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

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SECTION A. General description of project activity

A.1 Title of the project activity:

Bagasse based Co-generation Project at Titawi Sugar Complex.

Version 01

Date: 07/07/2006

A.2. Description of the project activity:

Mawana Sugars Limited (MSL) is the seventh largest private sector sugar manufacturer in India and accounts for more than 5% of sugar production in the state of Uttar Pradesh in India. MSL has three sugar manufacturing units viz. Mawana Sugar Works, Titawi Sugar Complex and Nanglamal Sugar Complex, all located in state of Uttar Pradesh, India.

Under present arrangement, heat and power requirement at the Titawi Sugar Complex is being met by low pressure boilers and turbo-generators (TG). There are three boilers (all operating at 42 kg/cm^2) and four turbo generators to meet the process steam and electricity requirement of the sugar unit. Bagasse generated by sugar mill is used for operating the existing cogeneration plant.

MSL is in the process of expanding its cane crushing capacity from existing 7,000 Ton Crushed per Day (TCD) to 10,500 TCD whereby surplus bagasse would be available. MSL has the option to install a new cogeneration plant with low pressure boilers (42 kg/cm^2) and turbo-generators, which is prevalent practice in the sugar industry in the region, to meet its increased captive steam and power requirements. However, based on anticipated benefits from Clean Development Mechanism, MSL has decided to implement high pressure configuration cogeneration system.

The proposed project activity envisages installation of one number of 90 Tons per Hour (TPH) nominal capacity high pressure boilers with steam outlet pressure of 86 kg/cm^2 and one number of backpressure turbo generator of 20.0 MW capacity.

Total steam and part of electricity generated by project activity would be used to run the cane crushing facility and cogeneration plant. Surplus electricity would be exported to the grid. The emission reductions from the project activity comes from the avoidance of carbon dioxide emissions from power plants supplying electricity to the Northern regional grid which is dominated by fossil fuel based power plants.

Contribution to Sustainable Development

Being a renewable energy project activity, it supports India's national policy to promote clean power. The government's clean power diversification strategy includes a multi-pronged strategy focusing on reducing wastage of energy combined with the optimum use of renewable energy (RE) sources, as adopted by the project activity.

The project activity substitutes, and hence decreases the future need, for primarily fossil fuel based power generation by the grid, thereby reducing carbon dioxide (CO_2) emissions from the Indian electricity sector. The project activity positively contributes towards more efficient waste disposal and natural resource conservation.

The project activity has contributed to the local job and income creation in rural area. It would further create steady and higher value jobs for skilled workers at the cogeneration facility. In summary, the project's sustainable development benefits and issues include:

- Export of surplus power, thereby reducing GHG emissions through displacement of same quantity of power by grid, which is dominated by conventional fossil fuels;
- Decreasing the growth in demand for precious fossil fuels, and making them available for higher-value economic applications;
- Contributing to an increase in the local employment in the area of skilled jobs for operation and maintenance of the cogeneration equipment.
- More efficient use of bagasse

A.3. Project participants:

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Name of Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants(as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
India	Mawana Sugars Limited.	No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

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A.4.1.1. Host Party(ies):

India

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

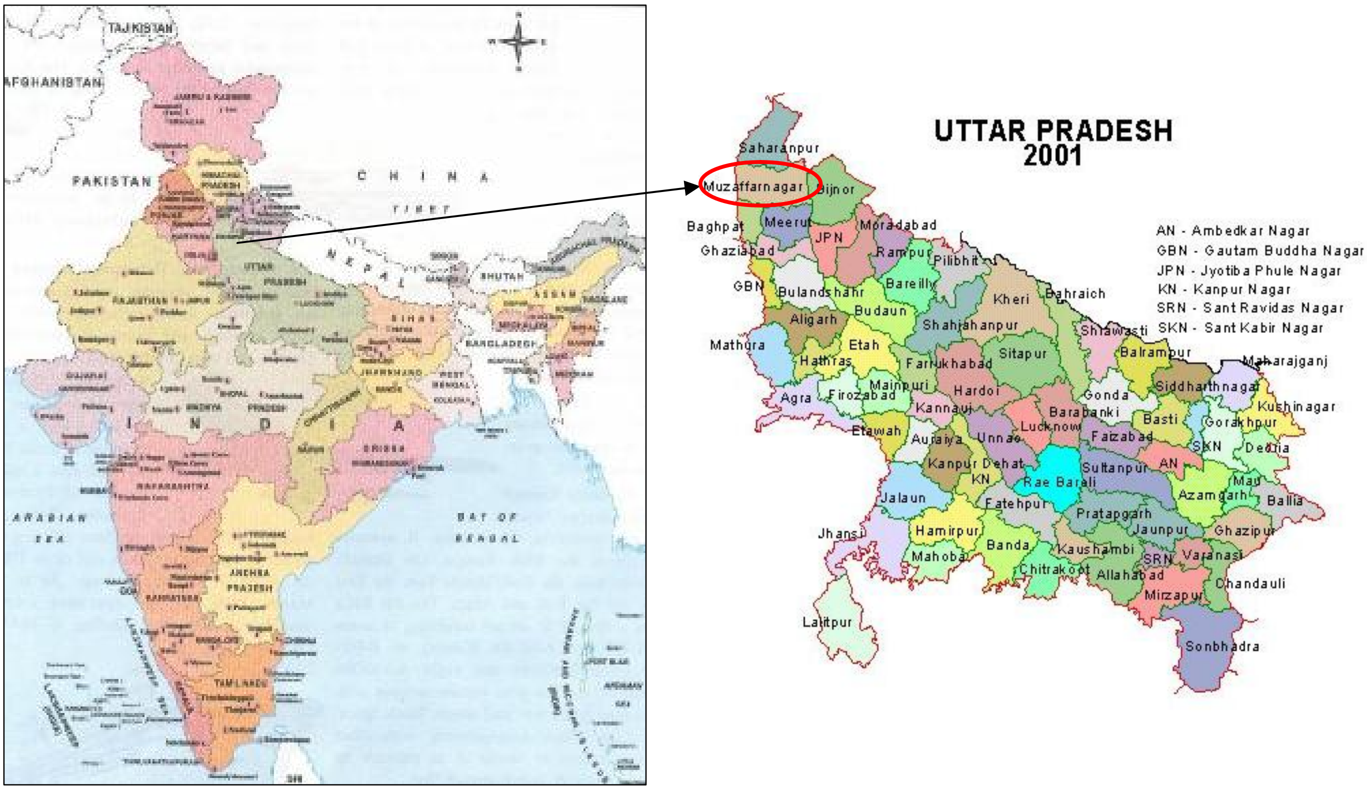
Uttar Pradesh

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

Village Titawi, District Muzaffarnagar

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 being implemented at one of the sugar manufacturing unit of MSL viz. Titawi Sugar Complex located in Titawi. Titawi is a small village situated in Muzaffarnagar District of Uttar Pradesh. The site is easily accessible by rail and road.



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

The project activity falls under the Sectoral Scope 1: Energy industries (renewable - / non-renewable sources) as per the sectoral scopes related approved methodologies and DOEs.

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

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

The plant is designed to operate with boiler outlet steam configuration of 86 kg / cm^2 and 515 ^oC. The cogeneration cycle for the plant is designed as an energy efficient regenerative cycle. Very few bagasse based cogeneration power plants are designed with above mentioned high pressure and temperature parameters in India. However the technology is well proven worldwide and is now being applied to cogeneration plants in India.

The plant is designed to operate at 90 Tonne Per Hour (TPH) nominal capacity boiler with the super heater outlet steam parameters of 86 kg/cm^2 & 515 ^0C and one backpressure type turbo-generator of 20.0 MW capacity, using bagasse as the fuel.

The plant is designed with all other auxiliary plant systems like

- ✓ bagasse handling system with storage and processing arrangements,
- ✓ high pressure feed water pumps
- ✓ ash handling system,
- ✓ water treatment plant,
- ✓ compressed air system,
- ✓ main steam, medium pressure and low pressure steam systems,
- ✓ fire protection system,
- ✓ water system
- ✓ the electrical system for its successful operation.

The power would be generated at 11.0 kV and stepped up to 132 kV and paralleled with the Uttar Pradesh Power Corporation Limited (UPPCL) grid at the sub-station located at Lalukheri near Shamli.

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

The proposed project activity uses bagasse as fuel for cogeneration unit. The bagasse being a renewable bio-mass fuel does not add any net carbon-dioxide to the atmosphere because of the carbon recycling during growth of sugar cane. Therefore, the project activity will lead to zero CO_2 on-site emissions associated with bagasse combustion.

The project activity would generate 20.0 MW power, exporting 11.0 MW during crushing season to grid after meeting captive requirements of the sugar mill. The crushing season of 180 days is envisaged for project activity operation. The project activity would not operate during non-crushing / off-season period.

Without the project activity, the same energy load would have been taken-up by grid mix and emission of CO_2 would have occurred due to combustion of conventional fossil fuels. Considering the export of clean electricity to the fossil fuel dominated grid by the project activity there will be continuous GHG reductions, as it would avoid equivalent GHG emissions.

The project activity would lead to emission reduction of **228,880 tonnes** of CO_2 over a 10 year crediting period.

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

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Years	Annual estimation of emission reductions in tonnes of CO_2 e
2006-2007	22888
2007-2008	22888
2008-2009	22888
2009-2010	22888
2010-2011	22888
2011-2012	22888
2012-2013	22888
2013-2014	22888
2014-2015	22888
2015-2016	22888
Total estimated reductions (tonnes of CO_2 e)	**228,880**
Total number of crediting years	10 years
Annual average over the crediting period of estimated reductions (**(**tonnes of CO_2 e)	**22,888**

A.4.5. Public funding of the project activity:

No public funding as part of project financing from parties included in Annex I of the convention is involved in the project activity.

SECTION B. Application of a baseline methodology

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

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

Reference – Approved consolidated baseline methodology ACM0006/Version 03, Sectoral Scope: 01, 19 May 2006

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

The said methodology is applicable to grid-connected and biomass residue fired electricity generation project activities, including cogeneration plants.

Project activity is a cogeneration plant fired with bagasse, which is a biomass residue from cane crushing process. Also project activity would supply surplus power to grid and hence meets the said applicability criteria.

As per the methodology, the project activity may include:

"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)**"

Project activity involves installation of new bagasse based cogeneration project, which would be operated next to existing cogeneration units fired with bagasse.

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.

The project activity is a cogeneration unit located in the sugar manufacturing facility, Titawi Sugar Complex, which generates bagasse.

Further, the project activity meets the applicability criteria of consolidated methodology as under:

Criteria 1: No other biomass types than *biomass residues*, 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)

The project activity would only use bagasse *(a biomass residue)* as fuel.

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

Implementation of the project activity would not result in increase of processing capacity of sugar manufacturing process.

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

The project activity would operate during 180 day crushing season only, using the bagasse produced during this period.

Criteria 4: 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.2. Description of how the methodology is applied in the context of the project activity:

The methodology is only applicable for the specific combinations of baseline scenarios.

Identification of baseline scenario

As per the methodology, identification of the most plausible baseline scenario among all realistic and credible alternative(s) is to be carried out. Steps 2 and/or 3 of the latest approved version of the “tool for the determination and assessment of additionality” should be used to assess which of these alternatives should be excluded from further consideration (e.g. alternatives where barriers are prohibitive or which are clearly economically unattractive). Where more than one credible and plausible alternative remains, as a conservative assumption, the alternative baseline scenario would be the one that results in the lowest baseline emissions as the most likely baseline scenario.

As per the methodology, realistic and credible alternatives should be separately determined regarding:

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

- In case of cogeneration projects: how the **heat** would be generated in the absence of the project activity

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

Baseline scenario for power generation	**Description**	**Comments**
P1	The proposed project activity not undertaken as a CDM project activity	Proposed project activity faces barriers as discussed in section B.3 hence, it cannot be taken as baseline scenario.
P2	The proposed project activity (installation of a power plant), fired with the same type of biomass but with a lower electrical energy efficiency	This is one of the options available with MSL hence, can be considered as one of the credible baseline scenario.
P3	The generation of power in an existing plant, on-site or nearby the project site, using only fossil fuels	Use of coal for power generation would be economically unattractive and would lead to higher baseline emissions hence, it cannot be taken as baseline scenario.
P4	The generation of power in existing and/or new grid-connected power plants	In absence of project activity, the equivalent power exported by project activity would be generated in existing and/or new grid-connected power plants. Hence, it is one of the credible baseline scenario.
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	The continuation of operation of existing cogeneration plants alone at site, without the implementation of project activity, would not generate enough electricity to meet the entire electricity requirements of the sugar mill. Hence, this is not a credible baseline scenario.
P6	The continuation of power generation in	The continuation of operation of existing

	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	cogeneration plants alone at site, without the implementation of project activity, would not generate enough electricity to meet the entire electricity requirements of the sugar mill. Hence, this is not a credible baseline scenario.

As the proposed project activity is a **cogeneration** project so alternatives for heat generation will also have to be identified. For **heat** generation, realistic and credible alternatives may include:

Baseline scenario for power generation	**Description**	**Comments**
H1	The proposed project activity not undertaken as a CDM project activity	Proposed project activity faces barriers as discussed in section B.3 hence, it cannot be taken as baseline scenario.
H2	The proposed project activity (installation of a cogeneration power plant), fired with the same type of biomass but with a lower thermal energy efficiency	This is one of the options available with MSL hence, can be considered as one of the credible baseline scenario.
H3	The generation of heat in an existing cogeneration plant, on-site or nearby the project site, using only fossil fuels	Use of coal for heat generation would be economically unattractive and would lead to higher baseline emissions hence, it cannot be taken as baseline scenario.
H4	The generation of heat in boilers using the same type of biomass residues	Installation of boilers for heat generation only, would be economically unattractive hence, it cannot be taken as baseline scenario.
H5	The continuation of heat generation in an existing cogeneration plant, fired with	The continuation of operation of existing cogeneration plants alone at site, without

	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	the implementation of project activity, would not generate enough heat to meet the entire heat requirements of the sugar mill. Hence, this is not a credible baseline scenario.
H6	The generation of heat in boilers using fossil fuels	Installation of boilers for heat generation only, would be economically unattractive. Use of fossil fuels in these boilers would make it further economically unattractive. Also it would lead to higher baseline emissions and hence, this is not a credible baseline scenario.
H7	The use of heat from external sources, such as district heat	There is no district heating system in the region hence, it cannot be taken as baseline scenario.
H8	Other heat generation technologies	Installation of technologies for heat generation only, would be economically unattractive hence, it cannot be taken as baseline scenario.

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

Baseline scenario for power generation	**Description**	**Comments**
B1	The biomass is dumped or left to decay or burned in an uncontrolled manner without utilizing it for energy purposes	Bagasse generated by sugar mills in the region is a useful resource and is not dumped or left to decay or burned in an uncontrolled manner. Hence, it cannot be taken as baseline scenario.
B2	The biomass is used for heat and/or	In absence of project activity, biomass

	electricity generation at the project site	would have been used for heat and electricity generation in a cogeneration system with lower efficiency than project plant. Hence, can be considered as one of the credible baseline scenario.
B3	The biomass is used for power generation, including cogeneration, in other existing or new grid-connected power plants	To meet its electricity and heat requirements, MSL would have used the biomass at site in a new cogeneration system with lower efficiency than project plant. Hence, it cannot be considered as one of the credible baseline scenario.
B4	The biomass is used for heat generation in other existing or new boilers at other sites	To meet its electricity and heat requirements, MSL would have used the biomass at site in a new cogeneration system with lower efficiency than project plant. Hence, it cannot be considered as one of the credible baseline scenario.
B5	The biomass is used for other energy purposes, such as the generation of biofuels	To meet its electricity and heat requirements, MSL would have used the biomass at site in a new cogeneration system with lower efficiency than project plant. Hence, it cannot be considered as one of the credible baseline scenario.
B6	The biomass is used for non-energy purposes	To meet its electricity and heat requirements, MSL would have used the biomass at site in a new cogeneration system with lower efficiency than project plant. Hence, it cannot be considered as one of the credible baseline scenario.

Among all the identified alternatives, the most credible and realistic alternatives that results in the lowest baseline emissions are:

Power – P2 and P4

Heat – H2

Biomass - B2

Thus the above alternative forms the baseline scenario. This specific combination of baseline scenario is defined for scenario 13, which states that:

"The project activity involves the installation of a new power unit, which is operated next to (an) existing biomass power generation unit(s). The existing unit (s) are only fired with biomass and continue to operate after the installation of the new power unit. In the absence of the project activity, a new biomass power unit (in the following referred to as "reference plant") would be installed instead of the project activity at the same site and with the same thermal firing capacity but with a lower electric efficiency as the project plant (e.g. by using of a low-pressure boiler instead of a high-pressure boiler). The same type and quantity of biomass as in the project plant would be used in the reference plant. Consequently, the power generated by the project plant would in the absence of the project activity be generated (a) in the reference plant and – since power generation is larger in the project plant than in the reference plant – (b) partly in power plants in the grid. The heat generated by the project plant would in the absence of the project activity be generated in the reference plant (the heat generated per biomass input in the project plant is smaller or the same compared to the reference plant)."

B.3. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity:

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According to the selected methodology, the project proponent is required to establish that the GHG reductions due to project activity are additional to those that would have occurred in absence of the project activity as per the 'Tool for the demonstration and assessment of additionality' Annex-1 to EB 16 Report.

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

Since, MSL wishes to have the crediting period starting after the registration of their project activity this step is not applicable.

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

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

Alternative scenarios complying with regulations in India have been discussed in section B.2.

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

All the credible options available to MSL are in compliance with legal and regulatory requirements of the host country.

Step 2. Investment analysis OR

Step 3. Barrier analysis.

MSL proceeds to establish project additionality by conducting the Step 3: Barrier Analysis.

It is required to determine whether the project activity faces barriers that:

(a) Prevent the implementation of this type of proposed project activity; and

(b) Do not prevent the implementation of at least one of the alternatives through the following sub-steps:

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

Barrier due to Prevailing Practice

The project activity which involves implementation of high pressure boiler (86 kg/cm^2) for the cogeneration project is among the first few of its kind being carried out in the region. Most of the sugar industries operating in the region continue to use low or medium pressure boilers for co-generation purpose. Prior to the mid-1970's, the steam pressure used in the majority of boilers located in Indian sugar mills was in the range of 10-15 kg/cm^2, which subsequently increased to the prevailing average of 21 kg/cm^2. The majority of the boiler systems in Indian sugar mills operate at a pressure of 21 kg/cm^2 and temperature of 340 ^{o}C, although some mills employ 14 kg/cm^2/265 ^{o}C or 32 kg/cm2/380 ^{o}C steam systems. In the mid-1980's, a few Indian mills installed higher pressure (42 kg/cm^2) boilers[1], this demonstrates that usage of boilers with higher pressures (86 kg/cm^2) is not being practised in the sugar industry in the region and hence is not a prevalent practice. There are 40 sugar mills in Uttar Pradesh, out of which only 14 have cogeneration systems[2]. High pressure configuration cogeneration systems similar to the project activity have been commissioned in only 4 plants out these 14 plants[3]. All of these 4 projects are in process of availing CDM funding. This clearly proves that in absence of CDM, installation of high pressure configurations cogeneration systems would have not been implemented in the region.

[1] Page 7 of 25 of the report "Promotion of Biomass Cogeneration with Power Export in the Indian Sugar Industry " http://www.netl.doe.gov/publications/carbon_seq/articles/india.pdf

[2] http://www.indiansugar.com/sugarmap/Map%20of%20UP.htm

[3] Only four projects implemented so far with similar technology (i) 1st Project of BCML at Balrampur, UP (ii) 2nd Project of BCML at Haidergarh, UP (iii) Triveni Sugar, Deoband (iv) Triveni Sugar, Khatauli

Moreover, Uttar Pradesh has a potential of more than 1000 MW for Bagasse based Cogeneration Plants and the installed 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 MUs from cogeneration plants out of its total power consumption of around 41000 MUs, which works out to around 0.43 only%[4]. This substantiates the fact that practice of sale of power to grid from bagasse based cogeneration projects has not penetrated in the region.

Other Barriers

Institutional Barriers:

(a) MSL has signed Power Purchase Agreement (PPA) with UPPCL. Project earnings are dependent on the payment from UPPCL against the sale of electricity to the grid. 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 32.82 billion[5]. Although the fiscal condition of state electricity board has improved considerably in present year, dealing with UPPCL has associated risks.

Also UPPCL is purchasing power at an average rate of INR 1.66/kWh from various sources. However, the purchase of power from cogeneration projects has been fixed as INR 2.98/kWh by UPERC, which is much higher than average cost at which UPPCL purchases power. Hence, likelihood of the PPA being renegotiated at later stage cannot be ruled out in the future.

(b) Imbalances in the Northern Region grid have been increasing over the years. In the year 2005-06 the grid failed twice. Similar failures in the future cannot be ruled out, which would lead to tripping of the project activity plant.

(c) Till 2004-05 the rate of purchase of power by UPPCL from similar projects was INR 2.25/kWh for base year 1999-2000 with annual escalation of 5 %. This would have made the tariff as INR 3.16/kWH in the year 2006-2007, however MSL would sale power at INR 2.98 with annual escalation of INR 0.04/kWh only, as per the recent order by UPERC. Also the the validity of the power purchase rate has been kept only for a period of 5 years[6]. Hence, possibility of further reduction in rate of power purchase after 5 years cannot be ruled out.

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

[5] UPERC, Tariff Order 2004-2005

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

(d) As per the policy that existed till year 2004-05, UPPCL and MSL would have shared the cost of transmission lines on equal basis. However, as per the recent orders by UPERC, MSL is required to bear the entire cost for laying the transmission lines form project plant to sub-station.

(e) Section 86 (1) (e) of the Electricity Act 2003 states that State Regulatory Commissions should promote and fix quantity of energy to be purchased from renewable and non-conventional energy (NCE) projects by state electricity boards. NEDA, the Nodal agency for promotion of NCE projects in Uttar Pradesh, has recommended that it should be made obligatory to procure 10% of total power consumption from Renewable and NCE source based plants. Going against this policy, UPERC kept this limit to 5 %. Uttar Pradesh Sugar Mills cogeneration association filed a petition with UPERC requesting it to increase this limit to 10 % in line with Electricity Act 2003. Taking view from the petitioners, UPERC revised the limit from 5 % to 7.5 %[7]. UPERC may in future reduce this limit again, whereby MSL might have to reduce its export to the grid. These revisions are bound to severely affect the sustainability of the project activity. If this scenario continues, then it would significantly affect the development of other such projects due to reluctance of the financial institutions to support them and would hamper the growth of eco-friendly non-emissive power generation in the state. In spite of these limitations, MSL is one such entrepreneur to initiate this GHG abatement project under Clean Development Mechanism. MSL's success would depend on securing the proposed carbon finance and it would definitely encourage other entrepreneurs to come up with similar project activities contributing further towards GHG emission reduction through the huge untapped bagasse based cogeneration potential.

Sub-step (3b). Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed project activity):

Implementation of alternative project (42 kg/cm^2 cogeneration system) does not face the prevailing practice barrier and other 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 high pressure configuration cogeneration system.

Step 4. Common Practice Analysis

Sub-step 4a. Analyze other activities similar to the proposed project activity:

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

As discussed earlier, high pressure configuration cogeneration systems, similar to the project activity have been commissioned in only 4 plants in the region. All of these 4 projects are in process of availing CDM funding. Therefore the MSL project activity is not a common practice.

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

Since there is no similar project activity with a similar investment climate implemented, this sub-step is not applicable.

Step 5. Impact of CDM registration

The benefits and incentives expected due to approval and registration of the project activity as a CDM activity would certainly improve the sustainability of the project activity and would help to overcome the identified barriers. For instance the additional revenues through CDM funding could compensate financial losses arising out of reduction in power purchase by UPPCL, reduction in tariff for power purchased or non-payment of money by UPPCL against sale of electricity.

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

For the purpose of determining GHG emissions of the project activity, project participants shall include the following emissions sources:

- CO_2 emissions from on-site fuel consumption of fossil fuels, co-fired in the biomass power plant; and

  There would be no fossil fuel co-firing in the cogeneration plants at site hence these emission sources are not included

- CO_2 emissions from off-site transportation of biomass that is combusted in the project plant.

  There is no off-site transportation of biomass for use in the project plant.

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

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

  These emission sources are included in project boundary

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

  There is no displacement of fossil fuel based heat generation by the project activity.

Where the most likely baseline scenario for the biomass is that the biomass would be dumped or left to decay or burned in an uncontrolled manner without utilizing it for energy purposes (case B1), project participants may decide whether to include CH4 emissions in the project boundary.

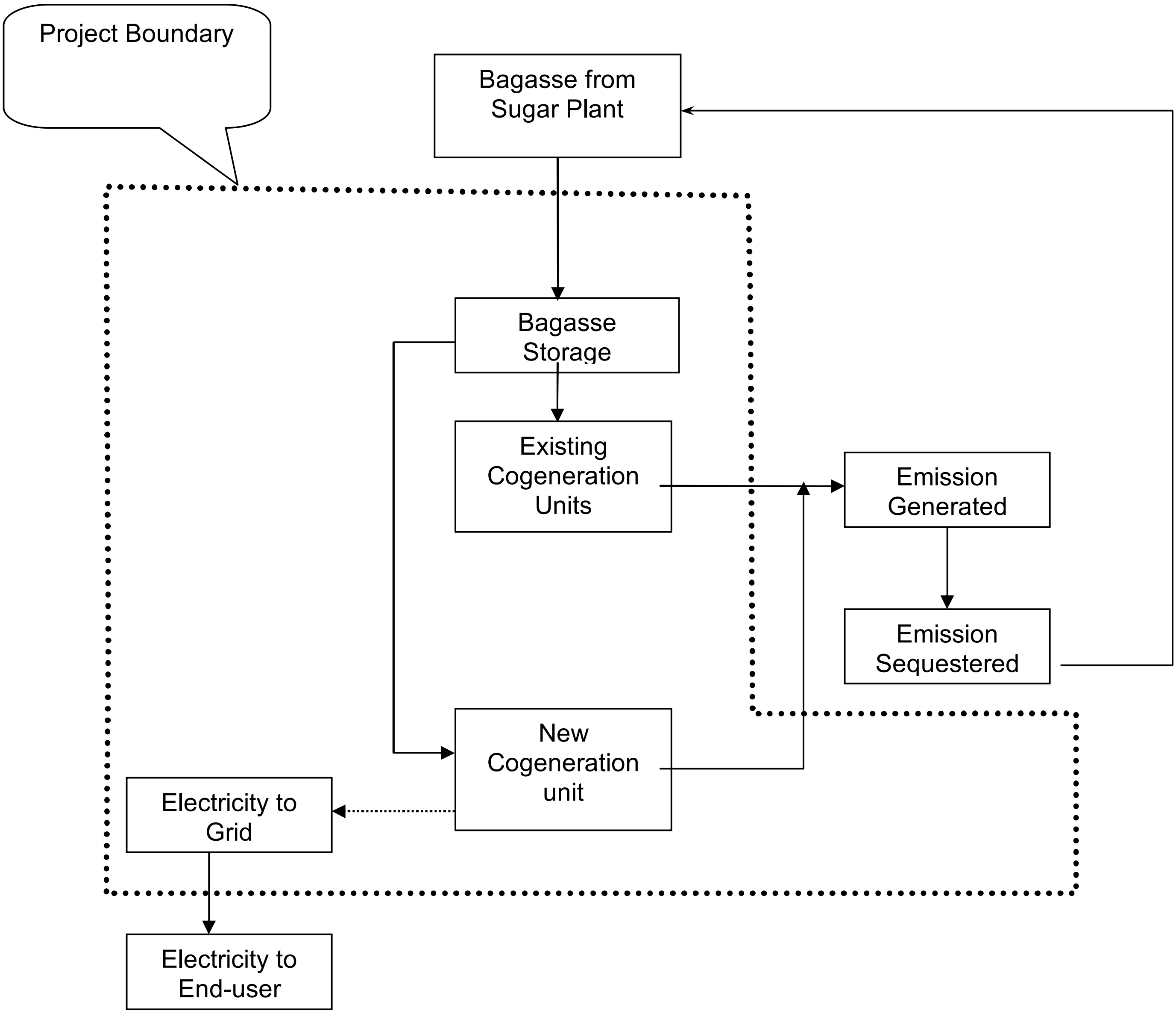
In the baseline scenario, biomass is not dumped or left to decay or burned in an uncontrolled manner.

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

For the purpose of determining the Build Margin (BM) and operating margin (OM) emission factor all power plants connected physically to the Northern region grid, which can be dispatched without significant transmission constraints have been included in the spatial extent of the project boundary.

Indian power grid system is divided into five regions namely Northern, North Eastern, Eastern, Southern and Western Regions. Inter regional energy exchange is very limited due lack of adequate transmission system; however, intra regional energy exchange is substantial. The Northern Region consists of Delhi, Himachal Pradesh, Punjab, Uttar Pradesh, Haryana, Jammu & Kashmir, Rajasthan and Uttaranchal. Project activity would supply power to Uttar Pradesh state grid, which is a part of Northern regional grid. Hence, calculation of baseline emission factor has been done for Northern regional grid.

Flow chart and project boundary is illustrated in the following Figure:



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

Please refer Annex 3 for details of baseline information.

Date of completing the final draft of this baseline section *(DD/MM/YYYY)*:

07/07/2006

Name of person/entity determining the baseline:

Mawana Sugars Limited has determined the baseline for the project activity. The entity is a project participant listed in Annex-I where the contact information has also been provided.

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:

February 2006

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

20 years

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

The project activity uses fixed crediting period

C.2.1. Renewable crediting period

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

Not selected

C.2.1.2. Length of the first crediting period:

Not selected

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

20/10/2006

C.2.2.2. Length:

10 years

SECTION D. Application of a monitoring methodology and plan

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

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

Reference – Approved consolidated monitoring methodology ACM0006/Version 03, Sectoral Scope: 01, 19 May 2006

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

The 'Approved consolidated monitoring methodology ACM0006' is used in conjunction with the 'Approved consolidated baseline methodology ACM0006'. The same applicability conditions as in baseline methodology ACM0006 apply. Project activity meets the applicability criteria of the 'Approved consolidated baseline methodology ACM0006' as already discussed in section B.1.1 and hence, can use the 'Approved consolidated monitoring methodology ACM0006'.

The monitoring methodology requires monitoring of the following:

- Electricity generation from the proposed project activity;

  This would be monitored

- Data needed to recalculate the operating margin emission factor, if needed, based on the choice of the method to determine the operating margin (OM), consistent with "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (ACM0002);

  Project activity would use the simple OM, which is calculated as full generation-weighted average for the most recent 3 years for which data are available at the time of PDD submission (*ex-ante*). Hence data needed to calculate OM need not be monitored.

- Data needed to recalculate the build margin emission factor, if needed, consistent with "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (ACM0002);

  Project activity would use the build margin, which is calculated *ex-ante* based on the most recent information available on plants already built for sample group m at the time of PDD submission. Hence data needed to calculate BM need not be monitored.

- Data needed to calculate, if applicable, carbon dioxide emissions from fuel combustion due to co-firing fossil fuels used in the project plant or in boilers operated next to the project plant or in boilers used in the absence of the project activity;

  There would be no fossil fuel co-firing in the cogeneration plants at site hence associated data need not be monitored.

- Where applicable, data needed to calculate methane emissions from natural decay or burning of biomass in the absence of the project activity;
- In absence of project activity, biomass is not left to decay hence, it is not required to monitor data needed to calculate methane emissions.
- Where applicable, data needed to calculate carbon dioxide emissions from the transportation of biomass to the project plant;
- There is no transportation of biomass to the project plant hence, it is not required to monitor data needed to calculate carbon dioxide emissions from transportation.
- Where applicable, data needed to calculate methane emissions from the combustion of biomass in the project plant;
- These emissions are not included in the project boundary hence, it is not required to monitor data needed to calculate methane emissions from combustion of biomass.
- Where applicable, data needed to calculate leakage effects from fossil fuel consumption outside the project boundary;

  There is no anticipated consumption of fossil fuel outside the project boundary due to project activity, since the project activity uses bagasse, which is generated in-house.

D.2. 1. Option 1: Monitoring of the emissions in the project scenario and the baseline scenario

D.2.1.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:								
ID number *(Please use numbers to ease cross-referencing to D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

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

Not applicable

D.2.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHGs within the project boundary and how such data will be collected and archived :								
ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording Frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

1. $EG_{project\ plant,\ y}$	Net quantity of electricity generated in the project plant during the year y	Metering records	MWh	m	Continuous	100%	Electronic	
2. $EG_{total,\ y}$	Total quantity of electricity generated at the project site (Including the project plant and any other plant at site existing at the start of the project activity)	Metering records	MWh	m	Continuous	100%	Electronic	
3.$BF_{i,y}$	Quantity of Biomass type i combusted in the project plant during year y	Metering records	ton	m	Continuous	100%	Electronic	
4. NCV_i	Net calorific value of biomass		MWh/ton	m	Annually	100 %	Electronic	

5. $Q_{project\ plant,\ y}$	Net quantity of heat generated from firing biomass in the project plant	Metering records	MWh	m	Continuous	100 %	Electronic	
6. E_{boiler}	Average net energy efficiency of heat generation in the boiler that is operated next to the project plant	Metering records	-	m	Quarterly	100 %	Electronic	

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

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

Where

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

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

$EF_{electricity,\ y}$ - is the CO_2 emission factor for the electricity displaced due to the project activity during the year *y* in tons CO_2/MWh

Calculation of CO_2 emission factor for the electricity displaced

The electricity baseline emission factor ($EF_{electricity,\ y}$) is calculated as a combined margin (CM), consisting of the combination of Operating Margin (OM) and Build Margin (BM) factors according to the following three steps. Calculations for this combined margin is based on data from an official source and made publicly available.

<u>STEP 1. Calculate the Operating Margin emission factor(s)</u>

Out of the four methods mentioned in ACM0002, simple OM approach has been chosen for calculations since the low-cost/must run resources constitute less than 50% of the total grid generation in the Northern region grid mix. Simple OM factor is calculated as under.

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

Where

$COEF_{i,j}$ - is the CO_2 emission coefficient of fuel i (t CO_2 / mass or volume unit of the fuel), calculated as given below and

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

$F_{i,j,y}$ - is the amount of fuel i (in a mass or volume unit) consumed by relevant power sources j in year(s) y, calculated as given below

j - refers to the power sources delivering electricity to the grid, not including low-operating cost and must-run power plants

The CO_2 emission coefficient $COEF_i$ is obtained as

$$COEF_i = NCV_i \times EF_{CO_2,i} \times OXID_i$$

Where

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

$EFCO_{2,i}$ -is the CO_2 emission factor per unit of energy of the fuel i

$OXID_i$ -is the oxidation factor of the fuel

The Simple OM emission factor ($EF_{OM,simple,y}$) has been calculated separately for the most recent three years (2002-2003, 2003-2004 and 2004-2005) and an average value has been considered as the OM emission factor for the baseline ($EF_{OM,y}$) (*ex-ante*).

$$EF_{OM,y} = \sum_{y} EF_{OM,simple,y} / 3$$

where y represents the years.

STEP 2. Calculation of the Build Margin emission factor ($EF_{BM,y}$)

It is calculated as the generation-weighted average emission factor (t CO_2/MWh) of a sample of power plants m of grid, as follows:

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

Where

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

Calculations for the Build Margin emission factor $EF_{BM,y}$ has been done as *ex ante* based on the most recent information available on plants already built for sample group m of Northern region grid at the time of PDD submission. The sample group m consists of the 20 % of power plants supplying electricity to grid that have been built most recently, since it comprises of larger annual power generation. (Refer Annex 3)

Further, none of the power plant capacity additions in the sample group have been registered as CDM project activities.

STEP 3. Calculate the electricity baseline emission factor (EF_y)

It is calculated as the weighted average of the Operating Margin emission factor ($EF_{OM,y}$) and the Build Margin emission factor ($EF_{BM,y}$):

$$EF_{electricity,y} = W_{OM} \times EF_{OM,y} + W_{BM} \times EF_{BM,y}$$

where the weights w_{OM} and w_{BM}, by default, are 50% (i.e., $W_{OM} = W_{BM} = 0.5$), and $EF_{OM,y}$ and $EF_{BM,y}$ are calculated as described in Steps 1 and 2 above and are expressed in t CO_2/MWh.

Calculation of net quantity of increased electricity generation

$$EG_y = \min\left\{\begin{matrix} EG_{projectplant,y} \\ EG_{total,y} - \frac{EG_{historic,3yr}}{3} \end{matrix}\right\} - \varepsilon_{el,otherplant(s)} \times \sum_i BF_{i,y} \times NCV_i$$

Where

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

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

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

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

$BF_{i,y}$ - is the quantity of biomass type *i* used as fuel in the project plant during the year *y* in mass unit, and

NCV_i - is the net calorific value of the biomass type i in MWh per mass of biomass.

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

D.2.2.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:								
ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

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

Not applicable

D.2.3. Treatment of leakage in the monitoring plan

D.2.3.1. If applicable, please describe the data and information that will be collected in order to monitor leakage effects of the project activity

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

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

Not applicable

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

Formula used for estimation of the total net emission reductions due to the project activity during a given year *y* is as under.

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

where

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

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

$ER_{heat,y}$ 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.

Emission reductions are only taken into consideration due to displacement of electricity and there are no project emissions and leakage involved in the project activity, therefore effectively the emission reductions is given by:

$ER_y = ER_{electricity,y}$

D.3. Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored		
Data *(Indicate table and ID number e.g. 3.-1.; 3.2.)*	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
D.2.1.3 (1)	Low	Electrical efficiency of the project plant would be calculated using the electricity generated and biomass fired in the project plant. This efficiency would be cross checked with previous year data
D.2.1.3 (2)	Low	Electrical efficiency of all the plants at site would be calculated using the electricity generated and biomass fired. This efficiency would be cross checked with previous year data
D.2.1.3 (3)	Low	Quantity of bagasse fired in the project plant would be cross checked with annual energy balance based on stock data
D.2.1.3 (4)	Low	Measured value of calorific value of bagasse would be cross checked with local/national published data.
D.2.1.3 (5)	Low	Thermal efficiency of the project plant would be calculated using the net heat generated and biomass fired in the project plant. This efficiency would be cross checked with previous year data
D.2.1.3 (6)	Low	Average net energy efficiency of heat generation in the boilers operated next to the project plant would be cross checked with manufacturers information

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

Shift in-charge would be assigned with the responsibility of monitoring and recording of parameters as per the monitoring plan. On a monthly basis, the monitoring records would be checked and discussed with project manager. In case of any irregularity observed, necessary action would be taken immediately. On monthly basis, the reports would be prepared and forwarded to the management. The project manager would be a qualified engineer with 10-15 years of experience in power sector and all shift in-charges would also be qualified engineers with 5-7 years of relevant experience.

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

Mawana Sugars Limited has determined the monitoring plan for the project activity. The entity is a project participant listed in Annex-I where the contact information has also been provided.

SECTION E. Estimation of GHG emissions by sources

E.1. Estimate of GHG emissions by sources:

As discussed in earlier sections, there would be no anthropogenic emissions by sources of greenhouse gases of the project activity within the project boundary.

E.2. Estimated leakage:

As discussed in earlier sections, there would be no net change of anthropogenic emissions by sources of greenhouse gases, which occurs outside the project boundary, and that is measurable and attributable to the project activity.

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

Net emission by project activity (E1+E2) is zero tonnes of CO_2.

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

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

$EF_{electricity,\ y}$ – has been estimated as 0.934 ton CO_2/MWh.

$$EG_y = \min\begin{Bmatrix} EG_{projectplany,y} \\ EG_{total,y} - \dfrac{EG_{historic,3yr}}{3} \end{Bmatrix} - \varepsilon_{el,otherplant(s)} \times \sum_i BF_{i,y} \times NCV_i$$

$EG_{project\ plant,\ y}$ – 60,087 MWh,

$\varepsilon_{el,\ other\ plant\ (s)}$ – 0.089 $MWh_{el}/MWh_{biomass}$. This is the efficiency of the reference plant (operating at 42 kg/cm^2 pressure), which would have been installed in absence of the project activity. This is the efficiency of electricity generation in commonly operating bagasse based cogeneration plants in the sugar industry in the region.

$EG_{total,\ y}$ – 93,234 MWh.

$EG_{historic,\ 3yr}$ – 33,091 MWh,

$BF_{i,\ y}$ – 150,904 ton

NCV_i – 2.642 MWh per ton of bagasse.

$EG_{project\ plant,\ y}$ is less.

EG_y – 24,505 MWh

$ER_{electricity,\ y}$ = 24505 x 0.934

$ER_{electricity,\ y}$ = 22,888 ton CO_2

In absence of project activity, MSL would have installed a reference plant based on in-house bagasse as fuel, to meet its heat and electricity requirements. Since bagasse would be the fuel used in project plant also, $ER_{heat,\ y}$ = 0

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

Since project activity emissions are zero, emission reductions are equal to baseline emissions.

$ER_y = ER_{electricity,y}$

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

Year	Estimation of project activity emission (tonnes of CO2 e)	Estimation of baseline emission (tonnes of CO2 e)	Estimation of leakage (tonnes of CO2 e)	Estimation of emission reductions (tonnes of CO2 e)
2006-2007	0	22888	0	22888
2007-2008	0	22888	0	22888
2008-2009	0	22888	0	22888
2009-2010	0	22888	0	22888
2010-2011	0	22888	0	22888
2011-2012	0	22888	0	22888
2012-2013	0	22888	0	22888
2013-2014	0	22888	0	22888
2014-2015	0	22888	0	22888
2015-2016	0	22888	0	22888
Total (tones of CO2 e)	**0**	**228,880**	**0**	**228,880**

SECTION F. Environmental impacts

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

S.No.	Impact Identified	Mitigation Measures/Remarks
1.	Air Quality:	
	The emissions will be generated on the combustion of bagasse in the boilers during operations. During the construction phase there may be additional dust in the air but that is a temporary impact considering the long term benefits. The ash obtained would be free from slag, silica and metallic compounds therefore can improve soil porosity, moisture retention and does not give out harmful metal leachets.	Electrostatic Precipitator type dust collector would be installed and flue gases shall be discharged into the atmosphere through a chimney of appropriate height.
2.	Water:	
	There shall be no significant effect on surface water quality and hydrology.	Extensive water recycling would be carried out in the plant, no water would be discharged outside the factory and remaining treated water would be used for irrigation purpose inside the factory premises.
3.	Noise:	
	Additional noise will be produced once the project activity is in operation stage but that will still be below the prescribed levels.	Though the impact on the noise level is minimal and will be in the permissible limits of 60dbA, plantation is done in and around the mill and mufflers would be distributed to the workers.
4.	Land:	
	No additional land acquisition is required since the project activity is carried out within the premises. About 1 TPD of domestic refuse would be given out at the colony of factory staff.	No rehabilitation program is required. The domestic refuse would be composted and given to the farmers.
5.	Socio-Economic:	
	Implementation of the project activity would not have any adverse impact on the socio economic aspects of the life of people residing in the village in core zone.	--------
6.	Flora and Fauna:	
	There will a negligible effect on the flora and fauna of the region due to increase in industrial and domestic activity.	--------

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

As discussed above, the project activity would not have any adverse environmental impacts.

The project activity does not fall under the purview of the Environmental Impact Assessment (EIA) notification of the Ministry of Environment and Forest, Government of India. Hence, not required by the host party.

Also, No Objection Certificate (NOC) has been issued by the State Pollution Control Board for the proposed project activity.

SECTION G. Stakeholders' comments

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

MSL organised stakeholder consultation meetings with identified stakeholders in the area with the objective to inform the interested stakeholders on the environmental and social impacts of the project activity and discuss their concerns regarding the project activity. Invitation for stakeholder consultation meeting was sent out requesting the members of village panchayat and local governing bodies to participate and communicate any suggestions/objections regarding the project activity in writing. On the day of meeting, MSL representatives presented the salient features of the company and the project activity to the participants and requested their suggestions/objections. The opinions expressed by them were recorded and are available. The other stakeholders identified for the project activity are as under:

1. Uttar Pradesh Pollution Control Board (UPPCB)
2. Uttar Pradesh Power Corporation Limited (UPPCL)

Other stakeholders were involved in the project activity at appropriate stages of the project development, to get their comments.

G.2. Summary of the comments received:

In view of various direct and indirect benefits (social, economical, environmental) no concerns were raised during the consultation with local stakeholders.

UPPCB have issued NOC to the project activity under the provisions of Water (Prevention and Control of Pollution) Act, 1974 / Air (Prevention and Control of Pollution) Act, 1981.

MSL has already signed Power Purchase Agreement (PPA) with UPPCL.

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

Since no concerns were raised during the consultation with local stakeholders, it is not required to take due account of the comments.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Mawana Sugars Limited
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding as part of project financing from parties included in Annex I of the convention is involved in the project activity.

Annex 3

BASELINE INFORMATION

Key parameters with their data sources

S No.	Key parameters	Data sources
1.	Generation data for all plants for the year 2002-03, 2003-04 and 2004-05(kWh)	Annual Reports of Northern Region Electricity Board (NREB) (http://www.nreb.nic.in/Reports/Index.htm)
2.	Coal consumption	Annual Performance Review of Thermal Power Plants; Central Electricity Authority (CEA) (http://www.cea.nic.in/Th_per_rev/CEA_Thermal%20Performance%20Review0405/SECTION-9.pdf)
3.	Calorific value of gas	IPCC
4.	Calorific value of coal	Chapter 2-India's NATCOM to UNFCCC
5.	Oxidation factors	IPCC
6.	Efficiency of gas based power plants supplying power to grid	Annexure 2a as given by "Baselines for Renewable Energy Projects under Clean Development Mechanism" by The Ministry of Non-Conventional Energy Sources, Govt. of India. http://mnes.nic.in/baselinerpt.htm

Average efficiency of gas/combustion turbine (peak load) works out to be 30 % and that for gas turbines in combined cycle works out to be 42 %[8]. On conservative basis average efficiency for base line calculations is considered as 45

[8] http://mnes.nic.in/baselinerpt.htm

Emission factors

Fuel	Emission factor (tC/TJ)	Emission factor (tCO_2/TJ)
Natural gas	15.3	56.1
Sub-bituminous coal	26.13	95.8

The generation data collected and used is presented further in Table 1.

Power generation Mix of Northern Region for five years					
Energy Source	**2000-01**	**2001-02**	**2002-03**	**2003-04**	**2004-05**
Total Power Generation (MU)	134492.7	140515.2	154544.34	168109.84	172681.58
Total Thermal Power Generation	99766.38	104339.7	115985.83	122955.41	126341.00
Total Low Cost Power Generation	34726.33	36175.51	37723.02	44681.92	46340.58
Thermal % of Total grid generation	74.18	74.26	75.05	73.14	73.16
Low Cost % of Total grid generation	**25.82**	**25.74**	**24.41**	**26.58**	**26.84**
% of Low Cost generation out of Total grid generation - Average of the five most recent years					**25.88**

Table 1: Generation details (million kWh)

Name	Type	Fuel	Generation (2002-03)	Generation (2003-04)	Generation (2004-05)
Badarpur TPS	Thermal	Coal	5267.22	5428.96	5462.78
Singrauli STPS	Thermal	Coal	16174.32	15643.40	15803.34
Rihand STPS	Thermal	Coal	7734.09	7949.26	7988.06
Dadri NCTPS	Thermal	Coal	6041.46	6181.12	6842.52
Unchahar-I TPS	Thermal	Coal	3039.51	3252.14	3342.83
Unchahar-II TPS	Thermal	Coal	3103.97	3187.93	3438.28
Tanda TPS	Thermal	Coal	2211.46	2872.81	3254.67
Anta GPS	Thermal	Gas	2757.73	2775.92	2595.77
Auriya GPS	Thermal	Gas	4268.68	4247.41	4119.47
Dadri GPS	Thermal	Gas	5211.55	5058.66	5527.71
Faridabad GPS	Thermal	Gas	2702.02	2792.58	3172.01
Bairasiul	Hydro	Hydel	671.67	687.79	689.67

Salal	Hydro	Hydel	3142.07	3477.42	3443.29
Tanakpur HPS	Hydro	Hydel	421.56	510.99	495.17
Chamera HPS	Hydro	Hydel	2253.53	2648.32	3452.25
Uri HPS	Hydro	Hydel	2448.16	2873.54	2206.71
RAPS-A	Nuclear	Nuclear	1439.31	1293.37	1355.20
RAPS-B	Nuclear	Nuclear	3398.83	2904.68	2954.43
NAPS	Nuclear	Nuclear	3580.38	2959.44	2760.01
Bhakra Complex	Hydro	Hydel	6531.01	6956.90	4546.01
Dehar	Hydro	Hydel	3253.10	3299.29	3150.52
Pong	Hydro	Hydel	763.85	1178.93	882.57
Delhi	Thermal	Coal	1455.83	1164.11	5203.80
SJVNL	Hydro	Hydel	-	1537.92	1617.45
Delhi	Thermal	Gas	2035.15	5159.77	4091.37
Haryana	Thermal	Coal	5867.03	6849.26	7192.41
Haryana	Hydro	Hydel	245.75	251.73	251.73
H.P.	Hydro	Hydel	1598.25	3666.39	3666.39
J&K	Hydro	Hydel	407.09	851.03	851.03
J&K	Thermal	Gas	67.36	15.41	23.51
Punjab	Thermal	Coal	13576.98	14118.96	14390.42
Punjab	Hydro	Hydel	3525.55	4420.43	4420.43
Rajasthan	Thermal	Coal	13826.40	15044.48	17330.79
Rajasthan	Thermal	Gas	218.92	201.37	360.70
Rajasthan	Hydro	Hydel	60.78	494.07	494.07
U.P.	Thermal	Coal	20426.15	20638.05	19788.21
U.P.	Hydro	Hydel	1391.30	2063.04	2063.04
Uttaranchal	Hydro	Hydel	3426.31	3452.96	3452.96
TOTAL			**154544.34**	**168109.84**	**172681.58**

The OM factor for Northern region grid taking average of recent three years is calculated as 1.131 kg CO_2/kWh

Table2: Power plants considered for calculating build margin

Plants supplying power to Northern grid are arranged in descending order of date of commissioning
Total generation for 2004-05 = 172681.585
20 % of total generation = 34536.32

	Plant	**Date of commissioning**	**MW**	**Generation in 2004-2005 (Million kWh)**[9]	**Fuel Type**
1.	Chamera HEP-II (Unit 1)	2003-2004	100	1344.07	Hydro
2.	Chamera HEP-II (Unit 2)	2003-2004	100		Hydro
3.	Chamera HEP-II (Unit 3)	2002-2003	100		Hydro
4.	SJVPNL	2003-2004	1500	5108.77	Hydro
5.	Baspa-II (Unit 3)	2003-2004	100	398.94	Hydro

[9] http://www.nrldc.org/docs/grmar2005.pdf

6.	Suratgarh-III (Unit-5)	2003-2004	250	1698.37	Coal
7.	Kota TPS-IV (Unit-6)	2003-2004	195	1302.49	Coal
8.	Baspa-II (Unit 1 & 2)	2002-2003	200	797.88	Hydro
9.	Pragati CCGT (Unit II)	2002-2003	104.6	790.21	Gas
10.	Pragati CCGT (Unit III)	2002-2003	121.2	915.61	Gas
11.	Ramgarh CCGT Stage -II (GT-2)	2002-2003	37.5	114.19	Gas
12.	Ramgarh CCGT Stage -II (GT-2)	2002-2003	37.8	115.11	Gas
13.	Upper Sindh Extn (HPS)(1)	2001-2002	35	32.12	Hydro
14.	Suratgarh stage-II (3 & 4)	2001-2002	500	3396.74	Coal
15.	Upper Sindh Stage II (2)	2001-2002	35	32.12	Hydro
16.	Malana-1 & 2	2001-2002	86	266.08	Hydro
17.	Panipat TPS Stage 4 (Unit-6)	2000-2001	210	1269.31	Coal
18.	Chenani Stage III (1,2,3)	2000-2001	7.5	19.10	Hydro
19.	Ghanvi HPS (2)	2000-2001	22.5	74.06	Hydro
20.	RAPP (Unit-4)	2000-2001	220	1309.70	Nuclear
21.	Ranjit Sagar (Unit-1,2,3,4)	2000-2001	600	1131.37	Hydro
22.	Gumma HPS	2000-2001	3	4.35	Hydro
23.	Faridabad CCGT (Unit 1) (NTPC)	2000-2001	144	1030.59	Gas
24.	Suratgarh TPS 2	1999-2000	250	1698.37	Coal
25.	RAPS-B (2)	1999-2000	220	1309.70	Nuclear
26.	Uppersindh-2 HPS #1	1999-2000	35	32.12	Hydro
27.	Faridabad GPS 1 & 2 (NTPC)	1999-2000	286	2046.86	Gas
28.	Unchahar-II TPS #2	1999-2000	210	1559.75	Coal
29.	Unchahar-II TPS #1	1998-1999	210	1559.75	Coal
30.	Suratgarh TPS #1	1998-1999	250	1698.37	Coal
31.	GHGTPLM (Unit 1)	1998-1999	210	1453.23	Coal
32.	GHGTPLM (Unit 2)	1997-1998	210	1453.23	Coal
33.	Tanda TPS (Unit-4)	1997-1998	110	731.54	Coal
Total				**34694.10**	
20% of Generation				**34536.32**	

The BM factor for Northern region grid considering recent 20 % of existing capacity is calculated as 0.737 kg CO_2/kWh

The net baseline emission factor for Northern region grid is calculated as 0.934 kg CO_2/kWh

Annex 4

MONITORING PLAN

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. All energy meters used would be electronic trivector meters of accuracy class 0.2 %. 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 half year by independent agency, which is accredited with National Accreditation Board for Testing & Calibration Laboratories, Department of Science & Technology, Govt. of India. If during half yearly test check, meters are found to be beyond permissible limits of error they would be calibrated immediately.

Calorific value of bagasse would be established every year based on test conducted by independent agency, which is 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 on the weigh bridge. 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.

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