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:

>> **"6 MW bagasse based cogeneration plant for electricity generation for grid supply at Mawana Sugars Limited (MSL) at Mawana in Uttar Pradesh".**

Date of document: 21 June 2007

Version 3

A.2. Description of the project activity:

>> This project activity encompasses increasing the electricity generation capacity of the existing bagasse (a renewable fuel source, produced as residue from sugarcane processing) based cogeneration plant at the premises of at MSL, a sugar mill located in north Indian state of Uttar Pradesh (UP). With implementation of this project MSL is able to sell electricity to the northern regional grid thereby replacing equivalent amount of electricity at the grid. The power plants connected to the northern regional grid uses conventional fossil fuels like coal, diesel/ oil, and natural gas among others. Thus, the project activity would reduce the CO_2 emissions and also save the fossil fuels to that extent.

The Mawana Sugar works were originally located at Barni in district Basti of UP and was shifted to Mawana in year 1949. MSL has a daily cane crushing capacity of around 10000 Metric tonnes of which capacity of Unit-I is 6000 TCD (Tonnes Crushed per Day) and Unit-II is 4000 TCD. Each unit has their individual cogeneration plant to meet the demand of process steam and power. Project activity confines within the boundary of cogeneration plant connected to Unit-I of MSL.

The project activity involves retiring of two numbers of less efficient low pressure boilers (20 Tonnes per hour (TPH) installed capacity generating steam at 20 kg/cm^2 and 340^{o}C) used only for steam generation and installation of two numbers of medium pressure boilers (32TPH installed capacity generating steam at 42 kg/cm2 and 410^{o}C) connected to one number of steam turbine (back pressure type) of capacity 6.4MW. Thus, the project leads to additional power generation of 6.4MW which is supplied to the connected grid. Of this 6.4 MW power generated, 0.4 MW is the auxiliary consumption of the project plant and thus, 6.0 MW is available for supply to the grid.

MSL had signed a Power Purchase Agreement (PPA) with Uttar Pradesh Power Corporation Limited (UPPCL) for supplying 9.0 MW of power generated in MSL during the sugar-crushing season (for a period of 180 days). The power export of 6.0 MW to the grid from MSL has commenced from March 22, 2006.

The tables on the next page gives details of steam generation and utilization and associated power generation prior to and post the implementation of the proposed CDM project activity.

Scenario prior to CDM project activity:

Bagasse burned for actual steam generation (TPH)	*Steam Utilization (TPH)*		*Power Generated (MW)*		
	Power	*Mills/ thru PRDS*[1]	*Installed Capacity*	*Captive usage including auxiliary use*	*Grid Supply*
70	88	72	9.2	8.6	Nil

Scenario post the implementation of CDM project activity:

Bagasse burned for actual steam generation (TPH)	*Steam Utilization (TPH)*		*Power Generated (MW)*		
	Power	*Mills/ thru PRDS*	*Installed Capacity*	*Captive usage including auxiliary use*	*Grid Supply*
70	130	30	15.6	9.0	6.0

MSL is of view that sustainable development will be achieved through influence on all four aspects of sustainable development defined by Ministry of Environment and Forests of Government of India. The subsequent paragraphs give details on how the project activity contributes towards the four indicators of sustainable development of India:

Environmental Aspects

The project activity being a renewable energy power project utilizes mill-generated bagasse as fuel for power generation thus leading to zero net CO_2 emissions. The CO_2 emissions generated during combustion of bagasse are offset against the CO_2 absorbed by the sugarcane plant species during its growth period. The bagasse handling (generation, storage and utilization) system at MSL ensures that there is no resource degradation. The mill uses state-of the-art systems for pollution control like, electro static precipitators among others. Due to utilization of green fuel, the project activity will contribute towards reduction in usage of finite natural resources namely fossil fuels that would have otherwise been used in grid-connected power plants.

Social Aspects

The project is located in rural settings. During the construction period the project employed local people and thus contributed towards direct and indirect employment. During the construction activity of the project local people were employed. The project will also help through distributed generation of power, thus, making it more readily available locally. MSL is also involved in many developmental activities for the local farmers like distribution of fertilizers, seeds and other agricultural needs.

Economic Aspects

The project activity involves an investment of INR 250 million in addition to which there will be continuous inflow of funds considering CDM revenues. In the absence of project activity such

[1] PRDS: Pressure Reduction and De-Superheating, this system includes the pressure reducing valve (PRV) mentioned in the subsequent sections

inflow of funds would have not occurred. This inflow of income would act as a stabilizing factor in an otherwise fluctuating sugar industry revenue due to the sheer nature of its operations. Since around 32 per cent of GDP for Uttar Pradesh comes from Agriculture & allied services, this is a positive contribution.

Technological Aspects

The project activity uses efficient and environment friendly technology of cogeneration. The power generation plant uses state-of-art electronic controls and power management system. This project contributes to technological development and capacity building.

A.3. Project participants:

>>

Name of 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 a project participant (Yes/ No)
Government of India	Mawana Sugars Limited (MSL)	No

MSL will be the lead and nodal entity for all communication with CDM-EB and Secretariat. Contact information has been provided in Annex-I.

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

>> The project activity is being implemented by MSL at their Mawana sugar works in Mawana village, District Meerut, Uttar Pradesh in India.

A.4.1.1. Host Party(ies):

>> The Government of India

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

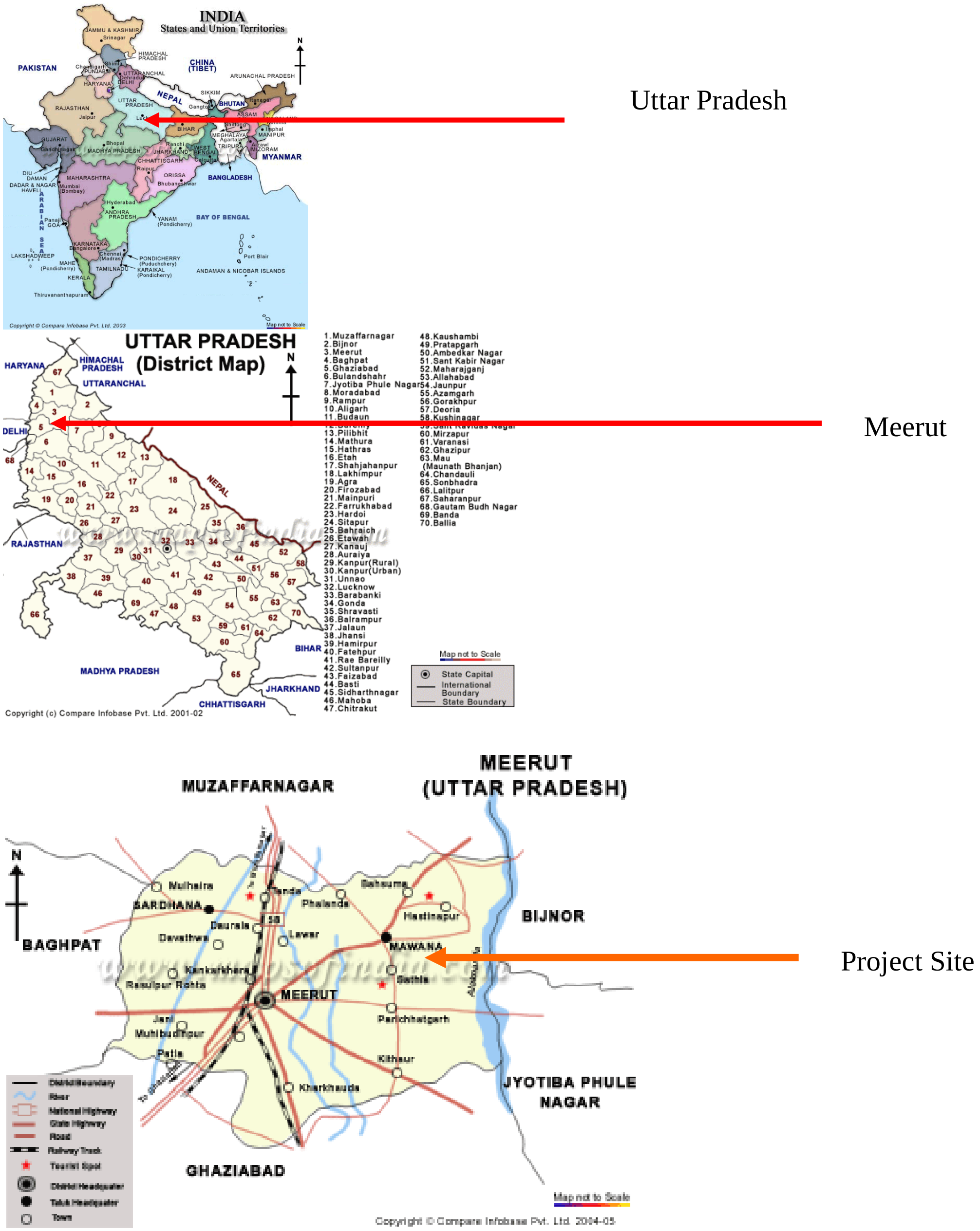
>> Uttar Pradesh

A.4.1.3. City/Town/Community etc:

>> Mawana in district Meerut

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

>> The project activity is located in Mawana Sugars Limited at Mawana village in district Meerut of Uttar Pradesh. The nearest railway station is that of Meerut town and nearest highway is state highway connecting Meerut to Kothdwar. The closet airport is New Delhi which is 100km away. It is 480 km from Lucknow, which is the capital city for the state of UP. The latitude at Mawana is 29.06N and longitude is 77.58E.



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

>> As per the scope of the project activity listed in the 'list for sectoral scopes and approved baseline and monitoring methodologies (version 02/28.11.03)', the project activity will principally fall in Scope Number 1, Sectoral scope – energy industries (renewable/ non-renewable sources).

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

>> In the project plant the bagasse is fired in the medium pressure boilers (of installed capacity of 32 TPH and generating steam at 42 kg/cm2 pressure and 410^{o}C temperature) to generate high pressure

steam which is then fed into the back pressure turbine (of capacity 6.4MW) to generate power. The exhaust steam from the turbine is used as process steam at low pressure. The boilers have been supplied by Thermax.

The power at the project plant is generated at 6.3kv and stepped up to 33 kV / 132 kV for export to UPPCL grid sub-station at Mawana, situated at a distance of around 2 km from the mill.

The table below provides details on the pre and post project configuration of the cogeneration plant of Unit-I of the MSL mill:

S.No	Equipment	Pre-Project	Project	Comment
1.	Boilers	Total 5 number: 2 of Texmaco make 50 TPH installed capacity generating steam at 32 kg/cm^2 and 350°C 2 of IJT make 20 TPH installed capacity generating steam at 20 kg/cm^2 and 340°C 1 of Oschatz make 20 TPH installed capacity generating steam at 20 kg/cm^2 and 340°C.	Total 5 number: 2 of Texmaco make 50 TPH installed capacity generating steam at 32 kg/cm^2 and 350°C 1 of IJT make 20 TPH installed capacity generating steam at 20 kg/cm^2 and 340°C 2 of Thermax **(new)** make 32 TPH installed capacity generating steam at 42 kg/cm^2 and 410°C	1 X 20 TPH boiler of IJT make of and 1 X 20 TPH boiler of Oschatz make has been scrapped.
2.	Turbines	4 numbers with capacities of 3.0, 2.5, 2.5 and 1.2 MW. Total capacity 9.2 MW	5 numbers with capacities of 3.0, 2.5, 2.5, 1.2 and 6.4 MW **(new)** Total capacity 15.6 MW	All steam lines from the turbine outlet(s) are connected to a common steam header (further routed for process use) with pressure of 1.5 kg/cm^2 and temperature of 150°C.

The modifications in the power plant increase the total steam generation installed capacity from existing of 160 TPH to 184 TPH and power generation installed capacity from existing 9.2 MW to 15.6 MW of which 6.0 MW will be surplus for grid supply after deduction for captive utilization and reactive losses. Thus with the implementation of the project, there has been a power capacity expansion of about 6MW (from 9.2 MW to 15.6) along with thermal capacity expansion.

The salient features of proposed power generation and export scheme are as follows:

i. The power output from 6 MW at the generator terminal shall be 6.3kV and stepped up to 33 kV / 132 kV for export.

ii. 6 MW power at 33 kV / 132 kV will be transmitted through Transmission line (about 2 km) to the UPPCL 132 kV substation at Mawana.

The new bagasse handling system has been installed with a reverse feeding arrangement and a provision for direct loading of surplus bagasse into the trucks for sale. The new boilers have a mechanised screw conveyor ash discharge system. The power generation plant uses state-of-art electronic controls and power management system.

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

>> The annual emission reduction works out to be **16544** equivalent tonnes of CO_2 and the total emission reduction for the entire crediting period of 10 years (2007-2017) works out to **165443** equivalent tonnes of CO_2.

Without the project activity, equivalent energy load would have been taken up by grid-mix with thermal power plants and emission of CO_2 would have occurred due to combustion of fossil fuels. The table below gives the annual estimation of GHG emission reductions.

Period	**Annual estimated emission reduction (Tonnes CO_2e)**
Year 1 (Aug 2007-July 2008)	16544
Year 2 (Aug 2008- July 2009)	16544
Year 3 (Aug 2009- July 2010)	16544
Year 4 (Aug 2010- July 2011)	16544
Year 5 (Aug 2011- July 2012)	16544
Year 6 (Aug 2012- July 2013)	16544
Year 7 (Aug 2013- July 2014)	16544
Year 8 (Aug 2014- July 2015)	16544
Year 9 (Aug 2015- July 2016)	16544
Year 10 (Aug 2016- July 2017)	16544
Total Estimated Reductions (Tonnes CO_2e)	**165443**
Total Number of Crediting Years	**10**
Annual Average over crediting period of Estimated Reductions (Tonnes CO_2e)	**16544**

A.4.5. Public funding of the project activity:

>> The total investment of the project activity is INR 250 million. The financing details are provided in Annex 2. There is no Official Development Assistance involved in the project funding.

SECTION B. Application of a baseline methodology

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

>> The approved baseline methodology applicable to the project activity is consolidated methodology ACM0006 **"Consolidated baseline methodology for grid-connected electricity generation from biomass residues".**

ACM0006 also refers to the latest approved version of ACM0002 ("Consolidated baseline methodology for grid-connected electricity generation from renewable sources"), the latest approved version of the "Tool for the demonstration and assessment of additionality".

Reference: Available on http://cdm.unfccc.int, Version 04 dated 1 November 2006

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

>> ACM0006 covers a number of different project types for power generation with biomass residues. It is applicable to grid-connected and *biomass residue* fired electricity generation project activities, including cogeneration plants. The applicability conditions are presented in the table below.

S.No	Applicability Criteria of ACM 006	Project Conditions
1.	The project activity may include any one of the following:	
	a) the installation of a new biomass power generation plant at a site where currently no power generation occurs **(greenfield power project**s); or	Project activity involves additions/ modifications to an existing unit.
	b) the installation of a new biomass power generation unit, which is operated next to existing power generation capacity fired with either fossil fuels or the same type of biomass residue as in the project plant (power capacity expansion projects); or	Project activity involves additions/ modifications to an existing unit.
	c) 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	Project activity involves installation of new bagasse based cogeneration unit, which would be operated next to existing cogeneration units fired with bagasse, leading to **power capacity expansion.**
	d) the replacement of fossil fuels by biomass in an existing power plant (fuel switch projects).	In the proposed project activity at MSL there is no utilization of fossil fuels either as a start-up fuel or secondary fuel.

S.No	Applicability Criteria of ACM 006	Project Conditions
2.	The project activity may be based on the operation of a power generation unit located in an agro-industrial plant generating the biomass residues or as an independent plant supplied by biomass residues coming from the nearby area or a market.	CDM project activity at MSL is cogeneration with bagasse, is based within the existing cogeneration plant which is located within its sugar-processing premises. Bagasse is being generated as by-product from the sugar-processing unit and is not purchased from outside
3.	*Biomass residues* are defined as *biomass* that is a by-product, residue or waste stream from agriculture, forestry and related industries. This shall not include municipal waste or other wastes that contain fossilized and/or non-biodegradable material.	Bagasse is a by-product / waste stream from cane-sugar processing system at MSL.
4.	Applicability conditions	
	No other biomass types than *biomass residue*s, as defined above, are used in the project plant and these biomass residues are the predominant fuel used in the project plant (some fossil fuels may be co-fired);	Bagasse is the only fuel being used for cogeneration at MSL
	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 installation of higher efficiency boilers in place of older ones and replacement of Pressure Reducing Valve (PRV) with turbine does not lead to increase in sugar processing capacity or change in process at MSL. The sugarcane processing capacity of Unit-I of MSL is 6000 TCD (Tonnes Crushed per Day) and remains constant before and after the project implementation.
	The biomass used by the project facility should not be stored for more than one year;	The bagasse used by the project plant is available only during the sugar cane crushing period (about 180 days in a year) thus is not stored for more than one year, any excess is being sold to nearby paper mills.
	No significant energy quantities, except from transportation of the biomass, are required to prepare the biomass residues for fuel combustion, i.e. projects that process the biomass residues prior to combustion (e.g. esterification of waste oils) are not eligible under this methodology	The bagasse produced from the sugar mill is directly fired in the boiler and no fuel preparation or processing is required.

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

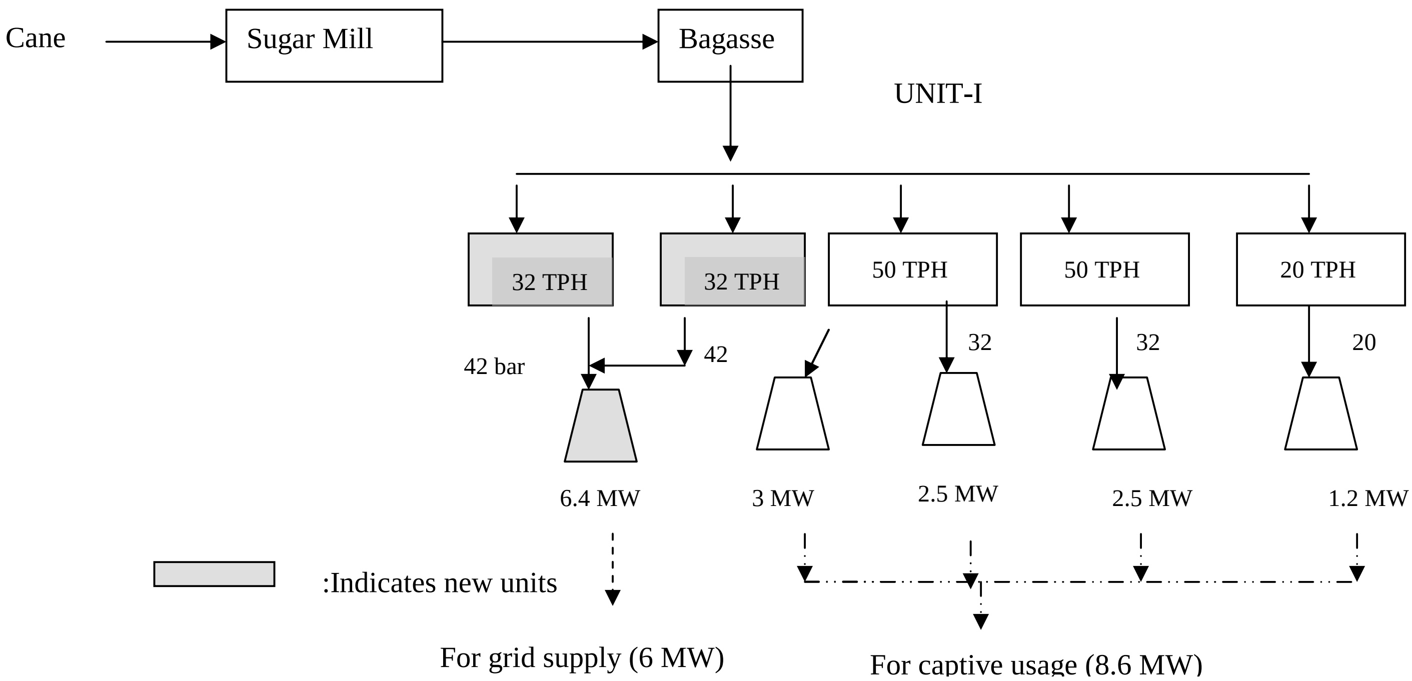
>> Based on the baseline methodology ACM0006, the project boundary for the proposed CDM project activity at MSL has been illustrated in form a flow chart on the next page.

The spatial extent of the project boundary encompasses the power plant at the project site, which includes the existing and proposed cogeneration systems.

As per the requirements of ACM006, for the purpose of calculating of project emissions, project should include CO_2 emissions from fossil fuel combustion at the project plant are considered. However as there is no use of fossil fuel co-firing in the cogeneration plants at site hence these emission sources are not included.

In the calculation of baseline emissions, only CO_2 emissions from fossil fuel fired power plant(s) connected to the northern regional grid electricity system of the country have been considered. There is no inclusion of CO_2 emissions linked to displacement of any heat generation from sources based on fossil fuel(s).

Project Boundary



The greenhouse gases included in or excluded from the project boundary are shown in the table below:

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

	Source	Gas	Included?	Justification / Explanation
Baseline	Grid electricity generation	CO_2	Yes	Main emission source.
		CH_4	No	Excluded for simplification. This is conservative.
		N_2O	No	Excluded for simplification. This is conservative.
	Heat generation	CO_2	No	No displacement of heat generation by fossil fuels.
		CH_4	No	Same as above
		N_2O	No	Same as above
Project Activity	On-site fuel combustion due to the project activity	CO_2	No	There is no fossil fuel combustion on-site.
		CH_4	No	Excluded for simplification.
		N_2O	No	Excluded for simplification.

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

>> As per ACM0006, realistic and credible alternatives should be separately determined regarding power generation, biomass utilization and in case of cogeneration, even heat generation. In the tables below various scenarios as applicable to the project activity have been evaluated and presented.

For **power** generation, the realistic and credible alternatives for the proposed CDM project activity are presented below:

Alt. No.	Baseline Scenario	Applicability to Project Activity
P1	*The proposed project activity not undertaken as a CDM project activity*	This always an option to go ahead with the project, however, this faces barriers to implementation (refer Section B.5) and hence cannot be a baseline option.
P2	*The proposed project activity (installation of a power plant), fired with the same type of biomass but with a lower electrical energy efficiency (e.g. an efficiency that is common practice in the relevant industry sector)*	The proposed project activity with lower electrical energy efficiency would be economically unattractive. Hence, it cannot be taken as baseline scenario.
P3	*The generation of power in an existing plant, on-site or nearby the project site, using only fossil fuels*	Use of any fuel purchased from the market would be economically unattractive in presence of ready to use biomass residue at project site. Hence, it cannot be taken as baseline scenario.
P4	*The generation of power in existing and/or new grid-connected power plants*	Yes, the additional power for grid supply would have otherwise been generated in

Alt. No.	Baseline Scenario	Applicability to Project Activity
		existing and/or new grid-connected power plants. Hence this option is considered to be the most credible baseline to the project for power generation.
P5	*The continuation of power generation in an existing power plant, fired with the same type of biomass as in the project activity, and implementation of the project activity, not undertaken as a CDM project activity, at the end of the lifetime of the existing plant*	Implementation of project activity at end of lifetime of existing plant would also face barriers as discussed in next section. Hence, this is not a credible baseline scenario.
P6	*The continuation of power generation in an existing power plant, fired with the same type of biomass as (co-)fired in the project activity and, at the end of the lifetime of the existing plant, replacement of that plant by a similar new plant*	The project activity involves capacity expansion in power generation by installation of new turbo-generator as the existing cogeneration unit could not have produced the additional power with its existing capacity. Hence, replacement of the existing plant with similar new plant is not a credible baseline option.

For **heat** generation, realistic and credible alternative(s) for the proposed CDM project activity are:

Alt. No.	Baseline Scenario	Applicability to Project Activity
H1	*The proposed project activity not undertaken as a CDM project activity*	This always an option to go ahead with the project, however, this faces barriers to implementation (refer Section B.5) and hence cannot be a baseline option.
H2	*The proposed project activity (installation of a cogeneration power plant), fired with the same type of biomass but with a different thermal energy efficiency (e.g. an efficiency that is common practice in the relevant industry sector)*	The proposed project activity with lower thermal energy efficiency would be economically unattractive. Hence, it cannot be taken as baseline scenario.
H3	*The generation of heat in an existing cogeneration plant, on-site or nearby the project site, using only fossil fuels*	Not applicable at MSL since it is a sugar mill and bagasse is available during the sugar crushing season. Also, use of fossil fuels would be both uneconomical and high on GHG emissions.
H4	*The generation of heat in boilers using the same type of biomass residues*	Yes, in absence of the project activity the cogeneration unit would have continued to fire bagasse in low pressure boilers producing steam for process requirement only (no power generation)
H5	*The continuation of heat generation in an existing cogeneration plant, fired with the*	Although this could have been one of the alternatives to the project for heat

Alt. No.	Baseline Scenario	Applicability to Project Activity
	same type of biomass as in the project activity, and implementation of the project activity, not undertaken as a CDM project activity, at the end of the lifetime of the existing plant	generation, however, this also faces barriers to implementation (refer Section B.5) and hence cannot be a baseline option.
H6	*The generation of heat in boilers using fossil fuels*	Not an option for a sugar mill
H7	*The use of heat from external sources, such as district heat*	Not available in India
H8	*Other heat generation technologies (e.g. heat pumps or solar energy)*	Not an option in India

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

Alt. No.	Baseline Scenario	Applicability to Project Activity
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.*	In absence of the project activity MSL would have continued to fire bagasse in the low pressure boilers to generate steam only, hence this is not a credible alternative.
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 1 or left to decay on fields.*	Not applicable as explained above.
B3	*The biomass residues are burnt in an uncontrolled manner without utilizing it for energy purposes.*	Not applicable as explained above.
B4	*The biomass residues are used for heat and/or electricity generation at the project site*	Yes this is a credible alternative to the project for heat generation as prior to implementation of the project plant the bagasse was fired in the existing boilers to produce only process steam.
B5	*The biomass residues are used for power generation, including cogeneration, in other existing or new grid-connected power plants*	Not applicable to the project as the generated bagasse out of sugar processing MSL Unit I is currently being used for steam generation for captive use in the existing boilers.
B6	*The biomass residues are used for heat generation in other existing or new boilers at other sites*	Not applicable as explained above.
B7	*The biomass residues are used for other energy purposes, such as the generation of*	Not applicable as explained above.

Alt. No.	Baseline Scenario	Applicability to Project Activity
	biofuels	
B8	*The biomass residues are used for non-energy purposes*	Not applicable as explained above.

From above evaluation of various alternatives, it is concluded that following alternatives for power and heat generation and biomass use are the most credible and realistic alternatives that results in the lowest:

For power generation : P4

For heat generation : H4,

For biomass use : B4

Under the applicability conditions for baseline scenarios, in ACM0006 specific combinations of types of baseline scenarios have been provided in Table 1 of the methodology document. Based on combination of power, heat and biomass baseline scenarios i.e P4, H4, and B4, Scenario 12 is of Table 1 of the methodology is applicable to the CDM project activity at MSL .This is further substantiated in the table below:

Scenario	**Project Type**	**Baseline scenario**			**Description of situation**	**Applicability to Project Activity**
		Power	**Biomass**	**Heat**		
12	Power capacity expansion projects	P4	B4	H4	The project activity involves the installation of a new biomass residue fired cogeneration unit, which is operated next to (an) existing biomass residue fired power generation unit(s).	The project activity involves installation of two new 32 TPH bagasse fired medium pressure boilers and a new 6.4 MW turbine next to its existing bagasse based co-generation units.
					The existing unit (s) are only fired with biomass residues and continue to operate after the installation of the new power unit.	The existing system continues to operate after installation of new cogeneration unit and are fired only with bagasse..
					The power generated by the new power unit is fed into the grid or would in the absence of the project activity be purchased from the grid.	The 6 MW surplus power generated by new cogeneration unit is being supplied to UPPCL grid.

Scenario	Project Type	Baseline scenario			Description of situation	Applicability to Project Activity
		Power	Biomass	Heat		
					The biomass residues would in the absence of the project activity be used for heat generation in boilers at the project site.	The bagasse quantity utilized in the new cogeneration unit remains unchanged and in the absence of the project activity the steam would have been generated from the existing boilers (currently retired) at low pressure (no power).

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 analysis has been carried out as per the latest version (version 2) of "Tool for demonstration and assessment of additionality". Information and data relevant to the industry practices and regulations have been used to establish the additionality of the project activity.

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

Steps for Additionality Check

Step 0: Preliminary screening based on the starting date of the project activity.

Has construction of the project already started? If yes, is there verifiable evidence to justify that CDM was seriously considered at the start of the project?

- Yes, the construction of the project activity has started after January 2005 and commissioned in October 2005 (refer Annex 5 for details). The power export of 6.0 MW from Unit-I has started from March 22, 2006. The project activity is likely to be submitted for registration as a CDM project activity at UNFCCC in May 2007.
- The MSL management had taken a decision to move ahead with the project, after considering CDM benefits under the Kyoto Protocol. The evidence for the same has been submitted to the DOE.

  The project activity has crossed step 0 of additionality demonstration, and can move to step 1.

Step1: Identification of alternatives to the project activity consistent with current laws and regulations

Sub-step 1a. Define Alternatives to the project activity

MSL identified different potential alternative(s) to project activity as available to the other sugar mills in India for alternatives that are complying all applicable regulatory requirements. The Electricity Act 2003 does not restrict or empower any authority to restrict fuel choice for power generation. Use of bagasse as a fuel for cogeneration is an internal decision of MSL board. Indian legislation applicable to cogeneration projects include approval under Boiler Act; Air Act and Water Act. These approvals are in place.

The analysis presented below was done separately for power, heat and biomass utilization as per the requirements of ACM 006. On evaluation of various alternatives, those applicable to the CDM project activity at MSL are:

For power generation	:	P4
For heat generation	:	H4
For biomass use	:	B4

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

Alternative for power generation

Option P1: Project activity not undertaken as CDM project activity

In this scenario the project proponent would replace the low-efficiency boilers in Unit-I to generate surplus power for grid supply without consideration for the CDM benefits. However, for the grid supply there are many risks involved:

- PPA delivery risks
- Variation in tariff structure of power by UPREC: Initially at the time of project inception, the rate was Rs. 3.17/kWh and expected escalation of 5% to a fixed However, the current recommended price is Rs. 2.86 per kWh.

Due to these reasons, this option is ruled out as baseline for the current CDM project activity.

Option P4: Power generation in existing and/or new grid-connected power plants

Conventionally it is easier for sugar mills to opt for low efficiency cogeneration plant considering that they are less capital intensive. MSL would continue to use bagasse to generate steam for meeting mill’s internal steam and power requirements by producing power in a less efficient manner with older boilers in Unit-I.

This is a very plausible baseline scenario else the 6.0 MW surplus power being generated from project activity would have otherwise been generated in grid-connected power plants.

Options P5 and P6: Power generation in existing old boiler configuration plant with lower electrical energy efficiency fired with the same type of biomass as in the project activity and replacement of plant at the end of its lifetime

In this scenario the project proponent would continue to use a lower electrical energy efficient cogeneration plant compared to the project activity and route the steam through the PRV. This would result in consumption of same amount of bagasse in order to generate equivalent steam and lesser power for in-house utilization or captive consumption only. Though this alternative does not entail surplus power generation and export to an electricity grid, it is in compliance with all applicable legal and regulatory requirements and could be the baseline. However, the boilers that have been replaced had a residual lifetime of 10 years and have been scrapped by MSL. Therefore, during the chosen crediting period of 10 years for the CDM project the Options P5 and P6 are not credible baseline scenarios.

*Thus, the only credible baseline option in terms of alternative for power generation for MSL project activity is **P4**.*

<u>Alternative for steam generation</u>

Option H1: Project activity not undertaken as CDM project activity

In this scenario the project proponent would replace the low-efficiency boilers in Unit-I to generate surplus power for grid supply. However, with the PPA delivery risks and reduction in unit rate of power by UPREC from Rs. 3.17/kWh and expected escalation of 5% to a fixed There is a recommended price of Rs. 2.86 per kWh would have been a major deterrent. Due to these reasons, this option is ruled out as baseline for the current CDM project activity.

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

Yes, since without an increase in quantity of bagasse being fired by adding new boilers and replacing a PRV with turbine, the quantity of power generation has increased.

Options H5: Continuation of heat generation in an existing cogeneration plant (old boilers) fired with the same type of biomass (i.e. bagasse and biomass) as in the project activity and implementation of the project activity not undertaken as a CDM project activity, at the end of the lifetime of the existing plant

The generation of steam at MSL before the project activity was by using the same type of biomass (i.e. bagasse) as fuel. However in case of cogeneration plants, the affect on emission reductions from displacement of heat needs to be determined. MSL's old boilers had lower energy efficiency lower than that of the project plant. Moreover, the boilers that have been replaced had a residual lifetime of 10 years and have been scrapped by MSL. Therefore, during the chosen crediting period of 10 years for the CDM project the Option H5 is not credible baseline scenario.

<u>Alternative for biomass utilization</u>

Option B4: Bagasse was used for heat and/or electricity generation at the project site

In the absence of the project activity bagasse would have been used to generate heat and power (required for captive consumption only) at the project site by the old boiler and turbine configuration. Cogeneration being an efficient process involving generation of two forms of useful energy from the same fuel source (using exhaust energy of one system as input for another system), such systems enable reduction of about 10 – 30 % of what is required by separate systems to produce the same outputs. The benefits of the project are from improved power cycle efficiency and reduced fuel consumption compared to the conventional power plant requiring fuel for generating electrical energy only. MSL mill was set up in Mawana in 1949 and has completed 57 seasons of sugar manufacture but they did not generate and export the surplus power till the implementation of the project activity. It is very likely that MSL would have continued to operate with the lower efficiency boilers and PRV with only slight modifications/ retrofits in absence of CDM project activity.

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

The Electricity Act 2003 does not restrict or empower any authority to restrict fuel choice for power generation. Use of bagasse as a fuel for cogeneration is an internal decision of MSL board. Indian legislation applicable to cogeneration projects include approval under Boiler Act; Air Act and Water Act. These approvals are in place.

The next step for additionality justification is either Investment Analysis (Step 2) or Barrier Analysis (Step-3). The project activity has crossed step 1 (1a and 1b) of additionality demonstration, and can move to either step 2 or step 3 or both. In the present case, step 3 has been opted for.

Step 3: Barrier analysis:

Step 3(a): Identify barriers that would prevent the implementation of type of the proposed project activity

Investment barriers

MSL faced investment barriers and in particular from high upfront cost and it was difficult to convince financial institutions/ bank in order to obtain financial closure for the project. PFC had sanctioned a loan INR 75 million in year 2000 but subsequently demanded payment security from UPPCL (erstwhile UPSEB). In the absence of this, PFC refused to disburse the loan amount. As MSL had been into sugar production business for more than 50 years (at the time of project implementation) with no background in power sector economics, financial support from bank was a difficult proposition.

For determining the tariffs for bagasse based power projects, the Uttar Pradesh Electricity Regulatory Commission (UPERC) has recommended 16% equity IRR pre tax to be is considered as appropriate equity return[2]. If the Project has a pre-tax equity IRR of less than 16%, then it can be considered to be additional.

The key assumptions used for calculating the benchmark (pre-tax equity IRR) are set out below:

Operations		
Plant Load Factor		60%
Auxiliary Consumption		8.5%
Operation & Maintenance Cost % of capital cost		2.50%
% of escalation per annum on O & M Charges		4.0%
Bagasse		
Bagasse Cost	Rs./MT	740
Escalation in Bagasse cost		4%
Plant Heat Rate	kCal/kWh	3,300

[2] Refer Section 5.3 on pages 14, 15 Uttar Pradesh Electricity Regulatory Commission, "Order on suo moto proceedings in the matter of Terms and Conditions of Supply and Tariff for Captive Generating Plants and Renewable and NCE source based plants on http://www.uperc.org/Copy%20of%20Order%20-UPERC%20NCE%20Policy%20FINAL%20DT.18-7-2005.pdf

Calorific Value of Bagasse	kCal/kg	2,275
Specific Bagasse Consumption	kg/kWh	1.45
Means of Finance		Rs Million
Own Source	50%	125.0
Term Loan	50%	125.0
Total Source		250.0
Terms of Loan		
Interest Rate	9.00%	
Tenure	7	Years
Moratorium	24	Months
Income Tax Depreciation Rate (Written Down Value basis)		
On Power plant assets		20%
On other Assets		10%
Book Depreciation Rate (Straight Line Method basis)		
On all assets		7.84%
Book Depreciation up to (% of asset value)		90%
Income Tax		
Income Tax rate		30%
Minimum Alternate Tax		10%
Surcharge		10%
Cess		2%
Working capital		
Receivables	No. of days	45
O & m exps	No. of days	30
Working capital interest rate		10.25%
CDM Development		
CDM Development expenses (One time)	Rs. Million	2.00
Transaction cost for sale of CERs		7%
Monitoring expenses	Rs. Million/year	0.25
CER Price	US$	-
Exchange rate	Rs./US$*	40.84
* RBI reference rate as of 15 June 2007		
Crediting period starts		1-Oct-07
Length of Crediting period	Years	10
Baseline Emission Factor for Northern Region		**793.18**
	Equity IRR - Pre tax	**13.33%**

The pre tax equity IRR for the project is 13.33%.

The availability of CDM funds will help to improve the financial viability of the project and would therefore the return on investment. With CDM funds the pre tax equity IRR is expected to improve to 18.72%.

Technological barriers:

The operating systems and instrumentation in the new improved boilers and turbine are much more sophisticated (being PLC based), this has proved to be a barrier in terms of additional training requirements for the operating staff at the mill.

Barriers due to prevailing practice

As per the report by the Ministry of Non-Conventional Energy Sources (MNES), Government of India, the potential for bagasse based cogeneration in the major sugar producing states of India is estimated as 3500 MW. Of this, the potential of surplus power generation from bagasse based cogeneration in sugar mills of Uttar Pradesh is 1000 MW of which capacity was around 100 MW in 2004-05, which was likely to increase to 150 MW by the end of the 2005-2006.

In terms of power procurement from these sources, UPPCL is currently purchasing around 170 million kWh from cogeneration plants out of its total power consumption of around 41000 million kWh, which works out to around 0.43%[3]. This substantiates the fact that practice of sale of power to grid from bagasse based cogeneration projects has not penetrated in the region. Clearly, there is a large scope for development in the area. There are several barriers due to which the above potential has not been harnessed. The project activity had its associated barriers to successful implementation, which have been overcome by MSL to bring about additional green house gas reductions. Further, the project is additional as it overcomes the barriers discussed further in this section.

Institutional barriers:

MSL's cash flows from sale of power depends entirely on the economic situation of the state electricity boards (UPPCL). MSL had to take this risk and face this institutional barrier on which they have limited or no control and therefore CDM funds are critical to MSL.

The earnings from project are dependent on the payment from UPPCL against the sale of electricity. It is known that the financial condition of electricity boards in India was not very healthy in the recent past. As per the data available till 2003-04, UPPCL was incurring heavy technical and commercial losses. The aggregate technical and commercial loss for UPPCL (off-taker) in the year 2003-04 was INR 43.07 billion[4].

Another major barrier faced by the project activity is the uncertainty on the received price in the PPA. At the time project inception, unit rate of power was expected to be Rs. 3.17/kWh with 5% annual escalation. However, UPREC has reduced this to electricity tariff of Rs. 2.86 per kWh in its signed PPA, the uncertainty still remains.

UPPCL is purchasing power at an average rate of INR 1.66/kWh from various other sources. However, the purchase of power from cogeneration projects has been fixed as INR 2.98/kWh by

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[3] http://www.uperc.org/Copy%20of%20Order%20-UPERC%20NCE%20Policy%20FINAL%20DT.18-7-2005.pdf (Page 11)

[4] Source: UPREC Tariff Order 2004-05

UPERC, which is much higher than average cost at which UPPCL purchases power. A, likelihood of the PPA being renegotiated at later stage cannot be ruled out in the future. In addition, the validity of the power purchase rate has been kept only for a period of 5 years[5] . Hence, possibility of further reduction in rate of power purchase after 5 years cannot be ruled out.This is a major risk that project faces as lower tariff makes project into a loss making one.

The policy that existed till 2004-05, UPPCL and MSL were to equally share the cost of transmission lines, however, based on UPERC's recent orders, the entire cost of laying the transmission lines from project plant to the substation now needs to be borne by MSL.

Since the barriers mentioned above are directly related to venturing into the business of export of power to grid (sale of electricity) there are no impediments for sugar manufacturing plants and also MSL to implement any of these alternatives. Additionally, these barriers do not exist for the alternatives/ options discussed above and thus do not prevent the wide spread implementation of these alternatives.

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

Step 3(b): Show that the identified barriers would not prevent the implementation of at least one of the alternatives

The alternatives as defined in sections B.4 and B.5 above do not face the barriers associated with export of power to grid. The barriers mentioned above are directly related to venturing into a new business of export of power to grid by installing higher pressure configuration cogeneration system.

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

- Overcoming the barriers facing project implementation and operation
- CDM project activity through equity
- Additional transaction costs such as preparing documents, supporting CDM initiatives and developing and maintaining M&V protocol to fulfill CDM requirements

The project activity has crossed step 3 of additionality demonstration, and can move to step 4.

Step 4: Is the project common practice?

Step 4(a): Analyse other activities similar to the proposed project activity:

As mentioned in Step 3(a) above. the northern grid generation mix for the year 2004-2005, as per data information available from Central Electricity Authority, is Hydro at 33.17%; Thermal (includes coal, gas and diesel) at 62.00%; Biomass based generation at 0.39%; Wind power generation 0.81% and Nuclear at 3.63%. It is evident that there is negligible contribution of energy through renewables and the project activity would make a positive impact. Power export to the grid by project activity

[5] http://www.uperc.org/final%20review%20order%20dated%2015.9.05%20(SUO-MOTO).pdf (Page 26)

would replace the conventional power (contributed by a generation mix predominated by fossil fuel based power plants) by clean power leading with net zero GHG emissions from the project.

The practice in the sector and region is that based on assured quantum of bagasse is to either:

- put up boilers that meet the process steam requirements
- put up boilers that meet the process steam requirements and also put up turbines that can utilise part of the steam to generate enough power to meet internal requirements

Only a minor percentage of total power generation of the Northern Grid comes from Biomass based Cogeneration plants. Of the 111 sugar factories in the state of Uttar Pradesh there are 25 mills exporting electricity to the grid and another 26 have applied for signing PPA with UPPCL[6]. More than half of these 25 mills that are supplying power to UPPCL the capacities are lower than 15 MW Moreover, of these 25 units, 10 units are registered as CDM projects and another 6 are requesting registration. In addition to this many other projects are in various stages of development as CDM projects.

Therefore, to set up a power generation system comprising boilers and turbines based on highest available quantity of bagasse and taking risks of bagasse availability and PPA deliverables is not a common practice.

Step 4(b): Discuss any similar options that are occurring:

The operating parameters (number of days, configuration etc.) and investment climate of Mawana do not occur in other similar project activities. Also, as demonstrated earlier there is no evidence of any similar project(s) being undertaken without the benefit of CDM.

The project activity has crossed step 4 of additionality demonstration, and can move to step 5.

Step 5:Impact of CDM registration

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

The corporate decision to invest in:

- Overcoming the barriers facing project implementation and operation
- CDM project activity through equity
- Additional transaction costs such as preparing documents, supporting CDM initiatives and developing and maintaining M&V protocol to fulfil CDM requirements

The impacts of CDM registration of the project activity will be that CDM returns from the project would reduce the impact of uncertainties of UPPCL tariff.

It would reduce financial uncertainties for small mills and would encourage investments in cogeneration such that the available bagasse can be utilized for effective power generation.

[6] http://uppcl.org/ppa.pdf

The project activity would not have occurred in the absence of the CDM simply because no sufficient financial, policy, or other incentives exist locally to foster its development in India and without the proposed carbon financing for the project the MSL would not have taken the investment risks in order to implement the project activity. Further CDM fund will provide additional coverage to the risk due to failure of project activity, shut down of plant and loss of production.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

>> As per ACM0006, the emission reduction ER_y by the project activity during a given year y is the difference between the emission reductions through substitution of electricity generation with fossil fuels, the emission reductions through substitution of heat generation with fossil fuels, project emissions, emissions due to leakage and, where this emission source is included in the project boundary and relevant, baseline emissions due to the natural decay or burning of anthropogenic sources of biomass, as follows:

$ER_y = ER_{heat,y} + ER_{electricity,y} + BE_{biomass,y} - PE_y - L_y$ **(Equation Number 1 of ACM0006)**

Where:

ER_y : are the emissions reductions of the project activity during the year y in tons of CO_2,

$ER_{heat,y}$: are the emission reductions due to displacement of electricity during the year y in tons of CO_2

$ER_{electricity,y}$: are the emission reductions due to displacement of heat during the year y in tons of CO_2

$BE_{biomass,y}$: are the baseline emissions due to natural decay or burning of anthropogenic sources of biomass during the year y in tons of CO_2 equivalents,

PE_y : are the project emissions during the year y in tons of CO_2, and

L_y : are the leakage emissions during the year y in tons of CO_2.

Project emissions

Project emissions (PE_y), as referred under formula number 2 of ACM0006, 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, CH4 emissions from the combustion of biomass ($PE_{Biomass,CH4,y}$).

In MSL project activity, the project emissions are nil as the biomass is being generated on-site; there is no on-site consumption of fossil fuels due to project activity and there are no methane emissions due to combustion of bagasse.

Emission reduction due to displacement of electricity

To calculate, emission reduction due to displacement of electricity, as per ACM0006 are calculated by multiplying the net quantity of increased electricity generated with biomass 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:

$ER_{electricity,y} = EG_{,y}$ X $EF_{electricity,y}$ **(Equation Number 8 of ACM0006)**

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, and

$EF_{electricity,y}$ 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 $EF_{electricity,y}$ is specific to the baseline scenario and the plant power generation capacity.

For the proposed CDM project activity, the identified baseline scenario is scenario number 12. Explanation and justification of selecting scenario 12 is provided in section B.4. The overall power generation capacity of the biomass fired power plant in Unit-I is 15.6 MW and the quantity of power being supplied to the grid and for which the PPA has been signed is 6.0 MW. Thus, based on ACM0006, $EF_{electricity,y}$ would correspond to the grid emission factor ($EF_{electricity,y} = EF_{grid,y}$) and $EF_{grid,y}$ shall be determined as combined margin of the electricity system.

The baseline methodology suggests that the project activity will have an effect on both the operating margin (i.e. the present power generation sources of the grid, weighted according to the actual participation in the regional grid mix) and the build margin (i.e. weighted average emissions of recent capacity additions) of the selected southern regional grid and the baseline emission factor would therefore incorporate an average of both these elements.

Combined Margin: The first contribution to the baseline emission calculation is the project's impacts on the operating margin (affecting the operation of power plants on the grid). The impact on the operating margin accounts for the fact that the system operator will adjust the output of other existing plants on the system in response to the output of the proposed project.

The second contribution is on the build margin (delaying or avoiding the construction of future power plants). This second contribution accounts for the fact that even a small project is likely to delay the commissioning of new generation sources, if not directly displace a specific other new generating source. In fact, this delay effect is a reasonable assumption where (a) there is a planned or unplanned sequence of new facilities to be built, and (b) the timing of construction is affected by the need to balance supply and demand, either through maintaining the reserve margin above a threshold level. In fact, this delay effect can be expected to effect total emissions at the build margin to a degree that is comparable in magnitude to the effect on the project's effect on emissions at the operating margin.

The baseline emission factor (EFy) has been calculated as a combined margin (CM) consisting of the combination of operating margin (OM) and build margin (BM). Therefore, OM has been calculated based on 'existing actual and historical emission of last 3-years average', and BM has been calculated based on power plants capacity additions in the electricity system that comprise 20% of the system.

The value of combined margin based emission factor for the northern regional grid has been taken from the CEA data base[7].

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

Choice of Grid:

As per ACM 0006, project electricity system is defined by the spatial extent of the power plants that can be dispatched without significant transmission constraints. Similarly, a connected electricity system, e.g. national or international, is defined as a (regional) electricity system that is connected by transmission lines to the project electricity system and in which power plants can be dispatched without significant transmission constraints. The Electricity Act 2003 and Draft National Electricity policy (Revised in 2004) allows for transfer and procurement of power from any two locators in the country.

As per ACM0006, Electricity transfers from connected electricity systems to the project electricity system are defined as **electricity imports** and electricity transfers to connected electricity systems are defined as **electricity exports**.

In case of India, power is a concurrent subject between the state and the central governments. The perspective planning, monitoring of implementation of power projects is the responsibility of Ministry of Power, Government of India. At the state level the state utilities or state electricity boards (SEBs) are responsible for supply, transmission, and distribution of power. With power sector reforms there have been unbundling and privatization of this sector in many states.

Many of the state utilities are engaged in power generation also. In addition to this there are different central / public sector organizations involved in generation like National Thermal Power Corporation (NTPC), National Hydro Power Corporation (NHPC), etc. in transmission e.g. Power Grid Corporation of India Ltd. (PGCIL) and in financing e.g. Power Finance Corporation Ltd. (PFC). There are five regional grids: Northern, Western, Southern, Eastern and North-Eastern. Different states are connected to one of the five regional grids. Uttar Pradesh is connected to the Northern grid along with the states of Haryana, Himachal Pradesh, Jammu & Kashmir, Punjab, Rajasthan, Uttaranchal, and Delhi.

The management of generation and supply of power within the regional grid is undertaken by the load dispatch centers (LDC). Different states within the regional grids meet the demand from their own generation facilities plus generation by power plants owned by the central sector i.e. NTPC and NHPC etc. Specific quota is allocated to different states from the central sector power plants. Depending on the demand and generation there are exports and imports of power within different states in the regional grid. Thus there is trading of power between states in the grid. Similarly there are imports and export of power between regional grids.

Since the CDM project would be supplying power to the regional grid it is also preferred to take the regional grid as project boundary than the state boundary. It also minimizes the effect of inter state power transactions, which are dynamic and vary widely.

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[7] Baseline Carbon Dioxide Emission Database Version 2.0 dated 21 June 2007 available on http://cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm

Thus **Northern regional grid** has been selected for calculation of baseline emissions. The value of combined margin based emission factor for the northern regional grid has been taken from the CEA data base.

Determination of EG_y

For scenario 12, EG_y corresponds to the lower value between (a) net quantity of electricity generated in the new power plant unit that is installed as a part of the project activity ($EG_{project\ plant,y}$) and (b) difference between the total net electricity generated from firing of the same type(s) of biomass residues at the project site ($EG_{total,y}$) and the historical generation of the existing power unit(s) ($EG_{histroric,3yr}$), based on the three most recent years, as follows:

$$EG_y = MIN\begin{Bmatrix} EG_{projectplant,y} \\ EG_{total,y} - \dfrac{EG_{historic,3yr}}{3} \end{Bmatrix}$$

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 (MWh/yr),

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

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

$EG_{histroric,3yr}$ net quantity of electricity generated during the three most recent years in all power plants at the project site, generated from firing of the same type(s) of biomass residues at the project plant (MWh)

Emission reductions or increases due to displacement of heat

As per ACM0006, in case of cogeneration plants, the emission reductions or increases due to displacement of heat ($ER_{heat,y}$) also need to be determined. For the scenario 12, the heat would be generated in biomass residue fired boilers in the absence of the project activity.

In the baseline scenario, total of 140 TPH superheated steam was being generated through a set of 5 boilers (2 no Texmaco make 50 TPH (32 kg/cm2 and 350°C); 2 no IJT make 20 TPH (20 kg/cm2 and 340°C); & 1 no Oschatz make 20 TPH (20 kg/cm2 and 340°C). Of the total steam generated, 115.3 TPH steam was being routed to 5 no turbines and the rest 44.7 TPH steam was being through the PRDS system. This 44.7 TPH steam underwent pressure and temperature reduction prior to being routed to sugar mill for process use. Thus, the heat from 44.7 TPH superheated steam from the boilers being dissipated to the atmosphere in the PRDS system.

The project activity involves:

A. retiring of two numbers of less efficient low pressure boilers (20 TPH installed capacity generating steam at 20 kg/cm2 and 340°C);
B. installation of two numbers of medium pressure boilers (32TPH installed capacity generating steam at 42 kg/cm2 and 410°C); and
C. passing the 44.7 TPH of steam now through one number new steam turbine (back pressure type) of capacity 6.4 MW.

The additional steam generated in the two new boilers takes care of the condensate requirement of 9.6 TPH due to change over from PRDS to turbine. In case, MSL would have continued with the old set of less efficient boilers, the additional heat generation would have been required by firing extra bagasse. The installation of more efficient boilers and turbine as a part of the project activity has helped in recovering the heat from superheated steam for power generation and this additional power generation in the existing bagasse based cogeneration plant is being supplied to the grid.

The table below presents the efficiency of heat generation from boilers and cogeneration system prior to and after implementation of project activity (refer Annex 3 for detailed calculation of these values):

S.No	Parameter	Value
1.	Average net energy efficiency of heat generation in the project cogeneration plant ($\varepsilon_{th,\ project\ plant}$)	63%
2.	Net average thermal efficiency of the boilers (ε_{boiler}) in the baseline	73%
3.	Average net thermal efficiency of the boilers after project implementation	85%
4.	Average net energy efficiency of heat generation in the overall cogeneration system at Unit-I of MSL after implementation of project activity	63%

The average net energy efficiency of heat generation in the project cogeneration plant ($\varepsilon_{th,\ project\ plant}$) activity at 63% is lower than the net average thermal efficiency of the boilers (ε_{boiler}) in the baseline at 73%.

The thermal efficiency of new set of 5 boilers (2 no Texmaco make 50 TPH (32 kg/cm2 and 350°C); 1 no IJT make 20 TPH (20 kg/cm2 and 340°C); & 2 no Thermax make 32 TPH (42 kg/cm2 and 410°C), after the implementation of the project activity, is higher at 85% as compared to than that for the old set of 5 boilers (73% as referred above). This new configuration keeps the overall thermal efficiency of the cogeneration plant on-site after implementation of the project activity same value (63%) as that prior to implementation of the project activity. Thus, the total quantity of bagasse fired in the boilers remains unchanged in pre-project and project scenarios and the increase in steam required in place of condensate injected in PRDS is off set by increased efficiency of the new boilers.

Since there is no utilization of any fossil fuels and no additional firing of biomass, for the current project activity, emission reduction due to displacement of heat,

$\mathbf{ER_{heat,y} = 0}$

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

For Scenario 12 as applicable to proposed CDM project activity, $\mathbf{BE_{Biomass,y}}$ = 0

Leakage

In MSL proposed CDM project activity, the baseline scenario is the use of the biomass for energy generation (scenario 12) and therefore, the diversion of biomass to the project activity is already considered in the calculation of baseline reductions.

In this case, leakage effects do not need to be addressed. Thus, in the MSL proposed CDM project activity,

$\mathbf{L_y = 0}$

Emission Reductions

Thus, the emission reductions in the MSL project activity are mainly through displacement of electricity as the quantity of heat generated in the cogeneration activity remains unchanged in the project activity scenario. Deriving from the equation (1) of ACM0006, for calculation of emission reductions, for MSL project activity:

$ER_y = ER_{electricity,y}$, which will be calculated as per equation no 8 of ACM0006.

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

The data/ parameters that are available at validation include the following:

Data / Parameter:	$EG_{historic,3y}$
Data unit:	MWh
Description:	Net quantity of electricity generated during the most recent three years in all power plants at the project site, generated from firing of the bagasse at the project plant
Source of data used:	On site measurements
Value applied:	89514.126
Justification of the choice of data or description of measurement methods and procedures actually applied :	This is from the past three years generation data (03-04, 04-05, 05-06)from the site and measured with energy meters on site
Any comment:	100% of the data has been archived and measurement has been done once at the start of the project activity.

Data / Parameter:	$EF_{electricity,y}$
Data unit:	tCO_2/MWh
Description:	Emission factor for GHG emissions due to electricity displacement as per ACM 0002.
Source of data used:	This has been taken from the Central Electric Authority website Baseline

	Carbon Dioxide Emissions from Power Sector, Baseline Carbon Dioxide Emission Database Version 2.0 – LATEST on http://cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm
Value applied:	0.7976 tCO_2/MWh
Justification of the choice of data or description of measurement methods and procedures actually applied :	This is conservative and is based on the actual generation data as collected and compiled by Central Electric Authority and is based on the combined margin of northern regional grid.
Any comment:	-

B.6.3 Ex-ante calculation of emission reductions:

>> Since, the emission reductions in the MSL project activity are through displacement of electricity as the quantity of heat generated in the cogeneration activity remains unchanged in the project activity scenario. Deriving from the equation (1) of ACM0006, for calculation of emission reductions, for MSL project activity:

$ER_y = ER_{electricity,y}$, which will be calculated as per equation no 8 of ACM0006.

The Northern regional grid is considered as GHG emission baseline for the project activity and the grid generation mix for baseline analysis and calculation of anthropogenic emissions by fossil fuels during power generation. As mentioned in Annex 3, in the Northern regional grid generation mix, coal, lignite, gas and diesel based power projects are responsible for GHG emissions. Estimation of baseline emissions has been carried out as per the approved consolidated baseline methodology (ACM0006). The average operating margin approach (referred to in option(d) in step 1 of baseline determination in ACM0002 version 6 has been used for estimation of electricity baseline emission factor.

Following formula is used to determine Emission reduction

CO_2 emission reduction due to project activity	=	CO_2 emission factor for electricity displaced by project ($EF_{electricity,y}$)	X	Net quantity of increased electricity generation from project in MWh ($EG_{\mathbf{y}}$)

The EF_y for northern grid = **0.7976 tCO_2/MWh** (Refer Annex 3)

EG_y is calculated as:

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

where:

EG_y is the net quantity of increased electricity generation as a result of the project activity (incremental to baseline generation) during the year y (MWh/yr),

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

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

$EG_{histroric,3yr}$ net quantity of electricity generated during the three most recent years in all power plants at the project site, generated from firing of the same type(s) of biomass residues at the project plant

$EG_{project\ plant,y}$							
Turbine capacity		6.0	MW	This is net generation after accounting for auxiliary consumption, the rated installed capacity of turbine is 6.4 MW			
Days of operation		180	days				
Plan load factor		85	%				
Electricity generation from project turbine				22032	MWh		
$EG_{histroric,\ 3yrs}$							
Generation of existing units							
Year	**Electricity**	**Unit**	**Steam Generation (tph)**		**Turbines (MW)**		
2003-2004	33013.985	MWh	2X50 TPH, 3X 20 TPH	160 tph	3.0+2.5+2.5+1.2	9.2	
2004-2005	27950.298	MWh	2X50 TPH, 3X 20 TPH	160 tph	3.0+2.5+2.5+1.2	9.2	
2005-2006	28549.843	MWh	2X50 TPH, 2X32 TPH, 1X 20 TPH	184 tph	3.0+2.5+2.5+1.2+6.4	15.6	689.1 MWh generated by 6.4 MW TG Set in March 2006 has been subtracted
Sum of power generation in last three years			89514.126	MWh			
Average for last three years			29838.04	MWh			
Total proposed generation at MSL Unit-1 in 2006-07					50581.84	MWh	
Difference between total generation at MSL Unit-1 and three year average generation of existing unit					20743.80	MWh	
EF for northern grid			0.7976	tCO_2/MWh			
Emission reductions			**16544**	tCO_2/year			

(MWh)

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

>> The estimated emission reduction to be achieved during the ten-year (10 year) crediting period aggregates to **165443 tCO_2e**.

The baseline emissions calculations are presented here:

Year	Estimation of Project Activity Emissions (tCO_2e)	Estimation of Baseline Emissions (tCO_2e)	Estimation of leakage (tCO_2e)	Emission Reductions (tCO_2e)
Year 1 (Aug 2007-July 2008)	0	16544.32	0	16544
Year 2 (Aug 2008- July 2009)	0	16544.32	0	16544
Year 3 (Aug 2009- July 2010)	0	16544.32	0	16544
Year 4 (Aug 2010- July 2011)	0	16544.32	0	16544
Year 5 (Aug 2011- July 2012)	0	16544.32	0	16544
Year 6 (Aug 2012- July 2013)	0	16544.32	0	16544
Year 7 (Aug 2013- July 2014)	0	16544.32	0	16544
Year 8 (Aug 2014- July 2015)	0	16544.32	0	16544
Year 9 (Aug 2015- July 2016)	0	16544.32	0	16544
Year 10 (Aug 2016- July 2017)	0	16544.32	0	16544
Total (tonnes of CO_2e)		**165443.2**	0	**165443**

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

>> The approved baseline methodology applicable to the project activity is consolidated methodology ACM0006 **"Consolidated monitoring methodology for grid-connected electricity generation from biomass residues".**

ACM-0006 also refers to the latest approved version of ACM0002 ("Consolidated baseline methodology for grid-connected electricity generation from renewable sources"), the latest approved version of the "Tool for the demonstration and assessment of additionality".

Reference: Available on http://cdm.unfccc.int, Version 04 dated 1 November 2006.

The detailed monitoring plan has been presented in Annex -4 attached herewith.

B.7.1 Data and parameters monitored:

1. Data / Parameter:	**Quantity of bagasse fired, $BF_{k,y}$**
Data unit:	Tonnes
Description:	Quantity of fuel fired in the project activity during the year y
Source of data to be used:	On-site measurements of cane crushed
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Used for calculation of thermal energy efficiency calculations presented in Annex 3. Total bagasse consumption in Unit-I is 840 tonnes per day based on dry matter, in all boilers.
Description of measurement methods and procedures to be applied:	To be based on the total sugar cane crushed, bagasse generated and its use for internal consumption. The quantity of bagasse will be calculated based on the quantity of cane crushed and quantity of surplus bagasse sold to the outside parties.
QA/QC procedures to be applied:	The measurements at the plant site will be cross-checked with an annual energy balance that will be based on the purchased quantities and stock changes.
Any comment:	This data would be kept for 2 years after end of crediting period. 100% of the data will be monitored and stored electronically.

2. Data / Parameter:	**$EG_{project\ plant,\ y}$**
Data unit:	MWh/ yr
Description:	The net quantity of electricity generated in the project plant during the year y
Source of data to be used:	Metering records on site.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Emission reduction calculations for Scenario 12 is according to: $EG_y = MIN\left\{ \begin{matrix} EG_{projectplant,y} \\ EG_{total,y} - \frac{EG_{historic,3yr}}{3} \end{matrix} \right\}$ For MSL activity, $EG_{project\ plant,\ y}$ is a higher value (22032).
Description of measurement methods and procedures to be applied:	This is calculated based on gross electricity generation value and auxiliary power consumption values
QA/QC procedures to be applied:	The consistency of metered net electricity generation will be cross-checked with receipts from electricity sales and the quantity of fuels fired (e.g. check whether the electricity generation divided by the quantity of fuels fired results in a reasonable efficiency that is comparable to previous years).
Any comment:	100% of data would be monitored continuously and would be kept electronically for 2 years after the end of the crediting period.

3. Data / Parameter:	**$NCV_{bagasse}$**
Data unit:	GJ/tonne of bagasse
Description:	**Net Calorific value of bagasse**
Source of data to be used:	From the plant records, based on measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	14.863 GJ/tonne (3550 kCal/kg) (Dry basis) Used for calculation of thermal energy efficiency calculations presented in Annex 3.
Description of measurement methods and procedures to be applied:	This would be based on testing by external agencies. It would be done every six months based on 3 samples. The data would be kept for two years after the end of crediting period.
QA/QC procedures to be applied:	The consistency of the measurements will be checked by comparing the measurement results with measurements from previous years.
Any comment:	100% of the data would be monitored continuously and would be kept electronically for 2 years after the end of the crediting period.

4. 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 of bagasse at the project plant, including the new power plant installed as part of project activity and any previously generating units, during the year y
Source of data to be used:	Metering records on site.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	50581.84 (refer Annex 3 for details)
Description of measurement methods and procedures to be applied:	This is measured directly with energy meters.
QA/QC procedures to be applied:	The consistency of metered net electricity generation would be cross-checked with receipts from electricity sales and the quantity of fuels fired.
Any comment:	100% of data would be monitored, this would be done on a continuous basis and would be kept electronically for 2 years after the end of the crediting period. $EG_{historic,3yr}$ will be derived from $EG_{total,y}$ and $EG_{project\ plant,\ y}$

5. Data / Parameter:	**$EC_{PJ,y}$**
Data unit:	MWh
Description:	On-site electricity consumption attributable to the project activity (auxiliary consumption) during the year *y*
Source of data to be used:	Metering records on site
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Refer Annex 3 for details
Description of measurement methods and procedures to be applied:	Use electricity meters. The quantity shall be cross-checked with electricity purchase receipts.
QA/QC procedures to be applied:	This would be cross-checked with receipts from electricity sales.
Any comment:	100% of data would be monitored continuously and would be kept electronically for 2 years after the end of the crediting period.

6. Data / Parameter:	**$Q_{project\ plant,y}$**
Data unit:	GJ
Description:	Net quantity of heat generated from firing biomass in the project plant
Source of data to be used:	On-site measurements for temperature and pressure of steam would be used for enthalpy calculations
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not required as per the formula applied. Emission reduction calculations are based on generation of 6 MW electricity using cogeneration process and bagasse as fuel for 180 days. The total heat generated in the boilers by firing of biomass at project site is 104.93 GJ.
Description of measurement methods and procedures to be applied:	Net heat generation would be determined as the difference of the enthalpy of the steam generated by the project cogeneration plant minus the enthalpy of the feed-water and any condensate return. The respective enthalpies would be determined based on the mass (or volume) flows, the temperatures and, in case of superheated steam, the pressure. Steam tables would be used to calculate the enthalpy as a function of temperature and pressure.
QA/QC procedures to be applied:	The consistency of net heat generation would be cross-checked by comparing thermal efficiency which should be comparable to previous years.
Any comment:	-

7. Data / Parameter:	**$Q_{total,y}$**
Data unit:	GJ
Description:	Net quantity of heat generated all cogeneration units at the project site, generated from firing the same type(s) of biomass residues as in the project

	plant, including the cogeneration unit installed as part of the project activity and any previously existing units, during the year *y*
Source of data to be used:	On-site measurements for temperature and pressure of steam would be used for enthalpy calculations
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not required as per the formula applied. Emission reduction calculations are based on generation of 6 MW electricity using cogeneration process and bagasse as fuel for 180 days. The total heat generated at project site is 328.64 GJ.
Description of measurement methods and procedures to be applied:	Net heat generation would be determined as the difference of the enthalpy of the steam generated by the project cogeneration plant minus the enthalpy of the feed-water and any condensate return. The respective enthalpies would be determined based on the mass (or volume) flows, the temperatures and, in case of superheated steam, the pressure. Steam tables would be used to calculate the enthalpy as a function of temperature and pressure.
QA/QC procedures to be applied:	The consistency of net heat generation would be cross-checked by comparing thermal efficiency which should be comparable to previous years.
Any comment:	100% of the data would be monitored continuously and would be kept electronically for 2 years after the end of the crediting period.

8. Data / Parameter:	ε_{boiler}
Data unit:	-
Description:	Average net energy efficiency of heat generation in the boiler that would generate heat in the absence of the project activity
Source of data to be used:	Measured value
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not required as per the formula applied. This has been calculated as average efficiency of the 5 boilers in the pre-project scenario, including 2 no Texmaco make 50 TPH (32 kg/cm2 and 350°C); 2 no IJT make 20 TPH (20 kg/cm2 and 340°C); and 1 no Oschatz make 20 TPH (20 kg/cm2 and 340°C), since there is a common steam header for all the boilers.
Description of measurement methods and procedures to be applied:	Direct method (dividing the net heat generation by the energy content of the fuels fired during a representative time period). It will be measured once at the project start, as two of these boilers are retired at the start of the project activity
QA/QC procedures to be applied:	Check consistency with manufacturers information
Any comment:	This parameter is required to prove that ERheat = 0 or eth reference <eth project plant. 100% of the data would be monitored continuously and would be kept electronically for 2 years after the end of the crediting period.

9. Data / Parameter:	**Moisture content of the biomass residues**
Data unit:	% Water content
Description:	Moisture content of each biomass residue type *k*
Source of data to be	On-site measurements

used:	
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:	Continuously, mean values calculated at least annually
QA/QC procedures to be applied:	None
Any comment:	100% of the data would be monitored continuously and would be kept electronically for 2 years after the end of the crediting period.

B.7.2 Description of the monitoring plan:

>> Shift operator would be assigned with the responsibility recording of parameters as per the monitoring plan. Shift- in- charge would verify the data recorded at end of every shift/ day. Section in- charge would verify data on daily basis and prepare the daily report. This daily report is sent to Unit Head, which is subsequently sent to Executive Director, Operations. In case of any irregularity observed by Section- in- charge, necessary action would be taken immediately.

The monitoring plan has been presented in Annex -4.

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

>> Date of completion of baseline study: 21 June 2007

PricewaterhouseCoopers (P) Limited has assisted the project proponent in determining the application of baseline study and monitoring methodology for the identified CDM project. PwC is not a project participant in the proposed CDM project activity.

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

>> 22 March, 2006.

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

>> 20 years.

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:

C.2.2.1. Starting date:

>> 01/09/2007 (this is the expected date of registration of the CDM project activity with UNFCCC).

C.2.2.2. Length:

>> 10 years.

SECTION D. Environmental impacts

>> The project activity is small in size and do not have any significant impacts. However, diligent documentation and examination of such impacts is carried out by the MSL. The EIA study is carried out by Newcon Consultants India Pvt. Ltd.

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

>> **Solid Waste Generation:** Solid waste generation is from the following operations:

- Filter Press (Press Mud): As the filter mud is used as farm manure, it does not pose any problem of disposal and pollution.
- Boiler Ash/ Fly Ash: As the ash is obtained from combustion of bagasse, it is free from slag, silica and metallic compounds. When applied to soil, it improves the soil porosity, moisture retention and does not give out harmful metal leachets. Some quantity of this ash can usefully be applied to fields as soil reconditioner. Remaining quantity is safely disposed off as land filling.
- Effluent Treatment Sludge: At the treatment plant, both primary and secondary sludge will be dewatered and dried on sludge beds and used as fuel manure. This solid waste will therefore not pose any threat to environment.
- Domestic Refuse: The refuse given out at the colony of factory staff will be composted and then given out to farmers.

Air Emission: Different Wet Scrubbing Systems and Dust Collector Systems are installed in the sugar mill to control air pollution. The values of SPM, SO_2, NOx are all found to be very less. All air pollution from the mill is within prescribed limits.

Noise and Vibration: The noise levels produced by the operation of the project activity are also within prescribed limits of MoEF.

Soil Quality: MSW from the project activity is not discharging any effluent on land or polluting land by any means. Hence, there will be no effect on soil quality or fertility.

Water Quality: The existing ETP will be sufficient to treat the effluent.

Socio-Economic Impact: Air, water, soil and noise pollution will be well within limits of the prescribed limits and will not have any significant impact on the socio-economic life of the people residing in the villages in the core zone. Apart from employment, following advantages will be availed by the local people:

- Better inland transportation.
- Growth of small shops, markets and trading activities.
- Electrification.
- Prosperity of farmers due to remunerative prices for sugar cane as raw material.
- Opportunity for self-employment/ small-scale industry.

- Green belt development in the area.

The project activity does not have any significant impacts on the environment. There are no transboundary impacts.

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 host party does not consider the environmental impacts of such activities as significant and hence excluded such activities from the Environmental Impact Assessment Notification (1991) under Environment Protection Act (1984). However, the MSL diligently identified the possible environmental impacts and mitigated these to the extent feasible in an environmental impact assessment of the project activity.

MSL has obtained an environmental clearance from the state government in addition to consent to establish and operate from the Uttar Pradesh State pollution Control Board. The factory has ISO 14000 accreditation and therefore any environmental impacts are recorded. The periodic (annual) audits as a part of ISO 14000 based management systems would take care of any undesirable environmental impacts.

The clearances obtained by the government and relevant reports are available with MSL, which shall be presented to the validator and verifier as and when required.

SECTION E. Stakeholders' comments

>>

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

>> A meeting was organized by the project proponent at the project site to get the comments and suggestions of the local stakeholders on their project activity. A public notice was given 15 days prior to the meeting and the meeting was conducted on 30th of September 2005 at the MSL factory. The stakeholders numbering 102, comprised a healthy mix of representatives of Cane Society, senior technical officers from Mawana, leaders from the farming community residing in the vicinity of Mawana.

The main content of the presentation at the meeting essentially focused on:

- General description about Mawana's CDM initiatives and issues associated with them
- Brief of the CDM initiatives included:
- Reduction in generation of anthropogenic carbon dioxide emissions by cogeneration of steam and power using bagasse
- Replacement of inefficient low pressure boilers with efficient medium pressure boilers
- Replacement of pressure reducing valves with back pressure turbine sets
- Supply of power produced to UP grid

Annex-6 gives the detailed Minutes of Meeting for the stakeholders' meet.

E.2. Summary of the comments received:

>> Villagers wanted to know about pollution and cogeneration in general and the questions were suitably replied to. The key aspects of cogeneration and how it can directly or indirectly affect the villagers' life was addressed.

The stakeholders were also keen to know if the power generated from this project be sent only to the Mawana feeder or whether it will be distributed to other townships also.

Another query was on effect of project on global warming.

Chairman once again requested the participants to articulate any concerns that they may be harbouring. After ensuring that all concerns had been satisfactorily answered and that no stakeholder wanted to raise any further questions, the Chairman closed the discussion. He heartily appreciated Mawana's management for their efforts towards this new kind of sustainable initiative. He endorsed the information dissemination and was eminently satisfied with such kind of efforts. He emphasized that this kind of stakeholder consultation has a positive effect in that it would boost the cooperation between the local stakeholders and Mawana's management. He stressed that this kind of initiative would set an example for other industries too, that would replicate such kind of CDM initiatives at their plant premises. Such efforts would collectively help to improve the overall local environment as well global environment.

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

>> Since the meeting was an interactive and involved a detailed presentation from the Mawana management all the comments were suitable replied to.

To the comment on power utilization, it was explained that since there is a load-shedding of around 5 MW in Mawana due to overloading of the system, with the supply coming from new unit this load-shedding will get reduced and further there will be transfer of 2-3 MW to Modipuram.

On query related to effect on global warming, it was explained that 6 MW power will be produced from bagasse and once fed into the grid, will replace the 6 MW power generated at UPPCL thermal power plants, thereby reducing the CO2 production from the burning of coal. This reduced CO2 will ultimately result in reduction of global warming.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Mawana Sugars Limited
Street/P.O.Box:	6th Floor, Kirti Mahal
Building:	19, Rajendra Place
City:	New Delhi
State/Region:	Delhi
Postfix/ZIP:	110 008
Country:	India
Telephone:	+91 11 2573 9103
FAX:	+91 11 2574 3659
E-Mail:	gnagrawal@mawanasugars.com
URL:	www.mawanasugars.com
Represented by:	Mr. G. N. Agrawal
Title:	Mr.
Salutation:	General Manager
Last Name:	Agrawal
Middle Name:	N
First Name:	G
Department:	Projects
Mobile:	+91 98106 77059
Direct FAX:	+91 11 25743659
Direct tel:	+91 11 25763482
Personal E-Mail:	gnagrawal@mawanasugars.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

Project finance plan involves:

- 50% through Equity Share Capital / Internal Accruals : INR 125 million
- 50% through Term Loan from Financial Institutions / Banks : INR 125 million

No Official Development Agency funds have been used

Annex 3
BASELINE INFORMATION

Emission Factors for the Northern Regional Grid of India based on information available in Baseline Carbon Dioxide Emission Database Version 1.1 – **LATEST** on http://cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm

Simple Operating Margin (tCO_2/MWh) (incl. Imports)					
	2001-02	2002-03	2003-04	2004-05	2005-06
North	0.9778	0.9994	0.9869	0.9757	0.9945
Build Margin (tCO_2/MWh) (not adjusted for imports)					
	2001-02	2002-03	2003-04	2004-05	2004-05
North				0.5335	0.6005
Combined Margin in tCO_2/MWh (incl. Imports)					
	2001-02	2002-03	2003-04	2004-05	2005-06
North	0.7556	0.7664	0.7602	0.7546	0.7975

EG Calculations:

$EG_{project\ plant,y}$

Turbine capacity (This is net generation after accounting for auxiliary consumption, the rated installed capacity of turbine is 6.4 MW)	6	MW
Days of operation	180	days
Plan load factor	85	%
Electricity generation from project turbine	22032	MWh

$EG_{historic,\ 3yrs}$

Generation of existing units

Year	Electricity	Unit	Steam Generation (tph)		Turbines (MW)		
2003-2004	33013.985	MWh	2X50 TPH, 3X 20 TPH	160 tph	3.0+2.5+2.5+1.2	9.2	
2004-2005	27950.298	MWh	2X50 TPH, 3X 20 TPH	160 tph	3.0+2.5+2.5+1.2	9.2	
2005-2006	28549.843	MWh	2X50 TPH, 2X32 TPH, 1X 20 TPH	184 tph	3.0+2.5+2.5+1.2+6.4	15.6	689.1 MWh generated by 6.4 MW TG Set in March 2006 has been subtracted

Average for last three years	29838.04	MWh		
Total Power generation in last three years	89514.126	MWh		
Total proposed generation at MSL Unit-1 in 2006-07			50581.84	MWh
Difference between total generation at MSL Unit-1 and three year average generation of existing unit			20743.80	MWh
EF for northern grid	0.7975	tCO_2/MWh		
Emission reductions	**16544**	tCO_2/year	**Based on 20743.80 MWh which is lower than 22032 MWh as per formula given for EGy determination for scenario 12 in ACM0006**	

CER calculations:

Year	Period	Power Generation (MWh)	Carbon emission factor (tCO_2/MWh)	Baseline emission (tCO_2/year)	CER (tCO_2/year)
1	Aug 07- July 08	20743.80	0.7976	16544.32	16544
2	Aug 08- July 09	20743.80	0.7976	16544.32	16544
3	Aug 09- July 10	20743.80	0.7976	16544.32	16544
4	Aug 10- July 11	20743.80	0.7976	16544.32	16544
5	Aug 11- July 12	20743.80	0.7976	16544.32	16544
6	Aug 12- July 13	20743.80	0.7976	16544.32	16544
7	Aug 13- July 14	20743.80	0.7976	16544.32	16544
8	Aug 14- July 15	20743.80	0.7976	16544.32	16544
9	Aug 15- July 16	20743.80	0.7976	16544.32	16544
10	Aug 16- July 17	20743.80	0.7976	16544.32	16544
	Total	207438.01		165443.18	165443.18

Efficiency Calculations:

Average net energy efficiency of heat generation in the project cogeneration plant ($\varepsilon_{th, project\ plant}$)[9]

Input	*Unit*	*Value*
Bagasse (50% moisture)	MT	22.35
Bagasse (dry) (**BF**)	MT	11.175
NCV	Kcal/kg	3550
Energy input (NCV*BF)	KJ	166095590
Output[10]		
Exhaust Steam @ 1.5 kg/cm^2, 150°C	MT	44.7
Specific heat of steam	KJ/kg	2765
Feed water + return condensate	MT	44.7
Specific heat of feed water/condensate @ 1 kg/cm^2, 100°C	KJ/kg	417.51
Energy output ($Q_{project\ plant,y}$)	KJ	104932803
$\varepsilon_{th\ project\ plant}$	KJ/KJ	**63%**

[9] Represents the ratio between the firing energy (coming from the fuel) in the new Thermax boilers and the heat generated (based on enthalpy of steam going in for the sugar production at the outlet of 6.4 MW turbine) for the project activity

[10] Net heat generation has been determined as the difference of the enthalpy of the steam generated by the project cogeneration plant minus the enthalpy of the feed-water and any condensate return.

Net Average thermal efficiency of the boilers in the baseline (ε_{boiler})[11]

Input	*Unit*	*Value*
Bagasse (50% moisture)	MT	70
Bagasse (dry) (**BF**)	MT	35
NCV	Kcal/kg	3550
Energy input (NCV*BF)	KJ	520209900
Output[12]		
Steam @ 20 kg/cm^2, 340°C	MT	52.5
Specific heat of steam	KJ/kg	3115
Steam @ 32 kg/cm^2, 350°C	MT	87.5
Specific heat of steam	KJ/kg	3113
Specific heat of feed water/condensate @ 1 kg/cm^2, 100°C	KJ/kg	417.51
Energy output	KJ	377473600
ε_{boiler}		**73%**

[11] Represents the ratio between the firing energy (coming from the fuel) and the heat generated from the old set of 5 boilers in the baseline (as going into turbines and PRDS system)

[12] This represents the average efficiency of the 5 boilers in the pre-project scenario, including: 2 no Texmaco make 50 TPH (32 kg/cm2 and 350°C); 2 no IJT make 20 TPH (20 kg/cm2 and 340°C); & 1 no Oschatz make 20 TPH (20 kg/cm2 and 340°C)

Average net thermal efficiency of the boilers after project implementation [13]

Input	*Unit*	*Value*
Bagasse (50% moisture)	MT	70
Bagasse (dry) (**BF**)	MT	35
NCV	Kcal/kg	3550
Energy input	KJ	520209900
Output		
Steam @ 20 kg/cm^2, 340°C Specific heat of steam	MT KJ/kg	17.5 3115
Steam @ 32 kg/cm^2, 350°C	MT	87.5
Specific heat of steam	KJ/kg	3113
Steam @ 42 kg/cm^2, 410°C	MT	56
Specific heat of steam	KJ/kg	3235
Specific heat of feed water/condensate @ 1 kg/cm^2, 100°C	KJ/kg	417.51
Energy output	KJ	440840890
Efficiency		**85%**

[13] Represents the ratio between the firing energy (coming from the fuel) and the heat generated from new set of 5 boilers (based on enthalpy of steam going into the turbines). This includes 5 boilers: 2 no Texmaco make 50 TPH (32 kg/cm2 and 350°C); 1 no IJT make 20 TPH (20 g/cm2 and 340°C); and 2 no Thermax make 32 TPH (42 kg/cm2 and 410°C)

Average net energy efficiency of heat generation in the overall cogeneration system at Unit-I of MSL after implementation of project activity[14]

Input	*Unit*	*Value*
Bagasse (50% moisture)	MT	70
Bagasse (dry) (**BF**)	MT	35
NCV	Kcal/kg	3550
Energy input (NCV*BF)	KJ	520209900
Output[12]		
Exhaust Steam @ 1.5 kg/cm^2, 150°C	MT	140
Specific heat of steam	KJ/kg	2765
Feed water + return condensate	MT	140
Specific heat of feed water/condensate @ 1 kg/cm^2, 100°C	KJ/kg	417.51
$\mathbf{Q_{total,y}}$	KJ	328648600
$\varepsilon_{\text{th project plant}}$		**63%**

[14] This represents the thermal efficiency of total cogeneration system at the MSL Unit-I site; it is the ratio between the firing energy (coming from the fuel) and the heat in the steam at outlet of turbines routed through the common steam header to sugar mill.

Annex 4

The methodology requires the project-monitoring plan to consist of metering the electricity generated by the project activity, total electricity generated by all the units at site, quantity of bagasse fired in project activity, calorific value of bagasse, net quantity of heat generated by project plant and average net energy efficiency of heat generation in the boilers operated next to the project plant.

Energy meters would be used for monitoring the energy generated by all the units. The energy meters shall be maintained in accordance with electricity standards in India. Each meter would be inspected and sealed and shall not be interfered with by anyone. All the energy meters would be tested for accuracy every year by independent agency, which is accredited with National Accreditation Board for Testing & Calibration Laboratories, Department of Science & Technology, Govt. of India. If during test check, meters are found to be beyond permissible limits of error they would be calibrated immediately. Faulty meter would be replaced by spare meter kept at site. Calorific value of bagasse would be established every six months based 3 samples by an independent agency, accredited with National Accreditation Board for Testing & Calibration Laboratories, Department of Science & Technology, Govt. of India.

Total quantity of bagasse fired in the project plant would be measured based on quantity of cane crushed, bagasse on cane and excess bagasse. For cane measurement and excess bagasse, the weigh bridge would be tested for accuracy every year by independent agency, which is accredited with National Accreditation Board for Testing & Calibration Laboratories, Department of Science & Technology, Govt. of India. If during yearly test check, weigh bridge is found to be beyond permissible limits of error it would be calibrated immediately.

Monitoring measurement and reporting of data

Shift operator would be assigned with the responsibility recording of parameters as per the monitoring plan. Shift-in-charge would verify the data recorded at end of every shift/day. Section in-charge would verify data on daily basis and prepare the daily report. This daily report is sent to Unit Head, which is subsequently sent to Executive Director, Operations. In case of any irregularity observed by Section-in-charge, necessary action would be taken immediately.

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Annex 5

Minutes of the Local Stakeholder Consultation meet on Clean Development Mechanism (CDM) initiatives at *Mawana Sugar Works* (A Unit of Mawana Sugars Ltd.), Mawana

Date: 30th September 2005
Time: 1100 hours

The list of attendees to the meeting is available for reference with MSL.

At the outset of the meeting, the participants were all warmly welcomed by Mr. Arvind Singh Addl. Mgr.(Welfare) . He then invited Mr. Karan Singh, General Manager of Mawana Sugars ("Mawana") to provide an overview of the objective and agenda of the meeting. Mr. Karan Singh touched briefly on power problems in India as well those of global warming. Mr. Arvind Singh then invited the audience to elect the Chairman of the meeting. Mr. Sham Singh, a farmer present in the audience, proposed the name of Mr. A.K. Singh, Exectuive Engineer-UPPCL, to chair the meeting. Mr. Sham Singh's suggestion was seconded by Mr. Chanuhas. The audience was further asked by Mr. Karan Singh if it had any reservations towards the choice of the Chairman. However, the audience wholeheartedly endorsed the Chairman's candidature and supported his election to the Chair. Accordingly, Mr. Karan Singh then requested Mr. A. K. Singh to chair the meeting. He also introduced the participants to the dignitaries present at the meet including Mr.Mange Ram Bhati, Chairman Cane Society. The stakeholders numbering 102, comprised a healthy mix of representatives of Cane Society, senior technical officers from Mawana, leaders from the farming community residing in the vicinity of Mawana.

After the round of introductions was completed, Mr. Arvind Singh invited Dr. Muna Ali of PricewaterhouseCoopers, to explain in brief about Climate Change and CDM-Kyoto Protocol.

Dr. Muna Ali started the presentation by requesting the active participation of the audience so that they may appreciate the uniqueness of the CDM initiatives adopted by Mawana. She then proceeded to make the presentation in Hindi by providing an overview of Climate Change and its impact, Kyoto Protocol and CDM process. Additionally, the technical details of the project were described in brief by Mr. G. N. Agrawal.

The main content of the presentation at the meeting essentially focused on:

- General description about Mawana's CDM initiatives and issues associated with them
- Brief of the CDM initiatives included:
- Reduction in generation of anthropogenic carbon dioxide emissions by cogeneration of steam and power using bagasse
- Replacement of inefficient low pressure boilers with efficient medium pressure boilers

- Replacement of pressure reducing valves with back pressure turbine sets
- Supply of power produced to UP grid

After the presentation, the Chairman highlighted the important role of the local stakeholders in articulating any concerns that they may have on the CDM project. He also requested the project proponents to provide clear and direct answers to the concerns raised by stakeholders. The Chairman further requested all stakeholders to come forward with their questions, if any, related to the Clean Development Mechanism and Mawana's CDM initiative.

Mr. Arvind Singh then opened the house for questions. Several pertinent questions were raised that reflected the active participation of all the stakeholders present. A detailed list of points/concerns raised and their respective replies have been provided below:

1. ***Q.** Please provide the meaning of pollution (Mr. Nadeem, Farmer, Icholi village)*

***A.** Pollution can be caused in air, water or land. In this context we are discussing about atmospheric pollution. When the electricity is produced from coal, CO2 and CO gases are generated. We aim for a system where CO2 emissions are minimized as it pollutes the atmosphere. Power generation from bagasse produced minimum CO2 and bagasse is also utilized.*

2. ***Q.** Please explain what is meant by cogeneration? (Mr. Amarpal Singh, Farmer, Baswara village)*

   ***A.** During the power generation in a back pressure steam turbine there is simultaneous generation of steam. This production of power and steam together is called cogeneration.*

3. ***Q.** What are the disadvantages of cogeneration? (Mr. Ajit Singh, Farmer, Tigri)*

***A.** Cogeneration has no disadvantages; rather it is advantageous not only to the mills but to the community as well. This is because the power being fed to the grid improves the quality of supply of power supply in that area in terms of voltage, frequency, etc.*

4. ***Q.** Will the power generated from this project be sent only to the Mawana feeder or whether it will be distributed to other townships also? (Mr. Sham Singh, Farmer)*

***A.** There is a load-shedding of around 5 MW in mawana due to overloading of the system. With the supply coming from MSW this load-shedding will get reduced and further there will be transfer of 2-3 MW to Modipuram.*

5. ***Q.** How will this project affect global warming? (Mr. Chanuhas)*

***A.** 6 MW power will be produced from bagasse and once fed into the grid, will replace the 6 MW power generated at UPPCL thermal power plants, thereby reducing the CO2 production from the burning of coal. This reduced CO2 will ultimately result in reduction of global warming.*

Chairman once again requested the participants to articulate any concerns that they may be harboring. After ensuring that all concerns had been satisfactorily answered and that no stakeholder wanted to raise any further questions, the Chairman closed the discussion. Mr. Arvind Singh then requested the Chairman to brief the audience about his own view point about the initiatives.

Mr A. K. Singh, the Chairman, in summarizing the discussion heartily appreciated Mawana's management for their efforts towards this new kind of sustainable initiative. He endorsed the information dissemination and was eminently satisfied with such kind of efforts. He emphasized that this kind of stakeholder consultation has a positive effect in that it would boost the cooperation between the local stakeholders and Mawana's management. He stressed that this kind of initiative would set an example for other industries too, that would replicate such kind of CDM initiatives at their plant premises. Such efforts would collectively help to improve the overall local environment as well global environment.

Mr. Mange Ram Bhati, Chairman Cane Society, provided the concluding remarks by stating that Mawana deserved hearty applause and appreciation for their CDM initiatives.

Finally, Mr. Bhatnagar, AGM-Production, Mawana, proposed the vote of thanks and the meeting concluded with thanks to the chair.

Chairman
(A. K. Singh)