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

CONTENTS

Annexure

SECTION A. General description of project activity

A.1 Title of the project activity:

Bagasse based Co-generation Power Project at Khatauli

Version 04

Date: 4th December 2006

A.2. Description of the project activity:

The purpose of the project activity is to utilize the bagasse generated in the sugar mill to generate steam and electricity for internal use and to export the surplus electricity to the Uttar Pradesh Power Corporation Limited (UPPCL). The project activity is 23.0 MW capacity cogeneration projects of Triveni Engineering and Industries Ltd. (TEIL) at Khatauli plant, Uttar Pradesh.

Pre Project Activity

TEIL sugar unit at Khatauli was meeting its internal steam and power requirement by set of low pressure boilers and turbo generators (TG) respectively. Following table depicts the boiler and turbogenerators configuration.

Boilers details.

Description	**1 no.**	**1 no.**	**3 nos.**	**1 no.**
Steam generating capacity (tons per hour)	65	32	40	20
Steam pressure (kg/cm^2)	43	43	22	11

Turbo Generator details.

Description	**2 nos. Back pressure**	**1 no. Back pressure**	**2 nos. Back pressure**	**1 no. Back pressure**
Power (kW)	3000	3000	1500	2500
Stem inlet pressure (kg/cm^2)	43	22	11	22

Post Project Activity

The project activity involved installation of one number of 120 TPH nominal capacity high pressure boilers with steam outlet pressure of 87 kg/cm^2, one number of extraction cum condensing turbo generator of 23 MW.

The existing power generation TG continue to operate after installation of project plant whereas existing boilers which were supplying steam to process plant shall remain as stand by units. Following tables show details of equipment in post project scenario.

Boiler Details

Description	**1 no.**	**1 no.**	**1 no.**	**3 nos.**	**1 no.**
Steam generating capacity (tons per hour)	120	65	32	40	20
Steam pressure (kg/cm^2)	87	43	43	22	11
Status	Project boiler-used	Used	Used	1 No. Stand by 2 Nos. Used	Standby

Turbo generator Details

Description	**1 No. extraction cum condensing**	**2 nos. Back pressure**	**1 no. Back pressure**	**2 nos. Back pressure**	**1 no. Back pressure**
Power (kW)	23000	3000	3000	1500	2500
Stem inlet pressure (kg/cm^2)	87	43	22	11	22
Status	Project turbine-used	used	used	used	Used to drive fibrizer and not to generate electricity.

Steam produced in project plant has been exported to sugar manufacturing unit whereas the electricity produced in the project plant is partially exported to sugar unit and partially to Uttar Pradesh Power Corporation Limited (UPPCL). The plant will have DG sets in sugar unit as stand by for emergency situations. Data of the past years show that electricity provided by these units is less that 2 percent of the total electricity consumption in the sugar unit.

The project plant exports 16.64 MW during cane crushing season and 19.99 during the off season period to Uttar Pradesh Power Corporation Limited (UPPCL), in absence of the project plant UPPCL would have withdrawn electricity from northern regional grid.

The project activity also induces environmental and sustainable development benefits. The project activity has introduced efficient high pressure cogeneration technology to the Indian sugar industry; reducing power shortages in the state of Uttar Pradesh (UP) India; and, fostering sustainable economic growth through promoting energy self-sufficiency and resource conservation in India's sugarcane industry.

The policy to grow in a sustainable manner with commitment towards environment has been adopted by the company. Decision to invest in a high pressure cogeneration system has been taken considering revenues through sale of carbon credits under the clean development mechanism (CDM). Technology used in the proposed activity is highly replicable as the country's sugar mills produce large quantities of bagasse that could be efficiently utilized to generate power.

Project's contribution to sustainable development

The project activity contributes towards local, national and global sustainable development. It supports India's national policy to rely on clean power. The government's clean power diversification strategy focus on reducing wastage of energy combined with the optimum use of renewable energy (RE) sources.

The project activity substitutes, and hence decreases the dependence on primarily coal-based power generation by the grid, thereby reducing carbon dioxide (CO_2) emissions. Coal which is a carbon intensive fuel, and emits large quantity of GHGs is being used to meet around 70% of the country's electricity demand in 2005. Diversification and energy self-reliance by the sugarcane industry results in GHG emission reduction. The project activity positively contributes towards the reduction in demand for carbon intensive energy resources, efficient waste disposal and resource conservation.

The project activity has contributed to jobs creation in local rural area where cane growers (local farmers) face highly cyclical income flows. It has created higher value jobs at the cogeneration facility. The inflow of carbon credits from the Project's net emission reductions would create a replicable model for the country's sugarcane industry, hence contributing towards sustainable development.

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 project participant (Yes/No)
India (host)	Triveni Engineering and Industries Ltd	No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

India

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

Uttar Pradesh

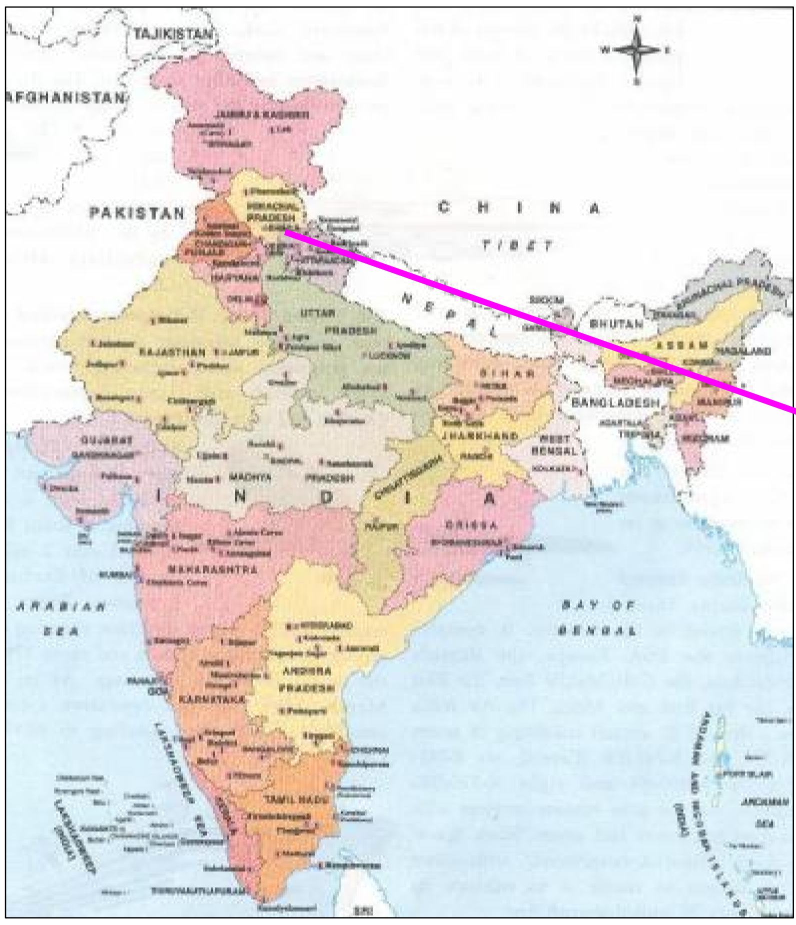
A.4.1.3. City/Town/Community etc:

Khatauli

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

The proposed project activity of Bagasse based cogeneration plant is located on the northern side of the sugar mill, in the existing premises of sugar plant of TEIL at Khatauli in Muzzafarnagar District of Uttar Pradesh. The nearest railway station is Khatauli. The plant is located across Khatauli – Jansath road. The site is located at 29^0N16' latitude and 77^0E42' longitude.

The UPPCL electrical substation of 132 kV for power export is only 5 km from the site. The location map of Khatauli and its location on Map of India is given in the figure below.



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. (version 05 Oct 06| 13:50)

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

The project plant has commissioned a boiler with nominal capacity of 120 tons per hour (TPH) and outlet steam configuration of 87 kg/cm^2, 515 ^{o}C and a double extraction cum condensing type turbo generator with rating of 23 MW. The cogeneration cycle for the plant is designed as an energy efficient regenerative cycle. This plant will give around 7 % more power output than the most of the cogeneration plants designed with boiler outlet steam parameters of 67 kg/cm^2 and 485 ^{o}C and 23 % more than normal configuration in India of 45 kg/cm^2 and 390 ^{o}C with back pressure turbine.

The boiler is of modern design with membrane furnace walls, electrostatic precipitators for dust collection, spreader stoker and travelling grate type. The inlet feed water is at 170 ^{0}C, with the feed water heated in a high pressure feed water heaters. The de aerator outlet water temperature is 115^{0}C. There is one controlled extraction at 3.0 kg/cm^2 and one uncontrolled extractions at 9 kg/cm^2.

The plant is designed with all other auxiliary plant systems like

- Bagasse handling system with storage and processing arrangements,
- High pressure feed water heaters,
- Ash handling system,
- Water treatment plant,
- compressed air system,
- Air conditioning system,
- Main steam, medium pressure and low pressure steam systems,
- Fire protection system,
- water system which include raw water system, circulating water system, condensate system, De-Mineralised water system and service with potable water system and
- The electrical system for its successful operation.

In India also, couple of plants[1] with 87 kg/cm^2 pressure and 515 ^{0}C temperature configurations have been commissioned and are operating successfully. However the technology is not a common practice in the region and there are only three[2] such units in the region which have implemented 87 kg/cm^2 pressure boilers so far keeping CDM benefits into consideration.

The power is generated at 11 kV level. The internal consumption requirements for auxiliaries and equipment of the sugar plant and the cogeneration plant are met by stepping down voltage level to 415V. The exportable power needs to be stepped upto 132 kV and paralleled with the UPPCL grid at the sub-station in Khatauli.

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 power 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 bagasse is expected to contain 53% moisture; this will

[1] Only four projects implemented so far with similar technology (i) Kakatia Sugars, AP; (ii) Project of BCML at Haidergarh, UP (iii) Bannari Amman, Sathyamangalam, TN (iv) TEIL Deoband Project.

[2] Project of HCML at Haidergarh, BCML at Balrampur, TEIL Deoband Project, Source: Survey of Sugar Mills of U.P

keep the temperatures at steam generator burners low enough not to produce nitrogen oxides. Moreover, the specification of the steam generator will stipulate over fire air system with staged combustion, which will ensure reduction in nitrogen-oxide emissions.

The project activity will generate 22.5 MW power, exporting 16.64 MW during crushing season and 19.99 MW during off-season period to UPPCL grid and rest to sugar manufacturing unit after meeting its auxiliary power needs. The crushing season of 185 days and non-crushing / off-season period of around 133 days is envisaged for project activity operation. A transmission loss of 2% is considered in the computation of exportable energy.

Therefore, a conventional energy equivalent of approximately 1157 million kWh for a period of 10 years in UP would be replaced by exporting power from the project activity with CO_2 emission reduction of 868,077 tonnes over a 10 year credit period.

Without the project activity, the same energy load would have been taken-up by Northern regional grid mix and emission of CO_2 would have occurred due to combustion of conventional fuels like coal. Thus the project activity would help in reduction of combined margin carbon intensity of the grid. 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.

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

Years	Annual estimation of emission reductions in tonnes of CO_2 e
2007-2008	55,202
2008-2009	90,319
2009-2010	90,319
2010-2011	90,319
2011-2012	90,319
2012-2013	90,319
2013-2014	90,319
2014-2015	90,319
2015-2016	90,319
2016-2017	90,319
Total estimated reductions (tonnes of CO_2 e)	**868,077**
Total number of crediting years	
Annual average over the crediting	**86,808**

period of estimated reductions **(**(tonnes of CO_2 e)	

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, 19th 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. 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)**"

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 uses only bagasse *(a biomass residue)* as a fuel in the boiler and usage of other biomass types like municipal solid waste (MSW) as fuel in boiler is not envisaged.

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 has no direct/ indirect effect on the bagasse production in the facility. Sugar production under the structured industrial development policy of government of India has been closely monitored by Government and any decision regarding enhancement of sugar production is guided by government regulations. Hence it can be said that implementation of a cogeneration unit does not have any influence on the production capacity of the sugar.

Criteria 3: The biomass used by the project facility should not be stored for more than one year.
Maximum portion of the bagasse generated during crushing season (which spans 185 days in a year) at the sugar plant is continuously used by the project activity. A small portion of the bagasse of the plant is stored at the plant premises for use in the non-crushing period. This quantity of bagasse is not stored at the project facility for more than one year.
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 done.
The project activity meets all the applicability criteria of the selected approved methodology and hence may be applicable to the project.

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

The methodology is only applicable for the combinations of project activities and baseline scenarios.

Identification of baseline scenario

As per the methodology, identification of the 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:
P1 The proposed project activity not undertaken as a CDM project activity
P2 The proposed project activity (installation of a power plant), fired with the same type of biomass but with a lower electrical energy efficiency

P3 The generation of power in an existing plant, on-site or nearby the project site, using only fossil fuels

P4 The generation of power in existing and/or new grid-connected power plants

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

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

Alternative P1 "The proposed project activity not undertaken as a CDM project activity" identified above faces barriers as given in the subsequent section B.3., hence can not be considered as baseline scenario. 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" would require more calorific input for producing equivalent amount of electricity. Dependence on bought bagasse from market faces barrier hence can not be considered as a probable scenario. Alternative P3 "The generation of power in an existing plant, on-site or nearby the project site, using only fossil fuels" is not a relevant alternative to the TEIL project activity because existing power plants which are running on biomass fuel, shall continue to run using biomass residue after implementation of the project plant. Alternative P4 "The generation of power in existing and/or new grid-connected power plants" does not face any barrier. In absence of electricity export from the project plant, existing and/or new grid connected power plant shall generate that electricity. Alternative 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" can not be considered as an alternative to TEIL project activity because existing power plants at TEIL are generating power to meet the captive requirements alone and can not generate surplus power to export to the power starved grid. Alternative 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" is not an alternative to project activity since existing power generation units of TEIL can not produce surplus electricity to export to the grid, which is the purpose of the project activity.

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:

H1 The proposed project activity not undertaken as a CDM project activity

H2 The proposed project activity (installation of a cogeneration power plant), fired with the same type of biomass but with a different efficiency of heat generation (e.g. an efficiency that is common practice in the relevant industry sector).

H3 The generation of heat in an existing cogeneration plant, on-site or nearby the project site, using only fossil fuels

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

H5 The continuation of heat generation in an existing cogeneration 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

H6 The generation of heat in boilers using fossil fuels

H7 The use of heat from external sources, such as district heat

H8 Other heat generation technologies

Alternative H1 "The proposed project activity not undertaken as a CDM project activity" face barrier elaborated in following section hence can not be the baseline scenario. Alternative H2 "the proposed project activity (installation of a cogeneration power plant), fired with the same type of biomass but with a different efficiency of heat generation (e.g an efficiency that is common practice in the relevant industry sector)" can not be the baseline scenario, since project activity of TEIL shall replace steam generated in existing boilers. Installation of a cogeneration power plant with lower thermal energy efficiency, require burning more biomass in the plant or other source of steam supply, which is economically unattractive. Alternative H3 "the generation of heat in an existing cogeneration plant, on-site or nearby the project site, using only fossil fuels" is not an alternative scenario, since there is no existing fossil fuel fired cogeneration unit. The existing power units supply only electricity and not steam to the sugar manufacturing facility. Alternative H4 "the generation of heat in boilers using the same type of biomass residues" which is also the current scenario for generation of steam is the most plausible scenario in absence of project plant. Alternative H5 "The continuation of heat generation in an existing cogeneration 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" can not be a probable scenario because project implementation without CDM benefits faces prohibitive barrier and these barriers are likely to persist even after the end of the lifetime of existing plant. Alternative H6 "The generation of heat in boilers using fossil fuels" is not an alternative scenario, since heat requirement of the sugar plant, can be met by existing biomass fired boilers.

Alternative H7 is not applicable in Indian context so it is excluded from further consideration. Alternative H8 being economically unattractive is not practiced and hence is excluded from further consideration. Alternative scenarios for biomass in absence of the project activity include following:

B1 The biomass is dumped or left to decay or burned in an uncontrolled manner without utilizing it for energy purposes

B2 The biomass is used for heat and/or electricity generation at the project site

B3 The biomass is used for power generation, including cogeneration, in other existing or new grid-connected power plants

B4 The biomass is used for heat generation in other existing or new boilers at other sites

B5 The biomass is used for other energy purposes, such as the generation of biofuels

B6 The biomass is used for non-energy purposes

Alternative B1, is clearly an uneconomical alternative because of price value associated with bagasse. Alternative B4 "The biomass is used for heat generation in other existing or new boilers at other sites" can not be an alternative scenario, since biomass is required for generating steam and electricity in existing boilers. Alternative B5 is not an alternative since there is no established practice in the region for converting bagasse into bio fuel. Alternative B3 "The biomass is used for power generation, including cogeneration, in other existing or new grid-connected power plants" can not be the baseline scenario since the bagasse is required at sugar manufacturing facility to produce steam in existing boilers. Alternative B2 "the biomass is used for heat and/or electricity generation at the project site" is a current practice and does not face any barrier. In absence of the project cogeneration plant generation of steam in existing boilers shall be the most probable scenario.

Among all the identified alternatives, the most credible and plausible alternative is:

Power, P4 The generation of power in existing and/or new grid-connected power plants

The project activity generates 23 MW of electricity and export excess electricity to Uttar Pradesh Power Corporation Limited after meeting auxiliary requirement and internal requirement at sugar plant. In absence of project activity the power generated in project plant would have been generated in the power plants connected to grid or new plant as there is no prohibitive barrier for its implementation.

Biomass, B2 The biomass is used for heat and/or electricity generation at the project site

The biomass generated at plant site would in absence of project activity be used in for generating heat and steam.

Heat, H4 The generation of heat in boilers using the same type of biomass residues

In absence of the project activity the heating requirement of sugar plant would be met by boilers using bagasse.

Thus the above alternative forms the baseline scenario. This specific combination of baseline scenario is defined for scenario 12, which states that:

"The project activity involves the installation of a new cogeneration unit, which is operated next to (an) existing power generation unit(s). The existing unit(s) is only fired with biomass and continue to operate after the installation of the new power unit. 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 biomass would in the absence of the project activity be used for heat generation in boilers at the project site. This may apply, for example, where the biomass has been used for heat generation in boilers at the project site prior to the project implementation."

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:

As per 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

TEIL had considered CDM revenues during the planning stage of the project[3] itself. The orders for purchasing equipment for the project activity were placed on 29th September 2004. However due to non applicability of the methodology ACM0006 to extraction cum condensing turbine TEIL could not initiate the CDM process till February 2006.

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

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

Alternatives to the project activity with respect to power, heat and biomass have been elaborated in above section B.2.

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

Alternatives defined in section B.2. above, are in compliance with prevailing legislations and regulations in India hence can be considered as alternatives.

Step 2. Investment analysis OR

Step 3. Barrier analysis.

[3] Correspondence with consultant in the planning stage of the project. Copies of letters verified by DOE.

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

For establishing the additionality 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:-

It has been estimated by ministry of non conventional energy sources, Government of India that there is a potential of 3,500 MW[4] power generations by using bagasse in the country. The potential for power generation in UP using bagasse is estimated at 1,350 MW per year, which is roughly 15% of the current installed capacity (9,000 MW) of the grid.[5]

Uttar Pradesh is the second largest sugar manufacturing state in India with over 120 sugar mills operational in the state. Steam and power requirements of these mills are being met mainly by low pressure boilers and supply from grid respectively. Few medium and large sugar mills have installed cogeneration power units to meet the captive power and steam requirements. Till December 2005 there were only three [6]sugar mills in the Uttar Pradesh which have installed 87 kg/cm^2 configuration cogeneration system and which are supplying power to the grid. All three projects were commissioned considering CDM benefits and are in different stages of execution. It can thus be said that, installation of high pressure configuration cogeneration systems for generating power and exporting to the grid is not a common practice in the region. Registration of bagasse based cogeneration projects under clean development mechanism shall make these projects financially attractive and set an example in the sugar manufacturing sector, which is highly replicable model due to the vast co generation potential in the state.

Other Barriers

The report of the thirteenth standing committee of the Ministry of non conventional energy sources mentioned that out of estimated potential of 3500 MW, till December 2005 only 508 MW has been commissioned in India. It is also mentioned in the report that bagasse based cogeneration projects faced problems in India like inability of co generative sugar mills to generate bankable projects, difficulties in

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[4] Thirteenth report of the standing committee on energy prepared by Ministry of Non conventional energy sources. Refer section 2.36

[5] Reference: All India Bagasse Co-generation Study of IREDA, taken from CII investor guidebook for bagasse based cogeneration

getting clearances for sugar mills investing in cogeneration, involvement of number of agencies for granting clearances to sugar units etc. The TEIL-Khatauli cogen project faced difficulties in getting clearances from multiple government agencies like civil aviation ministry, central ground water authority, pollution control board etc. involvement of different agencies delayed the commissioning process of the project.

Institutional Barriers:

TEIL has signed Power Purchase Agreement (PPA) with Uttar Pradesh Power Corporation Limited (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 (Source: UPERC, Tariff Order 2004-2005). Although the fiscal condition of state electricity board has improved considerably in present year, dealing with UPPCL has associated risks. TEIL was well aware of the situation but the management had to take this risk and face this institutional barrier on which they have limited or no control.

It is estimated that, of the total project proponents who get approval from central/state electricity authority to establish bagasse/biomass based power project in India, only a few are successful in commissioning of the plant due to some of the above mentioned barriers. The data on the Common Practice Analysis of the bagasse-based cogeneration suggests that the barriers discussed are strong enough to hinder growth of the sector.

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

It has been observed in Sub-step 3a that the - project activity had associated barriers to successful implementation. The other most realistic alternatives available to TEIL in absence of project activity were evaluated above (in section B.2.).

From the Step 1 and Step 3 we may conclude that there are alternatives as given in section B.2. that do not have any impediments preventing their implementation. However the project activity faces barriers, which would prevent TEIL from implementing the project activity as elaborated in the 'Barrier Analysis'.

Step 4-a. Common Practice Analysis

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[6] BCML- Balrampur, 2nd Project of BCML-Haidergarh, Triveni-Deoband

The common practice scenario tabulated below substantiates that the alternative 3 - project activity without CDM benefits is not a widespread proposition for the sugar-manufacturing units in similar socio-economic environment of Uttar Pradesh State. The alternative –1 (Cogeneration unit to meet the plant's energy requirements with no surplus power generation) is the most common practice adopted by the sugar-manufacturing units. The Indian sugar-manufacturing units have been in utilizing their bagasse in an inefficient manner by use of low-pressure boiler to generate steam and electricity only for in-house consumption.

Following data illustrates that the project is not a common practice in the proposed area of implementation.

Table B-6: Data on Co-generation practices adopted by the Sugar Industries	
Total Sugar manufacturing mills in Uttar Pradesh[7]	>120
Medium and Large sugar mills in Uttar Pradesh[8]	41
Cogeneration facility in medium and large Sugar Mills in Uttar Pradesh	*11*
87 Kg/Cm^2 configuration cogeneration facility commissioned	*3*
CDM consideration by high pressure sugar Mills	*3*
(Reference : Indian Sugar Mills Association and field visits to UP)	

Uttar pradesh is the second largest sugar manufacturing state in India with more than 120 sugar mills in operation. There are only three sugar manufacturing units in the state which have commissioned high pressure configuration of 87 kg/cm^2. All three sugar mills with high pressure boiler configuration have come up considering CDM benefits and hence excluded from the analysis. It can thus be said that TEIL-Khatauli cogeneration project is unique and not a common practice in the Uttar Pradesh state.

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. Despite of all the barriers associated with project activity TEIL's management took the decision to go ahead, considering the CDM revenues. The project activity of TEIL boosts the confidence of sugar manufacturers to invest in such clean technologies, thereby reducing GHG emission reductions and eventually results in sustainable development.

It is ascertained that the project activity would not have occurred in the absence of the CDM simply because no sufficient financial assistance, policy initiatives, or other incentives exist locally to foster its

7 http://www.localpower.org/documents_pub/report_bagasse_cogeneration.pdf#search=%22WADE%20bagasse%20 cogeneration%22

development in India and without the proposed carbon funding for the project the TEIL would not have taken the risks of implementing the project activity. In such an event the BAU baseline option is continued with release of carbon dioxide emissions.

As per the above-mentioned steps the project activity is additional and the anthropogenic emissions of GHG by sources will be reduced below those that would have occurred in the absence of the registered CDM project activity.

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

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

The **spatial extent** of the project boundary includes the power plant at the project site, the means for transportation of biomass to the project site (e.g. vehicles) and all power plants connected physically to the electricity system that the project activity is supplying power to. Further guidance on the spatial extent of the project electricity system, including issues related to the calculation of the build margin (BM) and operating margin (OM), has been taken from "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (ACM0002).

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

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

For the purpose of determining the baseline, the following emission sources are included:

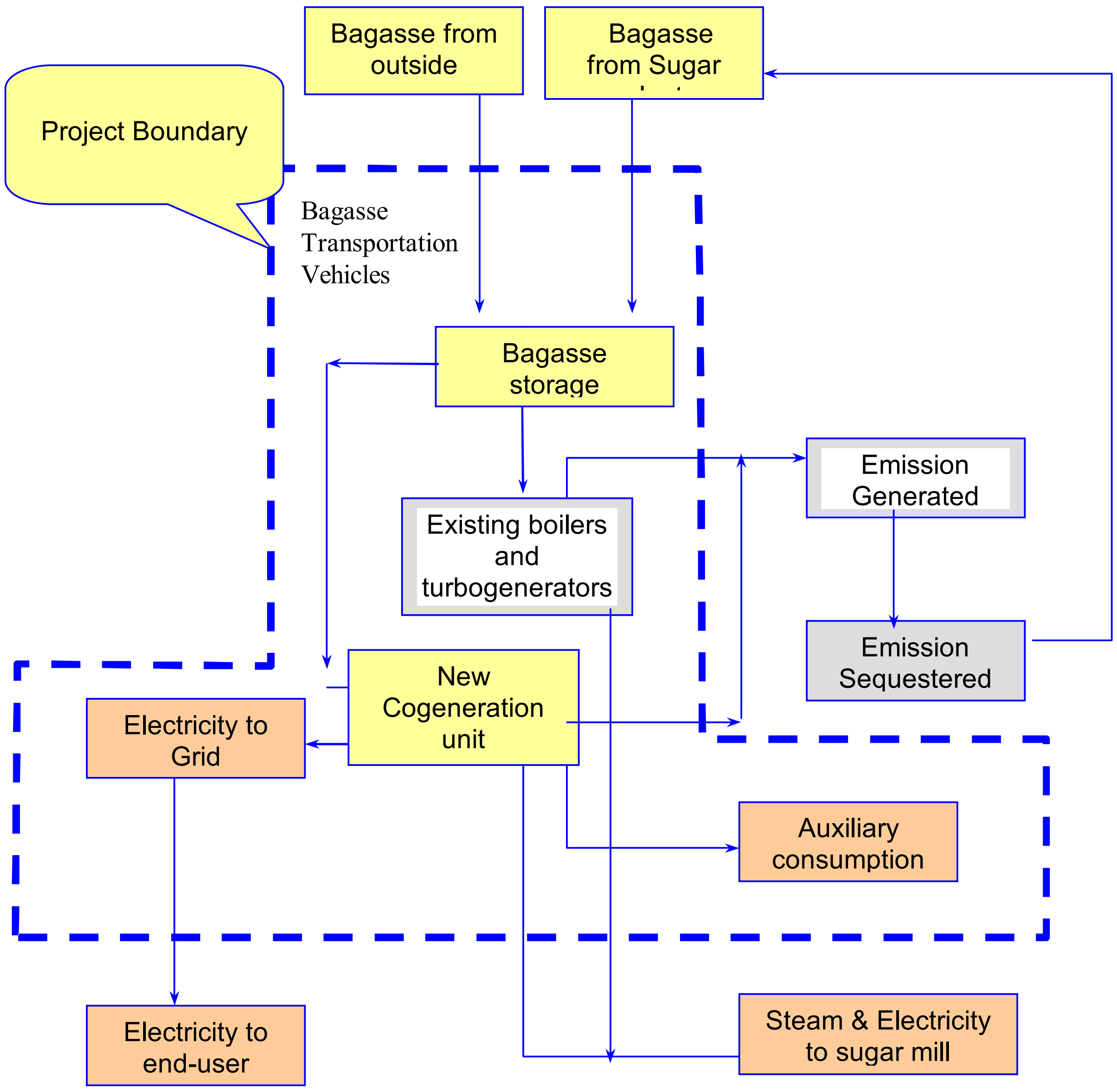
- CO_2 emissions from fossil fuel fired power plants connected to the electricity system.

As the bagasse is not dumped or left to decay or burned in an uncontrolled manner without utilizing it for energy purposes so CH_4 emissions arising due to the same are not involved in the project and baseline emissions.

Project Site

Project activity boundary covers bagasse fuel storage, new cogeneration plant, Auxiliary units, existing boilers and turbines. The project activity uses bagasse generated from its Mill. Flow chart and project boundary is illustrated in the following Figure:

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


Bagasse from outside
Bagasse from Sugar
Project Boundary
Bagasse Transportation Vehicles
Bagasse storage
Existing boilers and turbogenerators
Emission Generated
Emission Sequestered
New Cogeneration unit
Electricity to Grid
Auxiliary consumption
Electricity to end-user
Steam & Electricity to sugar mill

Connected (Project) electricity system - Power plants connected to the electricity system

For the purpose of determining the Built Margin (BM) and operating margin (OM) emission factor, a connected electricity system is defined as an electricity system that is connected by transmission lines to the project electricity system and in which power plants that can be dispatched without significant transmission constraints.

Indian power grid system is divided into five regions namely Northern, North Eastern, Eastern, and Southern and Western Regions. The Northern Region consists of Delhi, Himachal Pradesh, Punjab, Uttar Pradesh, Haryana, Jammu & Kashmir, Rajasthan and newly formed Uttaranchal State. Project activity is connected to the UP state grid which is a part of Northern regional grid. Calculation of baseline emission factor has been done for Northern regional grid.

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 to annex 3 for baseline information. The baseline study was conducted by TEIL. Baseline study was completed on 5th October 2006. TEIL is the project participant and contact information for TEIL is presented in Annex 1 of this document.

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:

29th September 2004

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

20 years

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

For the project activity, the preferred crediting period opted is 10 years.

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:

01/02/2007 or Date of registration

C.2.2.2. Length:

10 years, 0 Months

SECTION D. Application of a monitoring methodology and plan

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

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

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

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

The monitoring methodology is used in conjunction with the 'Approved consolidated baseline methodology ACM0006' (Consolidated baseline methodology for grid-connected electricity generation from biomass residues). The same applicability conditions as in baseline ACM0006 apply. Project activity meets the applicability criteria of the 'Approved consolidated baseline methodology ACM0006'. (Please refer to Section B.1.1 for details).

The monitoring methodology requires monitoring of the following:

- Electricity generation from the project activity;
- 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);
- 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);
- Where applicable, data needed to calculate carbon dioxide emissions from the transportation of biomass to the project plant;

In the TEIL project activity:

- The operating margin emission factor (Simple OM based on 3 year average) and build margin emission factor (ex ante) are fixed at the start of the project activity and hence do not require recalculation;
- There is no fossil fuel being combusted in the project activity;
- Decay or uncontrolled burning of biomass does not happen in the absence of the project activity;

- No transportation of biomass is involved as on site bagasse is used in the project activity;
- Methane emissions from the combustion of biomass is not applicable; and
- There is no leakage involved in the project activity.

Thus effectively the monitoring of the following parameters will be involved in the project activity:

- Net electricity generated from the proposed project activity;
- Total electricity generated from all the power plants at the project site; and
- The net quantity of electricity exported to the grid.

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 Type	Data variable	Data unit	Measured (m), calculated (c) or estimated (e)	Recording Frequency	How will the data be archived? (electronic/ paper)	Comment
1. $BF_{i,y}$	Mass or volume	Quantity of Biomass transported	Tons	M	Continuous, annual energy balance	electronic	Quantity of biomass transported on trucks shall be measured on a weigh bridge, provided with suitable scale to measure the weight. These scales shall be calibrated periodically by external agency for accuracy measurement.

2. AVDy	Distance	Average return trip distance between biomass fuel supply site and project site.	Km	M	continuous	electronic	If biomass supplied from different sites mean value of km travelled by trucks should be recorded.
3. Ny	Number	Number of truck trips for biomass transportation	-	M	continuous	electronic	Number of truck trips are measured and recorded in log books for measurement.
4. EFkm, CO2	Emission factor	Average CO2 emission factor for transportation of biomass with trucks	tCO2/Km	C	Annually		Local or national data is preferred.

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

Carbon dioxide emissions from combustion of fossil fuel for transportation of biomass to the project plant (PETy)

In cases where the biomass is not generated directly at the project site, project participants shall determine CO_2 emissions resulting from transportation of the biomass to the project plant. In many cases transportation is undertaken by vehicles. Project participants may choose between two different approaches to determine emissions: an approach based on distance and vehicle type (option 1) or on fuel consumption (option 2).

Emissions are calculated on the basis of distance and the number of trips (or the average truck load):

$PET_y = N_y \times AVD_y \times EF_{km, CO2}$

where:

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

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 Type	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. $EG_{project\ plant,\ y}$	Electricity Quantity	Net quantity of electricity generated in the project plant during the year y	Metering records	MWh	M	Continuous	100%	Electronic	Net quantity of electricity produced shall be monitored by energy meters of class-0.2 with tolerance level of 0.5%. Separate energy meters are used for measurement of gross electricity generation and auxiliary consumption. Energy meters shall be calibrated periodically as per standard procedures by accredited third party agencies.

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data Type	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
2. $EG_{total, y}$	Electricity Quantity	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	Total quantity of electricity produced shall be monitored by energy meters of class-0.2 with tolerance level of 0.5%. Separate energy meters are used for measurement of gross electricity generation and auxiliary consumption. Energy meters shall be calibrated periodically as per standard procedures by accredited third party agencies.

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data Type	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
3. $Q_{project\ plant,}$	Heat quantity	Net quantity of heat generated from firing biomass in the project plant	Meters	MWh	M	Continuous	100%	Electronic	Steam Quantity, its pressure and temperature will be monitored on continuous basis. Net quantity of heat can be calculated from monitored parameters. Accuracy of boiler outlet steam flow meter and turbine inlet steam flow meter (a) Nozzel Accuracy: 1 to 1.5 % Full scale division (FSD) (b) Transmitter accuracy 0.1% of FSD. All Meters are calibrated by accredited external third party, as per standard procedures, periodically

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data Type	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
4.$BF_{i,y}$	Mass or Volume	Quantity of Biomass type i combusted in the project plant during year y	Metering records	Mass or Volume unit	M	Continuous	100%	Electronic	Biomass measuring device has an accuracy level of +/- 0.5% of full scale, and ranging between 0-120 TPH. All Meters have been calibrated as per standard procedures periodically. All Meters are calibrated by accredited external third party, as per standard procedures, periodically
5. NCV_i	Net calorific value	Net calorific value of biomass		Mwh/Mass or Volume unit	m or c	annually	100 %	Electronic	Net Calorific value of biomass has been measured in accredited labs by bomb calorimeter using standard procedures.

ID number (Please use numbers to ease cross-referencing to table D.3)	Data Type	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*
6. ε_{boiler}	Thermal energy efficiency	Average net Energy efficiency of heat generation in the boiler that is operated next to the project plant			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.)

Baseline emissions are estimated as under

Calculation of electricity baseline emission factor

An 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 (where available) and made publicly available.

STEP 1. Calculate the Operating Margin emission factor(s)

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

$EF_{OM,simple,y}$ is calculated as the average of the most recent three years (2003-2004 , 2004-2005 & 2005-2006) .

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

where

$COEF_{i,j\ y}$- 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, and including imports from the grid

The Fuel Consumption $F_{i\ j,\ y}$ is obtained as

$$\sum_i F_{i,j,y} = \left(\sum_j GEN_{j,y} \otimes 860 \Big/ NCV_i \otimes E_{i,j} \right)$$

where

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

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

$E_{i,j}$ - Is the efficiency (%) of the power plants by source j

The CO_2 emission coefficient $COEF_i$ is obtained as

$$COEF_i = NCV_i \otimes EF_{CO2,i} \otimes OXID_i$$

where

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

$EF_{CO2,i}$ Is the CO_2 emission factor per unit of energy of the fuel i

$OXID_i$ Is the oxidation factor of the fuel

STEP 2. Calculate the Build Margin emission factor (EFBM,y) as the generation-weighted average emission factor (t CO_2/MWh) of a sample of power plants m of Northern regional grid, as follows:

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

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.

Considered calculations for the Build Margin emission factor $EF_{BM,y}$ as ex ante based on the most recent information available on plants already built for sample group 'm' of regional grid at the time of PDD submission. The sample group m consists of 20% of the power plants that has been built most recently, since it comprises of larger annual power generation. (Refer to Annex 3)
Further, power plant capacity additions registered as CDM project activities have been excluded from the sample group m of northern regional grid mix.

STEP 3. Calculate the electricity baseline emission factor $EF_{electricity,y}$ as the weighted average of the Operating Margin emission factor ($EF_{OM,y}$) and the Build Margin emission factor ($EF_{BM,y}$):

$$EF_{electricit\,y,y} = W_{OM} \otimes EF_{OM,Simple,y} \oplus W_{BM} \otimes EF_{BM,y}$$

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

The emission reductions due to the displacement of electricity are given as:

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

where

$ER_{electricity,y}$ - Are the baseline emissions due to displacement of electricity during the year y in tons of CO_2

EG_y - Is lower amongst the following options:

1. $EG_{\text{project plant, y}}$
2. $EG_{\text{total, y}} – (EG_{\text{historic, 3 yr}})/3$

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

$EG_{\text{historic, 3 yr}} =$

Nov.02- Oct.03 million KwH	Nov 03–Oct 04 million KwH	Nov 04 - Oct 05 million KwH
42.87	44.63	43.16

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

Not Applicable

D.2.2.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

ID number *(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.):

>>

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 due to heat generation is zero ($ER_{heat,y}$= 0) because additional heat required in project case shall be initiated in boilers fired with same type of biomass.

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.2.1.1. (1)	Low	Quantity of biomass transported shall be weighed on weigh bridge and emissions due to transportation of bagasse shall be calculated.
D.2.1.1. (2)	Low	Distance shall be measured and recorded in log books.

D.2.1.1. (3)	Low	Numbers of truck trips are recorded in log books.
D.2.1.1. (4)	Low	IPCC data has been taken.
D.2.1.3. (1)	Medium	Net electricity production has been calculated by deducting auxiliary consumption from gross generation of the plant. Digital meters calibration procedures are planned. Daily productions details are kept in log books and electronic data base. Energy meters are of class 0.2 with tolerance of 0.5%. All Meters are calibrated by accredited external third party, as per standard procedures, periodically.
D.2.1.3. (2)	Low	Energy meters on existing turbines are calibrated on annual basis by NABL accredited labs. Electricity generation in these units are recorded and kept in log books for verification purpose.Energy meters are of class 0.2 with tolerance of 0.5%. All Meters are calibrated by accredited external third party, as per standard procedures, periodically.
D.2.1.3. (3)	Low	Heat generated will be calculated by measuring quantity of steam produced and monitoring steam parameters. Accuracy of boiler outlet steam flow meter and turbine inlet steam flow meter (a) Nozzel Accuracy: 1 to 1.5 % Full scale division (FSD).
D.2.1.3. (4)	Low	Quantity of biomass has been monitored. Biomass measuring device has an accuracy level of +/- 0.5% of full scale, and ranging between 0-120 TPH. All Meters have been calibrated as per standard procedures periodically. All Meters are calibrated by accredited external third party, as per standard procedures, periodically
D.2.1.3. (5)	Low	NCV value of bagasse has been measured by bomb calorimeter in a national accredited lab.
D.2.1.3. (6)	Low	Boiler efficiency has been calculated by dividing energy output of steam from boilers by total energy of biomass input in boilers.

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

TEIL has implemented an operational and management structure in order to monitor emission reductions and any leakage effects, generated by the project activity. TEIL has formed a CDM team/committee comprising of persons from relevant departments, which will be responsible for monitoring of all the parameters mentioned in this section. The CDM team also comprises of a special group of operators who are assigned the responsibility of monitoring of different parameters and record keeping. On a weekly basis, the monitoring reports are checked and discussed by the senior CDM team members/managers. In case of any irregularity observed by any of the CDM team member, it is informed to the concerned person for necessary actions. On monthly basis, these reports are forwarded at the management level.

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

The monitoring methodology has been prepared by TEIL.

SECTION E. Estimation of GHG emissions by sources

E.1. Estimate of GHG emissions by sources:

The proposed Cogeneration project activity has been using bagasse as fuel. The project leads to no GHG on-site emissions. The GHG emissions of the combustion process, mainly CO_2, will be consumed by sugar cane plant species, representing a cyclic process of carbon sequestration. Since, the bagasse contains only negligible quantities of other elements like Nitrogen, Sulphur *etc*. release of other GHG emissions are considered as negligible. The bagasse is expected to contain 50% moisture; this will keep the temperatures at steam generator burners low enough not to produce nitrogen oxides. Hence there is no net emission within the project boundary.

[A] Project Emissions associated with fossil fuel combustion

Since there is no fossil fuel combustion associated with the project activity, there are no project emissions associated to fossil fuel combustion in the project activity.

[B] Project Emissions associated with transport of bagasse fuel

The bagasse to be used as the feedstock for project activity is supplied by the Mill itself,. the project emissions related to transportation of bagasse has been calculated ex-ante based on data for the year 2005-2006 and deducted from baseline emissions for calculating emission reductions. However actual quantity of bagasse purchased shall be monitored and corresponding emissions due to its transportation shall be deducted from baseline for a given crediting year.

[C] Project Emissions associated with the storage of bagasse fuel

The net increase of methane emissions associated with the storage of bagasse fuel is regarded as negligible if the bagasse is not stored for more than one year. The bagasse utilized for the project activity is stored in open piles for not more than one year. Therefore there would be no project emissions associated with the storage of bagasse fuel.

E.2. Estimated leakage:

There are no leakages involved in the project activity.

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

Total Project emissions by project activity are estimated as 96 tonnes of CO_2 per annum, which is due to transportation of bagasse has been calculated ex-ante based on data for the year 2005-2006 and deducted from baseline emissions for calculating emission reductions. However actual quantity of bagasse purchased shall be monitored and corresponding emissions due to its transportation shall be deducted from baseline for a given crediting year.

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

As per the methodology the anthropogenic emissions in the baseline for the project activity would occur due to the electricity generation by the fossil fuel intensive grid and will be given by:

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

Year	Estimation of Net quantity of increased Electricity (Due to project), EG_y (million kWh/annum)	Estimation of Emission factor, tonnes of CO_2 /million kWh	Estimation of baseline emissions (tonnes of CO_2e)
2007-2008	73.64[9]	750.87	55,298
2008-2009	120.41	750.87	90,415
2009-2010	120.41	750.87	90,415
2010-2011	120.41	750.87	90,415
2011-2012	120.41	750.87	90,415
2012-2013	120.41	750.87	90,415
2013-2014	120.41	750.87	90,415
2014-2015	120.41	750.87	90,415
2015-2016	120.41	750.87	90,415
2016-2017	120.41	750.87	90,415
Total (tonnes of CO_2e)	**1157.37**		**869,033**

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

The emission reductions of the project activity will be given as:

[9] Generation is presumed less for this year considering that one to two years are required for complete stabilization of the plant.

$ER_y = ER_{electricity,y} - PET_y$

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

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

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

Year	Estimation of project activity emissions (tonnes of CO_2e)	Estimation of baseline emissions (tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of emission reductions (tonnes of CO_2e)
2007-2008	96	55,298	0	55,202
2008-2009	96	90,415	0	90,319
2009-2010	96	90,415	0	90,319
2010-2011	96	90,415	0	90,319
2011-2012	96	90,415	0	90,319
2012-2013	96	90,415	0	90,319
2013-2014	96	90,415	0	90,319
2014-2015	96	90,415	0	90,319
2015-2016	96	90,415	0	90,319
2016-2017	96	90,415	0	90,319
Total (tonnes of CO_2e)	**960**	**869,033**	**0**	**868,077**

SECTION F. Environmental impacts

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

As per the Indian government guidelines on documentation of the Environmental impacts. The cogeneration plant at Khatauli required to obtain consent to operate from state pollution control board of Uttar Pradesh. Project proponent prepared an Environmental Impact Assessment (EIA) report and obtained consent from Uttar Pradesh state pollution control board to go ahead with the project. EIA report has covered various environmental attributes that get affected or likely to get affected by the project activity. It also covers issues regarding socio-economic changes and risks associated with the project activity within and outside the project boundary. The summary of EIA report is available as Enclosure-I.

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

Host party regulations require TEIL to obtain environmental clearance in the form of “No objection Certificate” from State Pollution Control Board, which in this case is Uttar Pradesh Pollution Control Board. The Environmental Management Plan has been prepared and submitted to the pollution control board. Environmental Impact Assessment has been conducted for the project activity to understand if there are any significant environmental impacts and the study indicates that the impacts are not significant.

The following consents were obtained from the State Pollution Control Board for the bagasse based cogeneration plant:

- Consent to ‘establish’ and ‘operate’ under Section 21 of the Air (Prevention and Control of Pollution) Act, 1981 (Central Act 14 of 1981) as amended
- Consent to ‘establish’ and ‘operate’ under Section 25/26 of the Water (Prevention and Control of Pollution) Act, 1974 (Central Act 6 of 1974) as amended.

SECTION G. Stakeholders' comments

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

TEIL invited comments from stakeholder which includes representative of colleges, schools and nearby village residents. Detailed list of stakeholders involved is given in the following section. TEIL informed stakeholders about the project activity by written communication sent in local language and asked people to comment on the activity.

G.2. Summary of the comments received:

Uttar Pradesh Pollution Control Board (UPPCB) and Environment Department of Uttar Pradesh have prescribed standards of environmental compliance and monitor the adherence to the standards. TEIL has received the 'Consent to Operate' the plant.

State's regulatory body of power is Uttar Pradesh Electricity Commission (UPERC) and they have issued consent for the installation of co-generation power plant of 23 MW capacity.

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

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

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

Representatives of following schools, colleges and gram panchayats also communicated TEIL about their views on the project activity.

1. Ch. Harbans Singh Kanya Degree College
2. Kabool Kanya Inter College
3. Lal Dayal public school
4. Janta Inter College
5. Adarsh Janta junior high school
6. Gram Panchayat, Yusufpr
7. Gram Panchayat, Dahod

8. Gram Panchayat, Ladpur

9. Gram Panchayat, Rasoolpur

10. Gram Panchayat, Nanglarud

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

Comments were received as written communications from various stakeholders, they appreciated TEIL efforts of putting up a bagasse based co-generation which will reduce the problem of electricity in the region. Representative o f gram panchayat of village Rasool pur appreciated TEIL efforts of putting up a power unit which has created direct and indirect employment opportunities for people and small industrial units in the region.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Triveni Engineering and Industries Limited (TEIL)
Street/P.O.Box:	15-16, Sector 16-A
Building:	8th Floor, Express Trade Towers
City:	Noida
State/Region:	Uttar Pradesh
Postfix/ZIP:	201301
Country:	India
Telephone:	+91-120-4308000
FAX:	+91-120-4311010-11
E-Mail:	ssinha@ho.trivenigroup.com
URL:	www.trivenigroup.com
Represented by:	
Title:	Vice President – Corporate Planning
Salutation:	Mr.
Last Name:	Sinha
Middle Name:	-
First Name:	Sameer
Department:	-
Mobile:	-

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

As suggested by the approved methodology ACM0006, The baseline emission factor for electricity supply is estimated by referring the "Consolidated Baseline Methodology for Zero-emissions Grid-connected Electricity Generation from Renewable sources" (ACM0002). According to ACM0002, in large countries with layered dispatch systems (e.g. state/provincial/regional/national) the regional grid definition should be used.

In India, there are five regions with respect to electrical transmission systems namely Northern Region, North Eastern Region, Eastern Region, Southern Region and Western Region. The location of project activity is in Uttar Pradesh state which is coming under Northern region. Northern region grid comprises of Delhi, Punjab, Haryana, chandigarh, Rajasthan, Jammu & Kashmir, Uttranchal, Uttar Pradesh and Himachal Pradesh. Therefore Northern grid region is selected as grid boundary to estimate the baseline

Baseline data

Baseline emissions are estimated as under

Calculation of electricity baseline emission factor an 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 (where available) and made publicly available.

STEP 1. Calculate the Operating Margin emission factor(s)

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

$EF_{OM,simple,y}$ is calculated as the average of the most recent three years (2003-2004, 2004-2005 and 2005-2006)

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

where

$COEF_{i,j\,y}$- 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, and including imports from the grid

The Fuel Consumption $F_{i,j,y}$ is obtained as

$$\sum_i F_{i,j,y} = \left(\sum_j GEN_{j,y} \otimes 860 \Big/ NCV_i \otimes E_{i,j} \right)$$

where

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

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

$E_{i,j}$ - Is the efficiency (%) of the power plants by source j

The CO_2 emission coefficient $COEF_i$ is obtained as

$$COEF_i = NCV_i \otimes EF_{CO2,i} \otimes OXID_i$$

where

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

$EF_{CO2,i}$ Is the CO_2 emission factor per unit of energy of the fuel i

$OXID_i$ Is the oxidation factor of the fuel

STEP 2. Calculate the Build Margin emission factor (EFBM,y) as the generation-weighted average emission factor (t CO_2/MWh) of a sample of power plants m of Northern regional grid, as follows:

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

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.

Considered calculations for the Build Margin emission factor $EF_{BM,y}$ as ex ante based on the most recent information available on plants already built for sample group 'm' of regional grid at the time of PDD

submission. The sample group m consists of 20% of the power plants that has been built most recently, since it comprises of larger annual power generation.
Further, power plant capacity additions registered as CDM project activities have been excluded from the sample group m of northern regional grid mix.

STEP 3. Calculate the electricity baseline emission factor $EF_{electricity,y}$ as the weighted average of the Operating Margin emission factor ($EF_{OM,y}$) and the Build Margin emission factor ($EF_{BM,y}$):

$$EF_{electricit\ y,y} = W_{OM} \otimes EF_{OM,Simple,y} \oplus W_{BM} \otimes EF_{BM,y}$$

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

Net Carbon Emission Factor of Grid as per combined margin = (OM + BM)/2 = **0.751 kg of CO_2 / kWh generation**.

Key elements to determine baseline for the project activity

The key elements such as variables, parameters and data sources used to determine the baseline for the project activity are tabulated below:

S No.	Key Parameters	Data Value	Data Sources	Reference
1	Generation of power of all the plants for the year 2001-02, 2002-03, 2003-04, 2004-05 and 2005-06	Refer: TEIL_ER_V04	Annual reports of Northern Region Load Dispatch Center (NRLDC) 2001-02 and 2002-03 Section 7.1, Annual reports of Northern region Electricity Board (NREB) 2003-04 – Annex-10.1.3 2004-05 – Annexure 2.7 2005-06	http://www.nrldc.org/docs/7-1.pdf http://www.nrldc.org/docs/2001-02-section5onwards.pdf http://nreb.nic.in/Reports/Index.htm
2	Coal consumption of each coal fired power plant for the year 2003-04, 2004-05 and 2005-06	70,923,000 tons/year	Annual Performance review of Thermal power plant (CEA)	www.cea.nic.in
3	Calorific value of coal	3820 Kcal/Kg for 2003-04 and 2004-05 3624 Kcal/Kg for 2005-06	CEA "General Review"2005, CEA CO_2 database for power sector, October 2006.	CEA Reports.
4	Calorific value of gas	11464 Kcal/Kg	Revised 2006 IPCC Guidelines for National Green house Gas Inventories: Reference Manual	www.ipcc.ch

5	Oxidation factors	Coal: 1.0 Gas: 1.0	Revised 2006 IPCC Guidelines for National Green house Gas Inventories: Reference Manual	www.ipcc.ch
6	Efficiency of gas based power plants supplying power to grid	45 %	MNES study titled "Baselines for Renewable Energy Projects under Clean Development Mechanism". Chapter 2,	http://mnes.nic.in/baselinepdfs/chapter2.pdf
7	Emission factor of natural gas,	56.1 tCO2/TJ	CEA CO_2 database for power sector, October 2006.	www.cea.nic.in
8	Emission factor of non-coking coal	95.8 tCO2/TJ	CEA CO_2 database for power sector, October 2006.	www.cea.nic.in
9	Emission factor of Eastern and Western grids	Refer TEIL_ER_V04	CEA CO_2 database for power sector, October 2006.	www.cea.nic.in

Note:

The value of emission factors are given in terms of carbon unit in Revised 2006 IPCC Guidelines for National Green house Gas Inventories: Reference Manual. It is converted in terms of CO_2 as shown below:

Fuel	Emission factor	Emission factor
	tC/TJ	tCO_2/TJ
Natural gas	15.3	56.1 (15.3 x 44/12)
Non Coking Coal	26.13	95.8 (26.13 x 44/12)

Generation details

The power generation of power plants falls under Northern grid region for the past three years is given below:

Name	**Type**	**Fuel**	**Generation (2003-04) GWh**	**Generation (2004-05) GWh**	**Generation (2005-06) GWh**
Anta GPS	Thermal	Gas	2775.92	2595.77	2806.84
Auriya GPS	Thermal	Gas	4247.41	4119.47	4281.67
Badarpur TPS	Thermal	Coal	5428.96	5462.78	5380.54
Bairasiul	Hydro	Hydel	687.79	689.67	790.97
Bhakra Complex	Hydro	Hydel	6956.9	4546.01	6838.78
Chamera HPS	Hydro	Hydel	2648.32	3452.25	3833.66

Dadri GPS	Thermal	Gas	5058.66	5527.71	5399.34
Dadri NCTPS	Thermal	Coal	6181.12	6842.52	6768.09
Dehar	Hydro	Hydel	3299.29	3150.52	3122.68
Dhauliganga	Hydro	Hydel	-	-	312.46
Delhi	Thermal	Coal	1164.11	5203.8	1559.10
Delhi	Thermal	Gas	5159.77	4091.37	4046.11
Faridabad GPS	Thermal	Gas	2792.58	3172.01	2954.64
H.P.	Hydro	Hydel	3666.39	3666.39	2870.48
Haryana	Thermal	Coal	6849.26	7192.41	8352.58
Haryana	Hydro	Hydel	251.73	251.73	258.30
J&K	Hydro	Hydel	851.03	851.03	1133.41
J&K	Thermal	Gas	15.41	23.51	28.31
NAPS	Nuclear	Nuclear	2959.44	2760.01	2138.45
Pong	Hydro	Hydel	1178.93	882.57	1730.70
Punjab	Thermal	Coal	14118.96	14390.42	14848.73
Punjab	Hydro	Hydel	4420.43	4420.43	4999.36
Rajasthan	Thermal	Coal	15044.48	17330.79	19903.79
Rajasthan	Thermal	Gas	201.37	360.7	432.58
Rajasthan	Hydro	Hydel	494.07	494.07	921.33
RAPS-A	Nuclear	Nuclear	1293.37	1355.2	1267.50
RAPS-B	Nuclear	Nuclear	2904.68	2954.43	2815.73
Rihand STPS	Thermal	Coal	7949.26	7988.06	10554.73
Salal	Hydro	Hydel	3477.42	3443.29	3480.87
Singrauli STPS	Thermal	Coal	15643.4	15803.34	15502.80
SJVNL	Hydro	Hydel	1537.92	1617.45	3867.12
Tanakpur HPS	Hydro	Hydel	510.99	495.17	483.26
Tanda TPS	Thermal	Coal	2872.81	3254.67	3329.89
U.P.	Thermal	Coal	20638.05	19788.21	19326.44
U.P.	Hydro	Hydel	2063.04	2063.04	1244.92
Unchahar-I TPS	Thermal	Coal	3252.14	3342.83	3544.89
Unchahar-II TPS	Thermal	Coal	3187.93	3438.28	3501.21
Uri HPS	Hydro	Hydel	2873.54	2206.71	2724.81
Uttaranchal	Hydro	Hydel	3452.96	3452.96	3496.87
TOTAL			**168109.8**	**172681.6**	**180853.9**

Calculation of Operating Margin Emission Factor

The following table gives a step by step approach for calculating the Simple Operating Margin emission factor for Northern Regional electricity grid for the most recent 3 years at the time of PDD submission i.e.2003-2004, 2004-2005 & 2005-2006.

	2003-04	**2004-05**	**2005-06**
Generation by Coal out of Total Generation (GWh)	102704.29	106451.00	112572.8

Generation by Gas out of Total Generation (GWh)	20251.12	19890.00	19949.49
Imports from others			
Imports from WREB (GWh)	282.02	1602.84	2153.23
Imports from EREB (GWh)	2334.76	3600.58	4112.67

Fuel 1 : Coal	**2003-04**	**2004-05**	**2005-06**
Avg. Calorific Value of Coal used (kcal/kg)	3820	3820	3624
Coal consumption (tons/yr)	70,397,000	73,279,000	77,121,000
Emission Factor for Coal (tonne CO_2/TJ)	95.8	95.8	95.8
Oxidation Factor of Coal-IPCC standard value	1	1	1
COEF of Coal (tonneCO_2/ton of coal)	1.806	1.806	1.806
Fuel 2 : Gas			
Avg. Efficiency of power generation with gas as a fuel, %	45	45	45
Avg. Calorific Value of Gas used (kcal/kg)	11464	11464	11464
Estimated Gas consumption (tons/yr)	3,739,808	3,673,119	3684105.1
Emission Factor for Gas- IPCC standard value(tonne CO_2/TJ)	56.1	56.1	56.1
Oxidation Factor of Gas-IPCC standard value	1	1	1
COEF of Gas(tonneCO_2/ton of gas)	2.419	2.419	2.419
EF (WREB), tCO2/GWh	880	890	890
EF (EREB), tCO2/GWh	1050	1040	1040
EF (OM Simple), tCO_2/GWh	**952.98**	**960.85**	**916.99**
Average EF (OM Simple), tCO_2/GWh			**943.60**

List of power plants considered for calculating build margin

During 2005-06, the total power generation in northern grid region was 180,853.94 GWh. Twenty % of total generation is about 36,170.79 GWh. The recently commissioned power plant whose summation of power generation is about 37,608.63 GWh is considered for the calculation of Build margin. The list is tabulated below:

S. No.	Plant	Date of commissioning	MW	Generation of the unit in 2005-2006 (GWh)	Fuel Type
1	Dhauliganga unit-I	2005-2006	70	78.61	Hydro
2	Dhauliganga unit-II	2005-2006	70	78.61	Hydro
3	Dhauliganga unit-III	2005-2006	70	78.61	Hydro
4	Dhauliganga unit-IV	2005-2006	70	78.61	Hydro
5	Rihand Stage - II unit I	2004-2005	500	2593.70	Coal
6	Panipat # 7	2004-2005	250	921.46	Coal
7	Panipat # 8	2004-2005	250	1613.95	Coal
8	Chamera HEP-II (Unit 1)	2003-2004	100	567.67	Hydro
9	Chamera HEP-II (Unit 2)	2003-2004	100	567.67	Hydro
10	Chamera HEP-II (Unit 3)	2002-2003	100	567.67	Hydro
11	SJVPNL	2003-2004	1500	4104.25	Hydro
12	Baspa-II (Unit 3)	2003-2004	100	389.87	Hydro
13	Suratgarh-III (Unit-5)	2003-2004	250	2033.40	Coal
14	Kota TPS-IV (Unit-6)	2003-2004	195	1695.70	Coal
15	Baspa-II (Unit 1 & 2)	2002-2003	200	779.74	Hydro
16	Pragati CCGT (Unit II)	2002-2003	104.6	728.29	Gas
17	Pragati CCGT (Unit III)	2002-2003	121.2	843.86	Gas
18	Ramgarh CCGT Stage -II (GT-2)	2002-2003	37.5	146.80	Gas
19	Ramgarh CCGT Stage -II (GT-2)	2002-2003	37.8	147.97	Gas
20	Upper Sindh Extn (HPS)(1)	2001-2002	35	68.52	Hydro
21	Suratgarh stage-II (3 & 4)	2001-2002	500	3844.81	Coal
22	Upper Sindh Stage II (2)	2001-2002	35	68.52	Hydro
23	Malana-1 & 2	2001-2002	86	337.79	Hydro
24	Panipat TPS Stage 4 (Unit-6)	2000-2001	210	1688.29	Coal
25	Chenani Stage III (1,2,3)	2000-2001	7.5	3.88	Hydro
26	Ghanvi HPS (2)	2000-2001	22.5	69.71	Hydro
27	RAPP (Unit-4)	2000-2001	220	1432.17	Nuclear
28	Ranjit Sagar (Unit-1,2,3,4)	2000-2001	600	2012.84	Hydro
29	Gumma HPS	2000-2001	3	6.59	Hydro
30	Faridabad CCGT (Unit 1) (NTPC)	2000-2001	144	986.70	Gas
31	Suratgarh TPS 2	1999-2000	250	2112.17	Coal
32	RAPS-B (2)	1999-2000	220	1432.17	Nuclear
33	Uppersindh-2 HPS #1	1999-2000	35	68.52	Hydro
34	Faridabad GPS 1 & 2 (NTPC)	1999-2000	286	1959.71	Gas
35	Unchahar-II TPS #2	1999-2000	210	1732.60	Coal
36	Unchahar-II TPS #1	1998-1999	210	1767.20	Coal

Built Margin Emission Factor is calculated as per the following table:

Considering 20% of Gross Generation		
Sector		
Thermal Coal Based	20003.28	
Thermal Gas Based	4813.33	

Hydro	9927.69	
Nuclear	2864.33	
Total	37608.63	
Built Margin	-	-
Fuel 1 : Coal		
Avg. calorific value of coal used in Northern Grid, kcal/kg		3624
Coal consumption, tons/yr		12952313
Emission factor for Coal,tonne CO_2/TJ		95.8
Oxidation factor of coal (IPCC standard value)		1
COEF of coal (tonneCO_2/ton of coal)		1.454
Fuel 2 : Gas		
Avg. efficiency of power generation with gas as a fuel, %		45
Avg. calorific value of gas used, kcal/kg		11464
Estimated gas consumption, tons/yr		802405
Emission factor for Gas (as per standard IPCC value)		56.1
Oxidation factor of gas (IPCC standard value)		1
COEF of gas(tonneCO_2/ton of gas)		2.693
EF (BM), tCO_2/GWh		**558.13**

Therefore the **net baseline emission factor** as per combined margin
(OM + BM)/2 = 0.751 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. In order to monitor the mitigation of GHG due to the project activity, the total energy exported and imported need to be measured. The net energy supplied to grid (difference of energy exported and imported) by the project activity multiplied by emission factor for Northern regional grid, would form the baseline for the project activity.

GHG SOURCES

Direct On-Site Emissions

Direct on-site emissions after implementation of the project arise from the combustion of biomass in the boiler. These emissions mainly include CO_2. However, CO_2 released is taken up by the biomass when it grows, therefore no net emissions occur.

Direct Off-Site Emissions

Direct off-site emissions in the project activity arise from the biomass transport. The same type of CO_2 emission occurs during transportation of coal from coal mines to thermal power plants (supplying power to state grid). However on conservative basis these emissions have been deducted from baseline emissions.

Indirect On-Site Emissions

The indirect on site GHG source is the consumption of energy and the emission of GHGs involved in the construction of project activity.

Considering the life of the cogeneration plant and the emissions to be avoided in the life span, emissions from the above-mentioned source is too small and hence neglected.

No other indirect on-site emissions are anticipated from the project activity.

Key Project Parameters affecting Emission Reductions

The project revenue is based on the net units exported by TEIL. The power exported by TEIL would be monitored to the best accuracy and as per the table given in section D.2.

The general principles for monitoring above parameters are based on:

- Frequency
- Data recording
- Reliability
- Experience and training

Frequency

Monthly joint meter reading of main meters installed at interconnection point shall be taken and signed by authorised officials of TEIL and UPPCL on the first day of every month.

Data recording

Records of this joint meter reading would be maintained by TEIL and UPPCL. Daily and monthly reports stating the net power export would be prepared by the shift in-charge and verified by the plant manager.

Reliability

Reliability of energy data would be maintained as per PPA.

TEIL shall archive and preserve all the monthly invoices raised against net saleable energy, for at least two years after end of the crediting period. TEIL shall also archive the complete metering data at generation electronically and all the data would be preserved for at least two years after end of the crediting period.

All the records shall be maintained at site.

Appendix 1

Abbreviation

BP	Back Pressure
CDM	Clean development mechanism
CER	Certified emission reduction
CMA	Cement manufacturers association
CO_2	Carbon dioxide
CPP	Captive Power Plant
Distt	District
EC	Extraction cum Condensing
EIA	Environment impact assessment
Equ	Equivalent
Gcal	Giga calories (10^9 calories)
GHG	Greenhouse gas
IPCC	Inter governmental panel on climate change
IRR	Internal Rate of Return
Km	Kilometer
KWh	Kilo watt hour
MNES	Ministry of Non-conventional Energy Source
MoEF	Ministry of Environment & Forest
PDD	Project design document
p.a.	Per annum
INR	Indian rupees
Sp	Specific
UNFCCC	United Nations Framework Convention on Climate Change
TEIL	Triveni Engineering and Industries Limited

ENCLOSURE – I: EIA SUMMARY REPORT

ENVIRONMENTAL IMPACT ASSESSMENT

The environmental impacts can be categorized as either primary or secondary. Primary impacts are those that are attributed directly by the project, secondary impacts are those which are indirectly induced and typically include the associated investment and changed patterns of social and economic activities by the proposed action.

The proposed project would create an impact on the environment in two distinct phases:

- During the construction phase and
- During the operation phase which would have long term effects.

The proposed cogeneration plant is being set up adjacent to existing sugar mill, in a common premise. . The land is presently barren with not much vegetation. No cutting of trees is involved and there is no deforestation required.

IMPACTS DURING CONSTRUCTION The impacts envisaged during the construction of the proposed plant are:
Impact on Land use The land use pattern will not be impacted due to construction of proposed plant, since plant is being constructed adjacent to the existing sugar mill. The land required for project activity is available within the premises of sugar mill.
Impact on Terrestrial Ecology The proposed land is barren and there is no requirement to clear the land. There is no negative effect of the proposed project on the terrestrial ecology of the area. The project site will also be extensively landscaped with the development of green belt consisting of variety species which would enrich the ecology of the area.
Impact on Soil The impact of proposed expansion and power plant project on soil is negligible. Land development activities have already been completed in the area, which will reduce the soil erosion in the adjacent land.

Demography and Socio-Economics
During construction of project plant, the nearby local villagers and skilled people near project area get employment opportunities. There will be an increase in economic activities in the project area due to more employment, henceforth improving the living standard of people.
Traffic and Traffic Hazards for Access Roads
During construction phase, the building material, equipment and machinery and labour will be transported to the site and this will increase the volume of traffic on access roads. However this effect will not be very significant in view of the fact that the construction activities will be spread over a period of 10 months.
Impact on Air
Construction activity will have minor impact on ambient air scenario due to dust emissions from the movement of vehicles at site.

The impacts during the construction phase are regarded as temporary or short term and hence do not have an everlasting affect on the soil, air, noise or water quality of the area.

During Construction Phase

The impact from the construction phase is not envisaged to be serious. However the following factors are considered to make certain that the impacts are minimal.

Site Preparation

No major leveling operations are required. However during dry weather conditions, it is necessary to control the dust generated by excavation and transportation activities. To achieve this at site, such activity will be carried out after water sprinkling.

Sanitation

The construction site shall be provided with sufficient and suitable toilet facilities for workers meeting the proper standards of hygiene. These facilities shall be connected to septic tank and maintained to ensure minimum environmental impact.

Noise

The impact of noise on the nearest inhabitants during the construction activity will be negligible. Site workers using high noise equipment will use noise protection devices like ear muffs. Noise prone activities will be restricted to the extent possible during night, particularly during the period 10 p.m. to 6 a.m. in order to have minimum environmental impact.

Construction Equipment and Waste

It will be ensured that both gasoline and diesel powered vehicles are properly maintained to minimize smoke in the exhaust emissions. The vehicle maintenance area will be located in such a manner to prevent contamination of surface and ground water sources by accidental spillage of oil. Unauthorized dumping of waste oil will be prohibited.

Deforestation

Although the site is not endowed with trees and vegetation, in order to avoid felling of trees in the vicinity, the construction site workers will be assisted in procuring fuel for cooking purposes in order to avoid felling of any trees in the neighborhood.

Storage of Hazardous Materials

The following hazardous materials are anticipated to be stored at site during construction:

- Petrol and Diesel
- Gas for welding purpose
- Painting materials

These materials will be stored in drums as per international safety norms.

Land Environment

As soon as construction is over the surplus earth will be utilized to fill up low lying areas, the rubbish will be cleared and all unbuilt surfaces reinstated. There are no trees at the present site hence no felling of trees is involved. Appropriate vegetation will be planned after construction activity.

During construction the impacts are generally manifested by loss of minor vegetative cover, migration of minor avian population restricted to site. After green belt development these will be mitigated and the avian population will increase after green belt development since there are no trees presently.

Development of green belt is to be taken up along with civil works.

IMPACTS DURING OPERATION
The operational phase will involve power production using bagasse. The following activities in relation to the operational phase will have varying impact on the environment and are considered for impact prediction.
Impact on Air Quality

The EIA study establishes that the existing status of the ambient air quality of the area is well within the national ambient air quality standard.

The pollutants envisaged from the proposed co-generation power plant are Suspended Particulate Matter (SPM), Oxides of Nitrogen (NO_x), Carbon mono-oxide (CO) and CO_2.

As such the bagasse has very low ash content (1.5%). The SPM as ash is controlled by high efficiency Electro-Static Precipitator (ESP). High efficiency (> 99%) ESP will ensure SPM levels less than 150 mg/Nm^3 in the stack. Moisture content of 50% in bagasse will keep the burner temperatures low so that NO_X formation will not take place. Similarly the for high efficiency combustion is envisaged so that CO formation do not take place and the CO_2 gets absorbed by the sugar canes harvested each year.

The air pollution from the plant in the form of particulate matter emitted mainly from the boiler are found to be well within the prescribed norms and hence no mitigation measures are envisaged. In case of non-availability of bagasse, biomass is envisaged to be used as fuel. Considering bio-mass has more ash content (17%) against 1.5% of bagasse the ESP needs to be fine tuned so that stack emissions remains within limits. ESP is already included in equipment specifications of the boiler order.

Impact on Soil

Most of the impacts on soil due to the project are negligible and restricted to the construction phase and will get stabilized during the operational phase. Fly ash collected from the ESP hoppers and air heater hoppers and the ash collected from the furnace bottom hoppers can be used as landfills and also can used as fertilizers in the sugar cane fields. The ash content in the bagasse is less than 2%. The total fly ash collected may be mixed with press mud from the sugar plant and sold to farmers as manure because of its high nutrient value.

The boiler soot after cleaning will be stored in a closed drum and to be disposed properly. Similarly the oily waste, cloth *etc.* should be stored in a drum and disposed properly.

Impact On Water Resources

Only 0.25 million cubic meter annum will be required for the proposed project which will be drawn from the ground which will not affect the existing water level of the area.

Impact on Noise

For assessing the impact of noise during operation phase, considerations have been given to two aspects, those relating to the noise sources and the other relating to potential receivers.

The sound pressure level generated by noise sources decreases with increasing distance from the source due to wave divergence. An additional decrease in sound pressure level with distance from the source is expected due to atmospheric effect in its interaction with objects in the transmission path. Hence, the maximum exposure of noise is when a person is at line of sight from the noise generating source.

In the cogeneration unit continuous and very high noise levels are generated near primary air fans, forced drafted fans, boilers, generators, compressors and pumps.

Plant equipments are designed to keep noise levels less than 90 dB(A). This is considering damage risk criteria as enforced by OSHA (Occupational Safety and Health Administration) to reduce hearing loss, stipulates that noise level upto 90 dB(A) are acceptable for 8 hour working shift per day.

For computing the noise levels at various distances with respect to the plant site in general and the turbo-generator bay in particular, noise propagation analysis was undertaken. The noise computed at a far distance of about 750 m is of the order of 44 dB(A) during the operation of the plant. The ambient noise level recorded in the nearby villages ranges between 44-53 dB(A). (Details provided in the EIA Report) Due to masking effect, the ambient noise levels in the nearby villages will not increase during the operation phase.

The noise levels in the work areas like generator room and boiler room may be slightly on the higher side (>85dB(A) continuously) but at these places, continuous attendance of workers are not required and workers will be on duty only in shifts as required. Provision of protective personnel equipment in addition will reduce the impact of noise level. Hence these noise levels may not be of much concern from occupational health point of view. However under the general health check-up scheme as per factory act, a trained doctor will check up the workers for any Noise Induced Hearing Loss (NIHL).

The greenbelt, which is being provided by TEIL will act as noise attenuator.

Impact on Water Quality

The EIA study establishes that the existing status of the water quality of the area are well within the environmental norms. The effluent generated from the proposed project activity – the cogeneration power plant will be treated in the effluent treatment plant to ensure there is no environmental deterioration.

The liquid effluents from the power plant would include effluent generated from DM water treatment plant, boiler blow down, cooling tower blow-down, floor washings, sanitation etc.

- Effluent from DM Plant: Hydrochloric acid and sodium hydroxide will be used as regenerants in the DM water plant for boilers and effluent would be drained into epoxy lined underground neutralizing pits. Generally, these effluents are self neutralizing, however provisions will be made such that the effluents are completely neutralized by addition of acid/alkali. The effluent would then be pumped into the effluent treatment ponds, which are a part of the effluent disposal system.

- Effluent from Boiler:The salient characteristics of the blow down water from the point of view of pollution would mainly be the pH and temperature since the suspended solids are negligible. The pH would be in the range of 9.8 to 10.3 and the temperature would be around 100 ^{o}C. The quantity of the blow down water is as low as 1.2 tones/hr it is proposed to put the blow down into the trench and leave it into the sugar plant effluent ponds.

Therefore there are no major impacts envisaged due to effluent generation from the project activity.

Impact on Ecology

The inventory on terrestrial ecology has been compiled through data collection from marshes, irrigation canals, agricultural land and groves (Details provided in the EIA Report). Air emissions from the plant are very low as mentioned above. SPM will contain primarily ash with high nutrient value and will be beneficial to the plants. Other pollutants like NO_X and CO are not envisaged in much quantity to adversely affect the plants or animals.

Ecology and Green belt Development

Implementation of afforestation program is of paramount importance for any industrial development. In addition to augmenting green cover, it also checks soil erosion, marks the climate more conductive, restores water balance and makes ecosystem more complex and functionally more stable. TEIL is proposing an extensive program for the development of green belt around the plant. The green belt is being proposed for the following objectives:

- Mitigation of fugitive dust emissions including any odor problems
- Noise pollution control
- Controlling soil erosion
- Balancing eco-environment
- Aesthetics

The tree species selected for green belt would include the native species like *Mohua, Dhak, Neem, Mango, Bargad, Sesham, Ashoka etc*. The treated sewage effluent from the plant would be used for watering the green belt.