity generation	CO_2	No	It is assumed that CO_2 emissions from surplus biomass do not lead to

				changes of carbon pools in the LULUCF sector.
		CH_4	No	This emission source must be included if CH_4 emissions from uncontrolled burning or decay of biomass residues in the baseline scenario are included. However this is not the case in project activity and hence the source is not included.
		N_20	No	Excluded for simplification. These emissions are assumed to be very small as per the methodology.
	Storage of biomass residues	$C0_2$	No	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	No	Excluded for simplification. Since biomass residues are stored for not longer than one year, this emission source is assumed to be small.
		N_20	No	Excluded for simplification as per the methodology. The emissions are assumed to be very small.

B.4. Description of how the <u>baseline scenario</u> is identified and description of the identified baseline scenario:

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We have used the latest approved version of the "Combined tool to identify the baseline scenario and demonstrate additionality" to identify the most plausible baseline scenario.

Step 1: Identification of alternative scenarios:

Sub-step 1a: Define alternative scenarios to the proposed CDM project activity

The methodology lists the alternative scenarios for each of the outputs of the project activity, namely power, heat and biomass. The following section analyses each of these in turn to arrive at the most credible baseline scenarios.

For Power generation there are 11 possible alternative scenarios:

Baseline scenario for Power Generation	**Description**	**Comments**
P1	The proposed project activity not undertaken as CDM	This is an alternative scenario.
P2	The continuation of power generation in an existing biomass residue fired power and heat plant at the project site, in the same configuration, without retrofitting and fired with the same type of biomass residues as (co-) fired in the project activity.	This is a Greenfield project and there is no existing power plant at the site. Thus this scenario is not applicable.
P3	The generation of power in an existing captive power and heat plant, using only fossil fuels	This is a Greenfield project and there is no existing power plant at the site. Thus this scenario is not applicable.
P4	The generation of power in the grid.	In the absence of the project activity the equivalent power exported by the project activity would be generated in existing and/or new grid connected power plants. Hence it is a credible alternative baseline scenario.
P5	The installation of a new biomass residue fired power and heat plant, 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 is a credible alternative baseline scenario.
P6	The installation of a new biomass residue fired power and heat 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. Therefore, the power output is the same as in the project	The amount of biomass residues fired would be the same and not higher. Hence this is not a credible alternative scenario.

	case	
P7	The retrofitting of an existing biomass residue fired power and heat plant, 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	The proposed project activity is a new power plant and hence this scenario is not applicable.
P8	The retrofitting of an existing biomass residue fired power and heat 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	The proposed project activity is a new power plant and hence this scenario is not applicable.
P9	The installation of a new fossil fuel fired captive power and heat plant at the project site	Use of fossil fuels for power generation would be economically unattractive since it involves buying of fossil fuel from outside. This would also lead to higher baseline emissions and thus is not a plausible baseline scenario.
P10	The installation of a new single- (using only biomass residues) or co-fired (using a mix of biomass residues and fossil fuels) cogeneration plant with the same rated power capacity as the project activity power and heat plant, but that is fired with a different type and/or quantity of fuels (biomass residues and/or fossil fuels). The annual amount of biomass residue used in the baseline scenario is lower than that used in the project activity.	Use of fossil fuels for power generation would be economically unattractive and would lead to higher baseline emissions and thus is not a plausible baseline scenario. Moreover co-firing of biomass residues and fossil fuel would require purchasing of fossil fuel from outside. Since the sugar factory produces enough bagasse hence co-firing will not be done.
P11	The generation of power in an existing fossil fuel fired cogeneration plant co-fired with biomass residues, at the project site.	There is no existing fossil plant at the site and hence this is not a credible alternative scenario.

The proposed project activity is the cogeneration of power and heat. For heat generation, realistic and credible alternative(s) may include;

Baseline scenario	**Description**	**Comments**

for Heat Generation		
H1	The proposed project activity not undertaken as a CDM project activity	This is an alternative scenario.
H2	The proposed project activity (installation of a power and heat plant), fired with the same type of biomass residues but with a different efficiency of heat generation (e.g. an efficiency that is common practice in the relevant industry sector).	This can be considered as one of the credible alternative scenarios. In the absence of the project activity the project owners would have set up a conventional power plant to meet the captive requirements of the sugar factory.
H3	The generation of heat in an existing captive power and heat plant, using only fossil fuels.	There is no existing captive cogeneration plant and hence this is not a credible alternative scenario.
H4	The generation of heat in boilers using the same type of biomass residues.	The scenario implies that only heat is generated and this is only likely to arise where the sugar factory requires additional heat when there is an existing cogeneration unit established already. As this is not the case and therefore not applicable.
H5	The continuation of heat generation in an existing biomass residue fired power and heat plants at the project site, in the same configuration, without retrofitting and fired with the same type of biomass residues as in the project activity.	Since the project activity is new power plant this scenario is not applicable.
H6	The generation of heat in boilers using fossil fuels	The use of fossil fuels for these boilers would make it unattractive since these have to be brought from outside. Also it would lead to higher baseline emissions and hence is not a credible alternative scenario. http://scclmines.com/downloads/coalprice.htm
H7	The use of heat from external sources, such as district heat	There is not district heating system in the region and hence is not a credible scenario.
H8	Other heat generation technologies (e.g. heat pumps or solar energy)	Installation of technologies for heat generation only would be economically unattractive and hence cannot be taken as baseline scenario.
H9	The installation of a new single- (using only	Use of fossil fuels for heat

	biomass residues) or co-fired (using a mix of biomass residues and fossil fuels) power and heat plant with the same rated power capacity as the project activity power and heat plant, but that is fired with a different type and/or quantity of fuels (biomass residues and/or fossil fuels). The annual amount of biomass residue used in the baseline scenario is lower than that used in the project activity	generation would be economically unattractive and would lead to higher baseline emissions. Given that the biomass is supplied from the adjacent sugar factory it will be consumed in the power plant thus ruling out this alternative. Also the quantity of biomass burned in the project activity will be equal to that burned in the baseline plant

For use of biomass residues, the realistic and credible alternative scenarios may include:

Baseline scenario for Biomass	**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 is a useful resource and hence would not be dumped or left to decay.
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-piled2 or left to decay on fields	Bagasse generated by sugar mills is typically combusted in low pressure boilers and hence would not be dumped or left to decay in anaerobic conditions.
B3	The biomass residues are burnt in an uncontrolled manner without utilizing it for energy purposes.	Bagasse generated by sugar mills is typically combusted in low pressure boilers in the cogeneration plants and hence will not be burnt in an uncontrolled manner without utilizing it for energy purposes.
B4	The biomass residues are used for heat and/or electricity generation at the project site	In the absence of project activity the biomass residues would have been used for heat and/or electricity generation in a cogeneration system with lower efficiency than the project plant. Hence this is considered as a credible baseline scenario.
B5	The biomass residues are used for power generation, including cogeneration, in other existing or new grid-connected power and heat plants	To satisfy its heat requirements the project proponent would have used the biomass at the site in a new co generation system with a lower efficiency than the project plant. This is hence not a credible alternative scenario.

B6	The biomass residues are used for heat generation in other existing or new boilers at other sites	To satisfy its heat requirements the project proponent would have used the biomass at the site in a new co generation system with a lower efficiency than the project plant. This is hence not a credible alternative scenario.
B7	The biomass residues are used for other energy purposes, such as the generation of biofuels	To satisfy its electricity and heat requirements the project proponent would have used the biomass at the site in a new co generation system with a lower efficiency than the project plant. Moreover the technology for the generation of biofuels (cellulosic ethanol) from biomass is not available in India. This is hence not a credible alternative scenario.
B8	The biomass residues are used for non-energy purposes, e.g. as fertilizer or as feedstock in processes (e.g. in the pulp and paper industry)	To satisfy its electricity and heat requirements the project proponent would have used the biomass at the site in a new co generation system with a lower efficiency than the project plant. The biomass residues would hence have not been used for non energy purposes e.g. fertilizer/ feedstock etc and used in the cogeneration process. This is hence not a credible alternative scenario.

Among all the identified alternatives, the most credible baseline alternatives are:

For Power: P1, P4 and P5
For Heat: H1 and H2
For Biomass: B4

Outcome of Step 1a:
The plausible alternatives to the project activity are therefore chosen as:

1. The combination of P4, P5, H2 and B4 represents scenario 4 of the methodology which states that:
   "*The project activity involves the installation of a new biomass residue fired power and heat plant at a site where no power was generated prior to the implementation of the project activity. In the absence of the project activity, a new biomass residue fired power and heat plant (in the following referred to as "reference plant") would be installed instead of the project activity at*

the same site and with the same thermal firing capacity but with a lower efficiency of electricity generation as the project plant (e.g. by using a low-pressure boiler instead of a high-pressure boiler). The same type and quantity of biomass residues as in the project plant would be used in the reference plant. Consequently, the power generated by the project plant would in the absence of the project activity be generated (a) in the reference plant and – since power generation is larger in the project plant than in the reference plant – (b) partly in power plants in the grid. In case of cogeneration projects, the following conditions apply: The reference plant would also be a cogeneration plant; the heat generated by the project plant would in the absence of the project activity be generated in the reference plant."

2. The combination of P1 and H1 i.e. the project activity undertaken without CDM revenues.

In the absence of the project activity the following equipments would have been installed which is taken as the reference plant for a sugar factory of 3500tcd cane crushing capacity.

Boiler
Steam output: 80 tons per hour
Steam pressure: 45 kg/cm^2
Steam temperature: 450 $\pm$5 ^{o}C
Turbine
Type: Backpressure type
Capacity: 5MW
Steam pressure: 43 kg/cm^2
Steam temperature: 440$\pm$5 ^{o}C

Sub-step 1b: Consistency with mandatory applicable laws and regulations
Both the above alternatives are in compliance with the mandatory laws and regulations of the host country. There is no regulation governing the installation of power plants in sugar factories.

Outcome of Step 1b:
The plausible alternatives to the project activity are therefore:
1. Scenario 4 of the applicable methodology
2. The proposed project activity undertaken without CDM

The other steps as outlined in the combined tool are detailed in the section below in the demonstration of additionality.

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):

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CDM Consideration
In line with Annex 22, EB49 since the start date of the project activity is after 2nd August 2008, the project proponents have notified the Designated National Authority (DNA) of India and the UNFCCC about their intention to seek CDM status. The start date of the project activity as defined in Section C.1.1 is 10/11/2008 and the notification was sent on 21st April 2009 i.e. within 6 months of the project activity start date. The emails and letters will be provided to the validator during the validation.

Latest version of the "Combined tool to identify the baseline scenario and demonstrate additionality" has been used to demonstrate additionality for the project activity.

Step1: Identification of alternatives

As defined in Section B.4 the plausible alternative is

1. Scenario 4 of the applicable methodology
2. The proposed project activity undertaken without CDM

Step2: Barrier analysis

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

The alternative no. 2 i.e. the proposed project activity undertaken without CDM has the following barriers associated to its implementation.

Barriers due to prevailing practice:

The project activity which involves the implementation of high pressure boiler for the co-generation project is among one of its kind in the region. Most of the sugar industries operating in the region continue to use low pressure or medium pressure boilers for co-generation purposes. Prior to the mid 1970s, the steam pressure used in majority of the turbines was in the range of 10-15[2] kg/cm^2. The majority of the boiler systems in Indian sugar mills operate at a pressure of 21 ata and temperature of 340 ^{0}C, although some mills employ 14 ata/265^{0}C or 32 ata/380^{0}C steam systems. In the mid-1980's, a few Indian sugar mills installed slightly higher pressure (42 ata) boilers. The decision to install higher pressure boilers is largely dependent on two technical issues, one being the availability of high-pressure boilers and turbine generators in the local market and the confidence of the mill's staff in operating and maintaining higher pressure systems. This demonstrates that the usage of high pressure boilers is not being practised in the sugar industry and hence is not a prevalent practice.

The project activity cogeneration plant is designed to operate with boiler outlet steam configuration of 87 kg/cm^2 and 515^{0}C. The plant will give around 7[3] % more power output than the most of the cogeneration plants designed with boiler outlet steam parameters of 67 kg / cm^2 and 485 ^{o}C and 23 % more than normal configuration in India of 45 kg / cm^2 and 390^{0}C with back pressure turbine. Very few bagasse based cogeneration power plants are designed with the above mentioned high pressure and temperature parameters in India. However the technology is well proven worldwide and is now being applied to cogeneration plants. In India also, a couple of plants with 87 kg / cm^2 pressure and 515 ^{0}C temperature configurations have been commissioned and are operating successfully.

Outcome of Step 2a

The barriers that may prevent one or more alternative scenarios to occur have been identified above.

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

The above discussed barriers are faced by P1 and H1. The barriers to the project activity are not applicable to the other identified alternatives i.e. P4, P5, H2 and B4 as they are prevailing practices and

[2] Promotion of biomass co-generation with power export in the Indian Sugar Industry
http://www.netl.doe.gov/technologies/carbon_seq/refshelf/articles/india.pdf

[3] www.mnes.nic.in

business as usual scenario. Whilst the above barriers are significant but they are not conclusive to a major barrier in the implementation of the project activity without CDM.

As per the combined tool – "*If there are still several alternative scenarios remaining, including the proposed project activity undertaken without being registered as a CDM project activity, proceed to Step 3 (investment analysis).*"

Step 3: Investment analysis

This step serves to determine which of the alternative scenarios in the short list remaining after Step 2 is the most economically or financially attractive. For this purpose, an investment comparison analysis is conducted for the remaining alternative scenarios after Step 2. We have thus chosen levelized cost of electricity generation in Rs/MJ as the financial indicator.

The levelized cost of steam is calculated using the following formula, adopted from the formula for the levelized electricity cost[4]:

$$EGC = \Sigma\ [(I_t + M_t + F_t)\ (1+r)^{-t}]\ /\ \Sigma\ [E_t\ (1+r)^{-t}]$$

Where:

EGC Average lifetime levelized Energy Generation Cost (Mn Rs/T)

I_t Investment expenditure (Mn Rs)

M_t Operations and maintenance expenditure (Mn Rs)

F_t Fuel expenditures in year t (Mn Rs)

E_t Energy generation in year t (T steam)

r Discount factor

For the project scenario:

The following costs have been included for calculating the financial costs:

Parameter	Value	Basis of Assumption
Total project cost	893.223 Mn Rs	Detailed Project Report
Operation and Maintenance expenditure	22.33 Mn Rs	2.50% of TPC for the first year as per MERC with 5% escalation for the first 10 years.
Fuel (Bagasse cost)	0 Rs	DPR. The sugar mill will supply bagasse to the cogeneration plant for power generation and power plant will supply the power and steam to sugar factory free of

[4] Ref : **Projected Costs of Generating Electricity**, Nuclear Energy Agency, International Energy Agency & Organisation for Economic Co-operation and Development, 2005, p.174

		cost as a barter arrangement.
Interest on working capital	0.83 Mn Rs	DPR
Energy generation in the year	1109620512 MJ in first year and 1125646848 MJ from second year onwards	Calculated value
r (discount factor)	0.138[5]	PLR at the time of investment decision
T	20 years	Detailed Project Report

Using the formula as stated above the cost of levelized generation for the project activity without CDM is **0.13 Rs/MJ**

With CDM revenues

Parameter	Value	Basis of Assumption
Total project cost	893.22 Mn Rs	Detailed Project Report
CDM expenses	1.2 Mn Rs for the first year and 0.5Mn Rs from year 2 onwards	
Operation and Maintenance expenditure	22.33 Mn Rs	2.5% of Total Project Cost for the first year as per MERC with 5% escalation for the first 10 years.
Fuel (Bagasse cost)	0 Mn Rs	DPR. The sugar mill will supply bagasse to the cogeneration plant for power generation and power plant will supply the power and steam to sugar factory free of cost as a barter arrangement.
Interest on working capital	0.83 Mn Rs	DPR
Energy generation in the year	1109620512 MJ in first year and 1125646848 MJ from second year onwards	It is a calculated value.
r (discount factor)	0.138[6]	PLR at the time of investment decision
T	20 years	Detailed Project Report
CER price	€14/ CER	
Exchange rate	INR 67	

Using the formula as stated above the cost of levelized generation for the project activity with CDM is **0.10 Rs/MJ**

[5] http://www.rbi.org.in/scripts/WSSView.aspx?Id=12835

[6] http://www.rbi.org.in/scripts/WSSView.aspx?Id=12835

For the reference plant

Parameter	Value	Basis of Assumption
Total project cost	250Mn Rs	Quotations given by manufacturers
Operation and Maintenance expenditure	6.25 Mn Rs	2.50% of TPC for the first year as per MERC with 5% escalation for the first 10 years.
Fuel (Bagasse cost)	0 Mn Rs	The sugar mill would have supplied bagasse to the cogeneration plant for power generation and power plant would have supplied the power and steam to sugar factory free of cost as a barter arrangement.
Interest on working capital	0.23 Mn Rs	
Energy generation in the year	956102400.00 MJ	Calculated value. The calculations are shown in Annex 3
r (discount factor)	0.138[6]	PLR at the time of investment decision
T	20 years	

Using the formula as stated above the cost of levelized generation for the project activity is **0.04 Rs/MJ**

Sensitivity Analysis
Sensitivity analysis has been conducted to assess whether the conclusion regarding the financial attractiveness is robust to reasonable variations in the critical assumptions. The sensitivity analysis has been done in accordance with EB 51, Annex 58 '*Guidance on the Assessment of Investment Analysis'* paragraph 17 and 18. The results of variation in various input parameters are tabulated below:

	Investment Cost		
	-10%	Base Case	10%
Rs/MJ without CDM	0.12	0.13	0.14
Rs/MJ with CDM	0.09	0.10	0.11
Rs/MJ reference plant	0.04	0.04	0.05

	Net Energy Generation		
	-10%	Base Case	10%
Rs/MJ without CDM	0.14	0.13	0.12
Rs/MJ with CDM	0.11	0.10	0.06
Rs/MJ reference plant	0.05	0.04	0.04

	O&M expenses		
	-10%	Base Case	10%
Rs/MJ without CDM	0.13	0.13	0.12
Rs/MJ with CDM	0.10	0.10	0.09
Rs/MJ reference plant	0.05	0.04	0.05

Outcome of Step 3

It is evident from above that the investment analysis is conclusive and the financially most attractive alternative scenario is considered as the baseline scenario i.e. from the above calculations the cost of levelized generation for the reference plant is much lower than that for the project scenario making the project scenario financially unattractive for the project owner to undertake. The sensitivity analysis undertaken strengthens the argument in identifying the baseline scenario. Hence CDM revenues are essential for the implementation of the project activity.

Step 4: Common practice analysis

The share of electricity from cogeneration projects in India's total installed capacity is small. According to the statistics published by the Ministry of Nonconventional Energy Sources (MNES), the estimated potential for power generation from cogeneration is 5000 MW (as of September 2008)[7]. Out of this only 993.83MW is achieved for the whole of India[5]. India's total installed generation capacity is 124,287 MW.[8] Thus the cogeneration sector contributes to only 4 % of the total installed capacity in India[9]. Currently, India has 92 cogeneration power projects with an aggregate capacity of 760 MW. The MNES indicates that an estimated potential of about 19,500 MW of biomass to power projects exists in India including cogeneration. However, the percentage of installed capacity of cogeneration power in India is still only 2.25 % of the potential and majority from Sugar Mills. In Maharashtra, the total installed capacity of power generation from cogeneration is 32.50 MW (as of 2005) whereas state's total installed capacity is around 33,242.76 MW in 2008[10]. Thus the cogeneration sector's contribution to the state's installed capacity stands at a mere 0.09 %. As of March 2005 only 8 projects were successfully

[7] http://www.mnre.gov.in/akshayurja/sept-oct-2008-e.pdf

[8] http://en.wikipedia.org/wiki/States_of_India_by_installed_power_capacity

[9] Reference for all figures in this paragraph Ministry of Non-conventional Energy Sources(www.mnes.nic.in)

[10] Ministry of Power, Government of India (www.powermin.nic.in)

commissioned with a total 32.5MW capacity in Maharashtra and 7 more were under implementation[11]. Also in the past few years sugar mills in the western state of Maharashtra have been facing various problems due to the low cane availability combined with low rainfall. Out of the 143 sugar mills, 118 have been shut down as of March 17th 2009[12]. This further re-iterates the need for CDM revenues for the project activity as there is a major risk undertaken by the project proponent in the establishment of this project activity. As of November 2008 there are 11 sugar factories in India having grid-connected co-gen at the time of commissioning[13]. Out of that, 5 of them are operating at 87 bar and 515 ^{0}C and are all at some stage of obtaining CDM registration. All of these projects are also in Uttar Pradesh and a few in Karnataka, there is not a single project in the state of Maharashtra, which establishes that the project activity is not common practice in the region.

Based on the above steps it may be satisfactorily concluded that the project activity is not a baseline scenario and hence is clearly additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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The project activity reduces CO_2 emissions through substitution of power and heat generation with fossil fuels by energy generation with biomass residues. The emission reductions are calculated as follows:

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

Where:

ER_y	Emissions reductions of the project activity during the year y (tCO_2/yr)
$ER_{electricity,y}$	Emission reductions due to displacement of electricity during the year y (tCO_2/yr)
$ER_{heat,y}$	Emission reductions due to displacement of heat during the year y (tCO_2/yr)
$BE_{biomass,y}$	Baseline emissions due to natural decay or burning of anthropogenic sources of biomass residues during the year y (tCO_2e/yr)
PE_y	Project emissions during the year y (tCO_2/yr)
L_y	Leakage emissions during the year y (tCO_2/yr)

Project emissions

As per the applicable methodology, the possible sources of project emissions include:

1. *CO_2 emissions from transportation of biomass residues to the project site (PET_y);*
   The bagasse to be used in the project activity is supplied by the adjacent sugar mill and there is no transportation involved and hence there are no emissions associated with the transportation of the biomass residues.

2. *CO_2 emissions from on-site consumption of fossil fuels due to the project activity ($PEFF_y$);*
   As the project activity does not involve fossil fuel combustion there are no emissions associated with the fossil fuel combustion due to the implementation of the project activity. A DG set will be installed at the sugar factory for emergency purpose but since this is a part of the baseline and

[11] *mnre.gov.in/booklets/Book2-e.pdf.*

[12] http://in.reuters.com/article/businessNews/idINIndia-38545620090317

[13] Independent study carried out by STM Projects Limited

would have been set up with the baseline reference plant, project emissions from this have not been considered.

3. *CH_4 emissions from the storage of biomass residues ($PE_{Biomass}, CH_{4,y}$)*
   The emissions from the storage of biomass are considered negligible if they are not stored for more than a year. The bagasse used for the project activity will not be stored for more than a year.

4. *CO_2 emissions from electricity consumption*
   There is no on –site CO_2 emissions attributable to the project activity and hence this value is zero.

5. *Where waste water from the treatment of biomass residues degrades under anaerobic conditions CH_4 emissions from waste water.*
   Not applicable to the project activity.

Thus there are no project emissions attributable to the project activity.

Emission reductions due to displacement of electricity

Emission reductions due to the displacement of electricity are calculated by multiplying the net quantity of increased electricity generated with biomass residues as a result of the project activity (EG_y) with the CO_2 baseline emission factor for the electricity displaced due to the project ($EF_{electricity,y}$), as follows:

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

Where:

$ER_{electricity,y}$	Emission reductions due to displacement of electricity during the year y (tCO_2/yr)
EG_y	Net quantity of increased electricity generation as a result of the project activity (incremental to baseline generation) during the year y (MWh)
$EF_{electricity,y}$	CO_2 emission factor for the electricity displaced due to the project activity during the year y (tCO_2/MWh)

Step 1: Determination of $EF_{electricity,y}$

As per the applied methodology, in the case of the project activity - "*The emission factor for the displacement of electricity corresponds to the grid emission factor $EF_{electricity,y} = EF_{grid,y}$*".

Moreover the methodology states – "*If the power generation capacity of the project 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)*". The grid emission factor has been fixed ex-ante and taken from published Central Electricity Authority (CEA) database[14] which has calculated it using ACM0002.

Step 2: Determination of EG_y

In case of scenario 4, EG_y is the difference between the electricity generation in the project plant and the quantity of electricity that would be generated in the other power plant using the same quantity of biomass that is fired in the project plant as follows:

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[14] http://www.cea.nic.in/planning/c%20and%20e/database_publishing_ver5.zip

$$EG_y = EG_{projectplant,y} - \varepsilon_{el,otherplant(s)} * \frac{1}{3.6} * \sum_k BF_{k,y} * NCV_k$$

Where:

EG_y	Net quantity of increased electricity generation as a result of the project activity (incremental to baseline generation) during the year y (MWh)
$EG_{project\ plant,y}$	Net quantity of electricity generated in the project plant during the year y (MWh)
$\varepsilon_{el,other\ plant(s)}$	Average net energy 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 the project activity ($MWh_{el}/MWh_{biomass}$)
$BF_{k,y}$	Quantity of biomass residue type k combusted in the project plant during the year y (tons of dry matter or liter)
NCV_k	Net calorific value of the biomass residue type k (GJ/ton of dry matter or GJ/liter)

Emission reductions or increases due to displacement of heat

In case of scenario 4, heat and electricity would in the absence of the project activity be generated in a similar cogeneration plant but with a different configuration, i.e. the efficiency of power generation in the reference plant is lower than that in the project plant. The efficiency of heat generation, i.e. the heat generated per quantity of biomass residue fired, may differ between the project plant and the reference plant. To address the substitution effect for all Scenarios, the methodology suggests two approaches. In case of the proposed project activity we have chosen the first approach wherein we have demonstrated that the efficiency of heat generation i.e. thermal efficiency in the proposed project plant is larger compared to the thermal efficiency of the reference plant in the baseline scenario and then assumed that $ER_{heat,y}$ =0.

Description	Baseline configuration	Project configuration
Pressure (kg/cm^{2})	45	87
Temperature (deg Celsius)	490	515
Capacity (tph)	80	100
Enthalpy in (kcal)	105	170
Enthalpy out (kcal)	793.50	818.40
NCV (kcal/kg)	1813	1813
Boiler efficiency (%)	70	71
Plant efficiency (on NCV)	68.35%	89.25%

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

In case of scenario 4 the biomass residues would not decay or be burnt in the absence of project activity and hence $\boldsymbol{BE_{biomass,y}} = \mathbf{0}$

Leakage:

As per the methodology since the baseline scenario is 4, the diversion of biomass residues to the project activity is already considered in the calculation of baseline emissions and hence leakage effects need not be addressed.

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

Data / Parameter:	$EF_{grid,y}$
Data unit:	tCO_2/MWh
Description:	CO_2 emission factor for the electricity displaced due to the project activity during the year *y*
Source of data used:	Central Electricity Authority http://cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm CO_2 baseline database, version 05
Value applied:	0.84
Justification of the choice of data or description of measurement methods and procedures actually applied :	This value has been provided for the NEWNE grid in India by the Central Electricity Authority (CEA), a government body.
Any comment:	Specified *ex-ante*

Data / Parameter:	**OM**
Data unit:	tCO_2/MWh
Description:	Operating Margin for grid
Source of data used:	Central Electricity Authority http://cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm CO_2 baseline database, version 05
Value applied:	1.01
Justification of the choice of data or description of measurement methods and procedures actually applied :	This value has been provided for the NEWNE grid in India by the Central Electricity Authority (CEA), a government body.
Any comment:	

Data / Parameter:	**BM**
Data unit:	tCO_2/MWh
Description:	Build Margin for the grid
Source of data used:	Central Electricity Authority http://cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm CO_2 baseline database, version 05
Value applied:	0.68
Justification of the choice of data or description of measurement methods and procedures actually	This value has been provided by the Central Electricity Authority (CEA), a government body, for the NEWNE grid in India.

applied :	
Any comment:	

Data / Parameter:	$\varepsilon_{el,reference\ plant(s)}$
Data unit:	($MWh_{el}/MWh_{biomass}$)
Description:	Average net energy efficiency of electricity or heat generation in the reference plant that would be constructed in the absence of the project activity
Source of data used:	Based on power generation and bagasse consumption in the reference plant
Value applied:	0.051
Justification of the choice of data or description of measurement methods and procedures actually applied :	The values have been calculated as per the Heat Mass Balance Diagrams given by a third party consultant, Esbee Power Company.
Any comment:	Specified Ex-ante

B.6.3. Ex-ante calculation of emission reductions:

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The project activity mainly reduces CO_2 emissions through substitution of power and heat generation with fossil fuels by energy generation with biomass residues. The emission reduction is calculated as follows:

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

Where:

ER_y	Emissions reductions of the project activity during the year y (tCO_2/yr)
$ER_{electricity,y}$	Emission reductions due to displacement of electricity during the year y (tCO_2/yr)
$ER_{heat,y}$	Emission reductions due to displacement of heat during the year y (tCO_2/yr)
$BE_{biomass,y}$	Baseline emissions due to natural decay or burning of anthropogenic sources of biomass residues during the year y (tCO_2e/yr)
PE_y	Project emissions during the year y (tCO_2/yr)
L_y	Leakage emissions during the year y (tCO_2/yr)

Emission reductions due to displacement of electricity

Emission reductions due to the displacement of electricity is calculated as calculated by multiplying the net quantity of increased electricity generated with biomass residues as a result of the project activity (EG_y) with the CO_2 baseline emission factor for the electricity displaced due to the project ($EF_{electricity,y}$), as follows:

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

Where:

$ER_{electricity,y}$	Emission reductions due to displacement of electricity during the year y (tCO_2/yr)
EG_y	Net quantity of increased electricity generation as a result of the project activity (incremental to baseline generation) during the year y (MWh)
$EF_{electricity,y}$	CO_2 emission factor for the electricity displaced due to the project activity during the year y (tCO_2/MWh)

Step 1: Determination of $EF_{electricity,y}$
The emission factor for the displacement of electricity corresponds to the grid emission factor $EF_{electricity,y}$ = $EF_{grid,y}$. The grid emission factor has been fixed ex-ante and calculated as per the guidance provided in ACM0002 which is 0.84 as explained in Annex 3.

Step 2: Determination of EG_y
In case of scenario 4, EG_y is the difference between the electricity generation in the project plant and the quantity of electricity that would be generated in the other power plant using the same quantity of biomass that is fired in the project plant as follows:

$$EG_y = EG_{projectplant,y} - \varepsilon_{el,otherplant(s)} * \frac{1}{3.6} * \sum_k BF_{k,y} * NCV_k$$

Where:

EG_y	Net quantity of increased electricity generation as a result of the project activity (incremental to baseline generation) during the year y (MWh)
$EG_{project\ plant,y}$	Net quantity of electricity generated in the project plant during the year y (MWh)
$\varepsilon_{el,other\ plant(s)}$	Average net energy 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 the project activity (MWh_{el}/ $MWh_{biomass}$)
$BF_{k,y}$	Quantity of biomass residue type k combusted in the project plant during the year y (tons of dry matter or liter)
NCV_k	Net calorific value of the biomass residue type k (GJ/ton of dry matter or GJ/liter)
3.6	Conversion factor for joule to electricity unit, GJ/MWh

Parameter	Value	Unit
$\varepsilon_{el,other\ plant(s}$	0.051	MWh_{el}/ $MWh_{biomass}$
$BF_{k,y}$	95,040	Tonnes
NCV_k	17.73	GJ/tonne
$EG_{projectplant,y}$	75,680 for year1 80,132 from year 2 onwards	MWh

Therefore
EG_y = 51,808 MWh for year 1; 56,259 MWh from year 2 onwards

$ER_{electricity,y}$ = 0.84 * 51,808
=43,518 tCO_2e for year 1
= 0.84 * 56,259
=47,257 tCO_2e from year 2 onwards

Emission reductions or increases due to displacement of heat
In case of scenario 4, heat and electricity would in the absence of the project activity be generated in a similar cogeneration plant but with a different configuration, i.e. the efficiency of power generation in the reference plant is lower than that in the project plant. Therefore in accordance with the methodology **$ER_{heat,y}$ = 0**

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

In case of scenario 4 the biomass residues would not decay or be burnt in the absence of project activity and hence $\boldsymbol{BE_{biomass,y}} = \mathbf{0}$

Leakage:

As per the methodology since the baseline scenario is 4, the diversion of biomass residues to the project activity is already considered in the calculation of baseline reductions and hence leakage effects need not be addressed. $\boldsymbol{L_y} = \mathbf{0}$

Project emissions

As there is no fossil fuel combustion in the project activity, there are no project emissions associated with fossil fuel combustion due to the implementation of the project activity.

Therefore $\boldsymbol{PE_y} = \mathbf{0}$

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

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Year	Estimation of project activity emissions (tonnes of CO_2e)	Estimation of baseline emissions (tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of overall emission reductions (tonnes of CO_2e)
Year 1	0	43,518	0	46,217
Year 2	0	47,257	0	47,257
Year 3	0	47,257	0	47,257
Year 4	0	47,257	0	47,257
Year 5	0	47,257	0	47,257
Year 6	0	47,257	0	47,257
Year 7	0	47,257	0	47,257
Year 8	0	47,257	0	47,257
Year 9	0	47,257	0	47,257
Year 10	0	47,257	0	47,257
Total (tonnes of CO_2e)	0	**468,831**	0	**468,831**

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

B.7.1 Data and parameters monitored:

Data / Parameter:	$BF_{k,y}$
Data unit:	tons of dry matter
Description:	Quantity of bagasse combusted in the project plant during the year *Y*
Source of data to be	Plant records

used:	
Value of data applied for the purpose of calculating expected emission reductions in section B.5	95,040
Description of measurement methods and procedures to be applied:	The quantity of bagasse consumed is measured by using rotary feeders which is connected to a DCS.
QA/QC procedures to be applied:	Cross checked with annual energy balance. The RT8C form submitted to the government can also be used to cross check that the bagasse is not stored for more than 1 year as required by applicability conditions.
Any comment:	The bagasse is on dry basis adjusted with moisture content.

Data / Parameter:	$EG_{project\ plant,y}$
Data unit:	MWh/yr
Description:	Net quantity of electricity generated in the project plant during the year *y*
Source of data to be used:	Plant data
Value of data applied for the purpose of calculating expected emission reductions in section B.5	75,680 for year 1; 80,132 from year 2 onwards
Description of measurement methods and procedures to be applied:	The gross electricity generated will be monitored using energy meters installed at the site. This data will be monitored hourly and recorded daily by the shift attendant and entered in the logbooks on site. This daily data will be signed off at the end of every day by the power plant manager. The auxiliary consumption monitored by energy meter will be deducted off the gross generation to arrive at the net quantity of electricity generated.
QA/QC procedures to be applied:	The meter would be calibrated annually.
Any comment:	The data will be archived electronically and in paper for 2 years beyond the crediting period.

Data / Parameter:	$EG_{aux,y}$
Data unit:	MWh/yr
Description:	Auxiliary consumption in the project plant during the year *y*
Source of data to be used:	Plant data
Value of data applied for the purpose of calculating expected emission reductions in section B.5	8,409 for year 1; 8,904 from year 2 onwards
Description of	The auxiliary consumption monitored by energy meter will be deducted off

measurement methods and procedures to be applied:	the gross generation to arrive at the net quantity of electricity generated.
QA/QC procedures to be applied:	The meter would be calibrated annually.
Any comment:	The data will be archived electronically and in paper for 2 years beyond the crediting period.

Data / Parameter:	EG_y
Data unit:	MWh/yr
Description:	Net quantity of electricity generation as a result of project activity incremental to baseline generation
Source of data to be used:	Plant data
Value of data applied for the purpose of calculating expected emission reductions in section B.5	51,808 for year1; 56,259 from year 2 onwards
Description of measurement methods and procedures to be applied:	This will be calculated as per equations outlined in B.6.1
QA/QC procedures to be applied:	This is a calculated value which can be verified from the metered generation data.
Any comment:	--

Data / Parameter:	$\mathbf{NCV_k}$
Data unit:	GJ/ton of dry matter
Description:	Net calorific value of biomass residue type *k*
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	7.59
Description of measurement methods and procedures to be applied:	The net calorific value of bagasse is fairly constant. Annual in- house at appropriate time would be used for monitoring the calorific value of bagasse. The calorific value of bagasse is based on theoretical calculations as per E. HUGOT (Handbook of Sugar Engineering acceptable worldwide by Sugar Industries)
QA/QC procedures to be applied:	--
Any comment:	--

Data / Parameter:	$\mathbf{FF_{project\ site,\ i,y}}$

Data unit:	Tonnes
Description:	Quantity of fossil fuel type i combusted in the project site for the purposes other than boiler in the project activity during year y
Source of data to be used:	On-site measurements
Value of data	0
Description of measurement methods and procedures to be applied:	The stock/ log book records maintained at fuel storage yard. There would be 3 shifts each of 8 hours and records would be maintained by the Shift in- charge.
QA/QC procedures to be applied:	The fuel issue records can be cross checked with the purchased quantities and billings.
Any comment:	The data will be kept for the later of, two years after the end of the crediting period or the last issuance of CERs for the project activity.

B.7.2. Description of the monitoring plan:

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The monitoring plan, which will be implemented by the project proponent, describes the monitoring organization, the parameters to be monitored, the monitoring practices, quality assurance, quality control procedures, data storage and data archiving.

Monitoring requirement

The monitoring plan includes monitoring of energy parameters such as

- Quantity of bagasse consumption of the project activity, (tons)
- Gross electricity generation (MWh)
- Net quantity of electricity generated (exported) by the project activity (MWh)

Electricity generation

Monitoring shall consist of metering the electricity generated by the renewable technology. The generation data from the turbine will be continuously recorded using the electricity meters in the control room. A manual hourly record will be made by the Shift in-charge. This data will be collated at the end of each day by the Electrical in-charge and reported on a daily basis to the Site in-charge. This data will form the basis of the ongoing calculation which will then be tallied against the monthly recordings taken by the MSEB along with a representative from the factory.

The Site Head will be responsible for collating all electrical data monthly out of the daily data (electricity exported to the grid). He will transmit these data monthly to the Plant Manager. The electricity meter will be calibrated once a year by MSEB. The Instrumentation Engineer will be in charge of maintaining the records of the calibrations on site.

Fuel consumption

The bagasse consumption will be monitored using rotary feeders which is connected to a DCS at the site.

General

The staff will be trained to ensure that the monitoring process is appropriate and effective. The CDM data will be collated monthly and maintained by the Plant Manager. A detailed monitoring and verification report will be produced by the plant on a yearly basis.

The meters used will be calibrated annually as per requirements. In case, the meters are found outside the acceptable limits of accuracy or if not functioning properly, necessary action will be taken and the meters will be repaired or replaced immediately. The Instrumentation engineer will be in charge of calibrations and of maintaining the records of calibrations on site.

The project proponent shall keep complete and accurate records of all the data as a part of monitoring for at least a period of 2 years after the end of the crediting period or the last issuance of CERs for the project activity, whichever occurs later.

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):

>>

25/04/2009

Ms Bhawna Singh
Agrinergy Consultancy Private Limited
bhawna.singh@agrinergy.com

The entity is not a project participant.

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:

>>
10/11/2008
Turbine purchase order date

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

>>
20y 00m

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 applicable

C.2.1.2. Length of the first crediting period:

>>
Not applicable

C.2.2. Fixed crediting period:

A 10 year fixed crediting period has been chosen.

C.2.2.1. Starting date:

>>
01/01/2011 or the date of registration, whichever is later.

C.2.2.2. Length:

>>
10y 00m

SECTION D. Environmental impacts

>>

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

>>

In relation to the baseline scenario no negative environmental impacts will arise as a result of the project activity. An Environmental Impact Assessment (EIA) study has been carried out by the project proponents and as a result environmental clearance accorded to the project.

The positive environmental impacts arising from the project activity are:

- A reduction in carbon dioxide emissions from the replacement of fossil fuels which would be generated under the baseline scenario.
- A reduction in the emissions of other harmful gases (NOx and SOx) that arise from the combustion of coal in power generation
- A reduction in the production of ash as bagasse has a lower ash content than that of Indian coal which typically has an ash content of 30 to 40%

The power plant currently meets all environmental legislations as set out by the State Pollution Control Board and there will be on-going monitoring of the plant by this state body. A "No objection certificate" has been obtained from the Maharashtra Pollution Control Board for the project activity. A "Consent to operate" will be provided annually and this will form part of the monitoring procedures. Furthermore the consents for the existing power plant will be provided to the validator to demonstrate current environmental compliance.

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

>>

The project activity is a renewable energy project. There are no negative environmental impacts envisaged from the project activity.

SECTION E. Stakeholders' comments

>>

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

>>

The local stakeholders were identified and informed about the proposed project activity briefing them about the nature, scope and description of the project activity and thereby inviting them to submit their comments.

- A newspaper advertisement has been published informing the local people regarding the project activity. The newspaper notice was given in English in the Indian Express and in Marathi in Loksatta on 21st July 2009.
- A local stakeholder meeting has been undertaken through the invitation of comments from local people and the local municipal board on 24th July 2009. The local people were informed of the stakeholder meeting. The local people were informed of company's decision to set up the project and avail CDM benefits to make it financially feasible. A question and answer session was held and the stakeholders queries replied accordingly.

The following approvals have already been obtained for the project:

1. No objection certificate from the gram panchayat.
2. Land allocation from the Government for the project.
3. Consent to establish from Maharashtra Pollution Control Board

E.2. Summary of the comments received:

>>

All stakeholders encouraged the establishment of the project and till date no negative comments have been received.

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

>>

An EIA has been undertaken for the project as per the Ministry of Environment and Forest (MoEF) guidelines. A public hearing was held prior to the EIA wherein the local people were invited and the benefits of setting up the project activity were explained to them. The minutes of the meeting will be made available to the DOE during validation.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Daund Sugar Limited
Street/P.O.Box:	S.B. Road
Building:	ICC Trade Tower, 201 B Wing
City:	Pune
State/Region:	Maharashtra
Postcode/ZIP:	411016
Country:	India
Telephone:	020-64007005
FAX:	020-3028899
E-Mail:	daundsugars@gmail.com
URL:	
Represented by:	
Title:	General Manager
Salutation:	Mr
Last name:	Nibe
Middle name:	N
First name:	Abasaheb
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal e-mail:	daundsugars@gmail.com

Organization:	Agrinergy Pte Ltd
Street/P.O.Box:	10 Hoe Chiang Road
Building:	#08-04 Keppel Towers
City:	Singapore
State/Region:	
Postfix/ZIP:	089315
Country:	Singapore
Telephone:	+65-6592 0400
FAX:	+65-6592 0401
E-Mail:	
URL:	www.agrinergy.com
Represented by:	
Title:	Managing Director
Salutation:	Mr
Last Name:	Atkinson
Middle Name:	
First Name:	Ben
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	moc@agrinergy.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

The project has not received any public funding.

Annex 3

BASELINE INFORMATION

We have adopted the approach specified in the "Tool to calculate the emission factor for an electricity system" to calculate the CO_2 emission coefficient of the regional electricity grid. The tool specifies that for biomass based project activities: w_{OM} = 0.50 and w_{BM} =0.50 for the first crediting period and for subsequent crediting periods.

The Central Electricity Authority of, under the Ministry of Power, Government of India, has calculated the operating margin of the NEWNE to be 1.01 and the build margin to be 0.68[15]. Using the above information and values, the combined margin is calculated as 0.84.

This value of the combined margin is fixed ex-ante at 0.84 t CO_2/MWh and is calculated as shown in the table below:

	tCO_2/MWh
Operating Margin	1.01
Build Margin	0.68
Combined Margin	(1.01*0.5) + (0.68*0.5) = 0.84

Efficiency of the reference plant
As mentioned in section B.6.4 we have chosen a reference plant operating at a pressure of 45kg/cm[2]. The parameters of the reference plant are as listed below:

Description	Baseline configuration
Pressure (kg/cm$^{2)}$	45
Temperature (deg Celsius)	490
Capacity (tph)	80
Enthalpy in (kcal)	105
Enthalpy out (kcal)	793.50
NCV (kcal/kg)	1813
Boiler efficiency on NCV (%)	68.35

The average net efficiency in the reference plant has been obtained by dividing the power generation in the reference plant by the bagasse expressed in energy units as follows:

= Power generated/ Energy of bagasse
= 5/ 98.05
= 0.051
= 5.10%

[2] http://cea.nic.in/planning/c%20and%20e/database_publishing_ver5.zip

Annex 4

MONITORING INFORMATION

In addition to the measures for monitoring listed in section B.7.2 the following systems will be put in place to monitor the project activity. Training on CDM data monitoring will be provided to the operators of the power plant.

The monitoring of the project activity will be the responsibility of Daund Sugars Limited. The monitored data will be reported to Agrinergy by the Plant Manager on a quarterly basis for the calculation and estimation of emission reductions. This data will be checked against initial estimates. If the project is not performing as expected, a report will be sent to Daund Sugars Limited outlining where the project is deviating in its generation of emission reductions.

The procedure for storage of records and performance documentation is as given below:

- All data and records of data will be stored in electronic and paper format on site and will be maintained for the crediting period and two years thereafter.
- All calibration reports will be stored in paper format on site and will be maintained for the crediting period and two years thereafter.

The data quality will be ensured by the cross-check measures detailed below:

- Electricity exported to the grid: the electricity exported will be metered both by electricity meters in the control room and by electricity meters located at the switchyard. Data from the meters in the control room will be recorded continuously. Data from the meters at switchyard will be recorded monthly by MSEB. In case there is a difference between the two records, MSEB records will prevail.

<u>Measures to deal with possible monitoring data adjustment and missing data</u>

The following are the measures that shall be taken to account for missing or adjusted data:

- Electricity export to the grid: In case both the data recorded by MSEB from the switchyard meters and the meters in the control room is missing, then the emission reductions for the corresponding period shall be set to zero.
- Consumption of bagasse: In case the data pertaining to quantity of bagasse is missing, then the average GCV of the bagasse fired during the corresponding period for which data is available shall be used to arrive at the weight of bagasse fuels fired depending on the power generation during the particular period.

<u>Procedure for conducting internal audit at Daund Sugars Ltd:</u>

An internal audit shall be carried out during the project verification and monitoring phase, at every 12 months interval. The plant O&M manager and the plant manager shall be responsible for conducting internal audits annually.

The following points shall be carried out as part of the internal audit procedures:

1. Consolidation of quarterly data: The data recorded during the operation of the plant, shall be consolidated on a half-yearly basis by the plant manager. The number of ERs generated by the project activity shall be calculated and cross checked against the estimated ER as per the calculation sheet. Any difference arising in the ER generated and ER estimated shall be recorded

and reasons for the increase or decrease in the actual number of ERs generated shall be identified and documented.

2. Random checking of data: The plant manager shall cross check the recorded data randomly. For e.g., the data for electricity generation and import recorded for a particular months may be cross checked against the MSEB bills for that particular month.
3. Record of necessary calibration certificates / government approvals: The plant manager shall ensure that the measurement meters shall be calibrated as required by the state regulatory authority. The records of such calibrations done shall be updated and stored. The necessary approvals from the statutory bodies shall be updated and records maintained.
4. Storage of data: The plant manager shall ensure that the data recorded on a monthly basis for energy generation, supply of bagasse etc. shall be signed off by the individuals responsible for recording the respective data.
5. Data collection and storage procedures: The plant manager shall check that the CDM data is being collected and recorded as per the formats for data storage as provided during the validation of the project.

On completion of the above steps, minutes of meeting shall be prepared and all individuals participating in the internal audit shall sign the minutes of meeting and the record shall be maintained for future reference.

The organization will train the staff to ensure that the monitoring process is appropriate and effective. The CDM data will be collated monthly in an excel file maintained by the Plant Manager (a specific template will be provided by Agrinergy).

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Appendix – I

ACTION PLAN FOR MONITORING OF THE CONTRIBUTION OF 2% CER REVENUES TOWARDS SUSTAINABLE DEVELOPMENT (AS PER HOST COUNTRY GUIDELINES)

Daund Sugar Limited will contribute a minimum of 2% of the CER revenues accrued each year towards pre-identified sustainable development activities in the region surrounding the project activity. These funds will be provided on issuance and monetisation of the CERs from the project activity. The table below provides an estimation of the revenue that will be contributed towards sustainable development activities but the final figure will depend on the realised price:

Year	2% of estimated CERs	CER price (€/CER)	Exchange rate (€ to INR)	Estimation of 2% of CER revenue for sustainable development (INR)
1	862[16]	11	60	568,920
2	935	11	60	617,100
3	935	11	60	617,100
4	935	11	60	617,100
5	935	11	60	617,100
6	935	11	60	617,100
7	935	11	60	617,100
8	935	11	60	617,100
9	935	11	60	617,100
10	935	11	60	617,100

The following are the details of the contribution from the 2% of CER revenues,

1. 50% of the amount will be utilized to provide grants to educational institutions in the surrounding area of the project site.
2. The remaining 50 % shall be utilized in educating farmers in the area of the unit on cultivation of better quality sugar cane which will improve their earning capacity. In addition to this material will be provided free of cost in relation to cultivation of sugar cane.

Daund Sugar Limited will undertake an annual review of the progress in the contribution of revenue from the 2% of the CERs. The annual review process will detail the exact activities undertaken using the earmarked revenue and the detailed implementation of the expenditure. Receipts and acknowledgements, along with all the necessary papers, from the concerned authorities receiving the monies will be documented.

[16] After deduction of the 2% UN adaptation fund.