CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)
Version 03 - in effect as of: 22 December 2006

CONTENTS

Annexes

Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
03	22 December 2006	• The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.

SECTION A. General description of small-scale project activity

A.1 Title of the small-scale project activity:

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NSSM – Narkatiaganj Biomass Power Project
Version 2
06/02/07

A.2. Description of the small-scale project activity:

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The proposed project activity is the expansion of the power generation capacity in the sugar unit of New Swadeshi Sugar Mill (NSSM) located at Narkatiaganj, Bihar. The project involves the installation of a new 10 MW backpressure turbine and enhancing the capacity of a boiler from 80 tonnes per hour (tph) to 96 tph (see table below). The implementation of the project activity will permit the plant to supply approximately 5MW of electricity to the Bihar State Electricity Board (BSEB).

The 10 MW backpressure turbine will be powered by steam generated from the combustion of bagasse, a renewable biomass that is produced as a by-product of the sugar manufacturing process. The export of electricity to the regional grid will thus lead to a reduction in greenhouse gas emission through the substitution of the predominantly fossil fuel electricity generation in the grid.

The sugar unit is currently energy independent, employing co-generation for its captive steam and power requirement. The present captive steam and power requirement of the sugar unit is met through the operation of seven boilers and three turbines, the detail of this equipment is provided in the following table.

Boilers	Turbines
Boiler 1 – 80 tph, 45 kg/cm^2	TG 1 – 3 MW backpressure
Boiler 2 – 32 tph, 32 kg/cm^2	TG 2 – 3 MW backpressure
Boiler 3 – 32 tph, 32 kg/cm^2	TG 3 – 660 kW backpressure
Boiler 4 – 7 tph, 11 kg/cm^2	
Boiler 5 – 4 tph, 11 kg/cm^2	
Boiler 4 – 4 tph, 11 kg/cm^2	
Boiler 4 – 4 tph, 11 kg/cm^2	

The 32 kg/cm^2 and 45 kg/cm^2 boilers are currently used to supply steam to the turbines, whilst the steam from the 11kg/cm^2 boilers is passed through a pressure reducing station and then used within the sugar plant. After the implementation of the project activity the newly installed turbine will be operating with in conjunction with the upgraded boiler, Boiler 1, and the existing boilers will continue to operate as will one of the 3MW turbines. The 10 MW and 3 MW turbine generators will therefore meet the captive power demand and supply electricity to the grid[1]. The other 3 MW and 660 kW turbine generators will be decommissioned.

[1] Only the electricity from the new turbine may be exported to the grid as the electricity is generated at 11kV from this turbine whilst the existing turbines generate at 415V.

Bagasse[2] will continue to be used to generate steam in the boilers, which in turn will power the turbines to generate electricity. The surplus electricity generated from this system will be exported to the regional grid and thus the project activity will assist in reduction of GHGs through the displacement of existing and planned grid based generation..

Project's contribution to sustainable development

The project complies with the sustainable development policy of the Ministry of Environment and Forests through following scenarios.

The project makes a significant contribution to development, as any rurally based industry in India provides an important source of direct and indirect employment. At present the factory provides direct employment to 700 persons (13 managerial staff, 56 supervisory staff, 150 clerks and 481 factory workers) and 89 people are employed in the power plant, 21 of which are skilled labour. In terms of indirect employment the factory receives cane from over 60,000 local farmers. NSSM is also involved in providing extension work to the local farmers and has a full fledged wing for cane development consisting of 30 qualified agricultural graduates providing technical know how.

The provision of electricity to grid should generate extra revenue for the factory. This will assist the company to improve its financial position, which in turn will lead to modernisation, diversification and expansion. Since sugar industries are located in rural areas and cater the needs of local farmers, the fresh investment by the company will directly benefit the farmers and local community. The benefits will be in terms of enhanced employment, both direct and indirect, as well as improving opportunities for farmers.

The project activity has direct environmental benefits through GHG reductions through the displacement of the fossil fuel dominated electricity generation in the regional grid by an emission neutral renewable source. In addition to the reduction in carbon dioxide (CO_2) emissions the implementation of the project activity will lead to a reduction in other harmful gases (NOx and SOx) that arise from the combustion of coal in power generation. The project will also lead to reduced ash generation since the ash content2[3] in bagasse is lower than that of Indian coal.

A.3. Project participants:

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Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity (ies) project participants (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
India (host)	The Oudh Sugar Mills Ltd.	No
India (host)	DSCL Energy Services Company Ltd.	No
United kingdom	Agrinergy Ltd.	No

The Oudh Sugar Mills Ltd. is the project owner and will be the official contact for the CDM project activity, contact details as listed in Annex I.

A.4. Technical description of the small-scale project activity:

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[2] Bagasse is a by-product of sugar manufacturing process.

[3] Indian Coal – 30% to 40% & Bagasse – 2%

The proposed project activity involves the addition of a turbine generator and modification to a boiler at an existing renewable energy cogeneration plant. The project activity involves the capacity enhancement of a 45 kg/cm^2 boiler and the installation of a 10 MW backpressure turbine.

The 10 MW backpressure turbine is supplied by M/s Chola Turbo Machinery International. Power will be generated at 11 kV and will be stepped-up on-site to 132 kV before being transmitted to the nearby BSEB sub-station[4].

The technology employed in the project activity is readily available in India. The individual suppliers of the equipments will train the staff in charge at the NSSM after commissioning to operate and maintain the equipment. The suppliers will also provide a comprehensive set of manuals providing details for the maintenance schedule and the required activities associated with maintenance.

A.4.1. Location of the small-scale project activity:

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A.4.1.1. Host Party(ies):

>>
India

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

>>
West Champaran, State Bihar

A.4.1.3. City/Town/Community etc:

>>
Narkatiaganj

A.4.1.4. Details of physical location, including information allowing the unique identification of this small-scale project activity :

>>
The exact postal address is as:

New Swadeshi Sugar Mills
A Unit of The Oudh Sugar Mills Limited
P.O. Narkatiaganj, West Champaran,
Bihar - 845455,
India

The factory lies north of Bettiah and lies close to the foot hills of Himalaya range. Narkatiaganj is situated at a latitude and longitude of 27.38N and 80.45E respectively. The following map shows the exact location of the project activity.

[4] As an interim measure electricity may be supplied to a nearby BSEB substation at 11kV.

A.4.2. Type and category(ies) and technology/measure of the small-scale project activity:

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Type I – Renewable Energy Projects

D – Grid connected renewable electricity generation

As mentioned in section A.2. the project activity generates renewable energy through the combustion of bagasse, a biomass residue. The surplus electricitys supplied to the grid will displace electricity from existing and planned grid electricity generators, the majority of which are fossil fuel based.

The project activity will remain eligible as a small scale project throughout its life time due to the inability to scale-up the capacity without the purchase of additional turbines and boilers.

A.4.3 Estimated amount of emission reductions over the chosen crediting period:

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A renewable seven year crediting period has been chosen.

Year	Annual estimation of emission reduction in tonnes of CO_2e from power export
2007/08	13,102
2008/09	13,102
2009/10	13,102
2010/11	13,102
2011/12	13,102
2012/13	13,102
2013/14	13,102
Total estimated reductions (tonnes CO_2e)	91,718
Total number of crediting years	7 years
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	13,102

A.4.4. Public funding of the small-scale project activity:

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There is no public funding of the project activity.

A.4.5. Confirmation that the small-scale project activity is not a debundled component of a large scale project activity:

As per Appendix C, paragraph 2 of the Simplified Modalities and Procedures for Small-Scale CDM project activities states:

"A proposed small-scale project activity shall be deemed to be a debundled component of a large project activity if there is a registered small-scale CDM project activity or an application to register another small-scale CDM project activity:

- With the same project participants;
- In the same project category and technology/measure; and
- Registered within the previous 2 years; and
- Whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point."

As there is currently no registered CDM project at the site either large scale or small scale, the project will meet the criteria on debundling.

SECTION B. Application of a baseline and monitoring methodology

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

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Type I – Renewable Energy Projects

AMSID – Grid connected renewable electricity generation version 10, 23rd December 2006

B.2 Justification of the choice of the project category:

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The project activity meets the eligibility conditions as outlined below:

1. It generates renewable electricity from the combustion of bagasse, a biomass residue, that will displace existing and planned electricity generation of the grid
2. The project will not combine a renewable and non-renewable component in its supply of electricity to the grid.
3. The plant is a cogeneratng plant but no credits are being claimed for steam, the MW_{th} of the project activity is 13 and therefore also under the 45 MW_{th} limit for small scale activities.
4. The project activity involves the addition of a new 10 MW back pressure turbine the project activity therefore qualifies under the 15MW rule for small scale activities.

The project activity will remain eligible as a small scale project throughout its life time due to its inability to scale-up the capacity of generation, without the purchase of additional turbines and boilers.

With regard to Appendix B of the Simplified Baseline and Monitoring Methodologies, Type I D projects, the project does not fall under point 7 or 8[5] and therefore there is a choice of two approaches, 9 (a) or (b). We have chosen approach (a) to determine the emission coefficient and apply this to the exports of electricity from the project:

"(a) A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the approved methodology ACM0002. Any of the four procedures to calculate the operating margin can be chosen, but the restrictions to use the Simple OM and the Average OM calculations must be considered."

This will be held constant over the life of the project and therefore a three year average will be used for the calculation.

B.3. Description of the project boundary:

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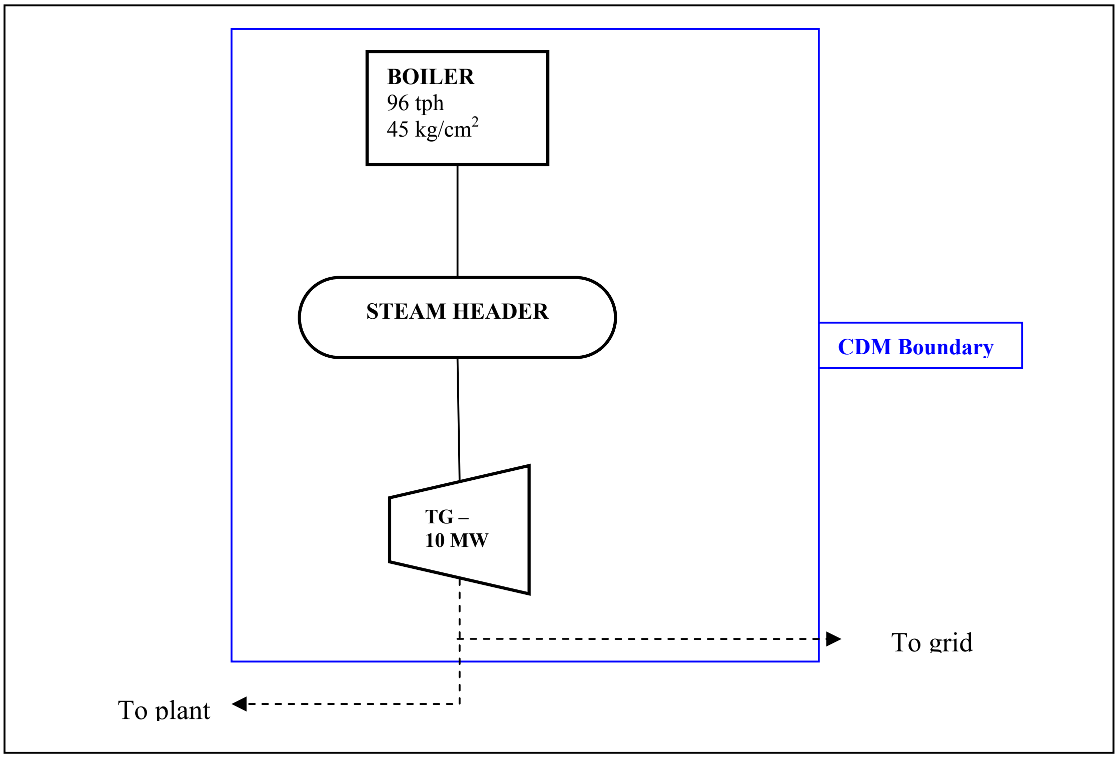
As per the guidance for small scale type ID projects "The project boundary encompasses the physical, geographical site of the renewable generation source". The boundary therefore encompasses the new turbine generator, the upgraded boiler and equipment required to export electricity to the grid (transformers, substation etc). This is shown in the following diagram;

[5] All existing generators use exclusively fuel oil and/or diesel fuel.



In terms of gases, the project boundary is restricted to CO_2. The boundary for the calculation of the grid emission coefficient is the eastern regional grid in India. The Indian power grid system is split into five regions. The regional grids facilitate the transfer of electricity between states, which is supplied by state-owned and central sector power generating stations. The Bihar state falls within the Eastern Region, hence the Eastern Grid is chosen for analysis of the carbon emission factor applied to the project activity.

In terms of leakage we are required to account for this source of emissions if there is the transfer of equipment. In the case of the project activity equipment is not transferred from another site but is newly purchased. In terms of biomass the plant currently has surplus availability of biomass and this will be used to satisfy the increased steam requirement of the increased boiler capacity.

B.4. Description of baseline and its development:

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The emissions baseline (BE_y) is the product of the energy baseline (EG_y) and the CO_2 emissions coefficient (EF_y) for the fuel displaced. Referring to Appendix B of the Simplified Baseline and Monitoring Methodologies we have chosen approach 9 (a) - A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the approved methodology ACM0002. Any of the four procedures to calculate the operating margin can be chosen, but the restrictions to use the Simple OM and the Average OM calculations must be considered. This is appropriate as in the case of the project activity the baseline scenario is that the factory continues to purchase power from the grid.

In line with the methodology to calculate the baseline emissions we use the relevant sections of ACM0002 (Consolidated baseline methodology for grid-connected electricity generation from renewable sources). The combined margin presented below consists of the calculation of the average of the Operating Margin (OM) and the Build Margin (BM). In calculating the operating margin, we select the Simple OM option. Whilst Dispatch Data Analysis is the preferred method of calculating the OM, this is not selected because the required dispatch order data are not available in India. If low-cost/must run resources constitute less than 50% of total grid generation we have the option of using Simple OM.

The first step therefore in selecting the Simple OM is to show that the proportion of low-cost/must run resources are less than 50% of total generation in the average of the last 5 years of data[6]. Low cost/must-run resources typically include hydro, geothermal, wind/ low cost biomass nuclear and solar generation. In addition, we must consider the possibility that coal is obviously used as must-run. In the Eastern Region, the marginal costs of generation from coal are above those of renewable sources such as hydro, wind, nuclear and low-cost biomass. Moreover, coal plants have the possibility to "ramp-up" and "ramp-down". We therefore conclude that coal generation is not an obvious must-run resource. Low-cost/must run resources identified are therefore restricted to hydro and nuclear (the CEA does not provide any generation data from low-cost biomass and wind resources in the Eastern Region). The following table clearly demonstrates the low percentage that low-cost/must run sources constitute of total generation and therefore confirms the choice of Simple OM.

Units operating in the Eastern Region

	2002-3 Generation,GWh	**2003-4 Generation,GWh**	**2004-5 Generation,GWh**	**2005-6 Generation,GWh**
Thermal	59972	68558	77550.36	88792.59
Nuclear	0	0	0	0
Hydro	4487	7304	8269.89	6188.8
Total	64459	75862	85820.25	94981.39
Hydro/nuclear as % of total	**6.96**	**9.63**	**9.64**	**6.52**

Source: CEA Generation report, http://www.cea.nic.in/newweb/opt2_mon_gena.htm

The calculation of the Simple OM initially requires us to calculate a CO_2 emission coefficient for thermal power plants based on the type of fuel used.

As per the methodology, the CO_2 emission coefficient $COEF_i$ is obtained from the following equation:

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

Where:

NCV_i is the net calorific value (energy content) per mass unit of a fuel i,
$OXID_i$ is the oxidation factor of the fuel,
$EF_{CO2,i}$ is the CO_2 emission factor per unit of energy of the fuel i.

In line with the methodology where available, local values of NCV_i and $EF_{CO2,i}$ should be used. If no such values are available, country-specific values should be used. The following table shows the NCV and EF factors used in the calculation of the Eastern Region emission factor.

[6] We have used a 4 year average as data for 5 years generation is not available, see http://www.cea.nic.in/god/opm/Monthly_Generation_Report/index_Monthly_Generation_Report.html

Factors used in calculation of the CO_2 emission coefficient

	NCV_i,		$OXID_i$, %		$EF_{CO2,i}$, tC/TJ	
	Factor	**Source**	**Factor**	**Source**	**Factor**	**Source**
Coal	19.23 TJ/kt	India's Initial National Communication to the UNFCCC[2]	98	IPCC	26.13	India's Initial National Communication to the UNFCCC
Gas	37.68 TJ/cbm	Gail and IPCC[3]	99.5	IPCC	15.3	IPCC
HSD	43.33	IPCC	99	IPCC	20.2	IPCC
Naptha	45.01	IPCC	99	IPCC	20	IPCC

ACM0002 states " Plant emission factors used for the calculation of operating and build margin emission factors should be obtained in the following priority:
1. acquired directly from the dispatch center or power producers, if available; or
2. calculated, if data on fuel type, fuel emission factor, fuel input and power output can be obtained for each plant; if confidential data available from the relevant host Party authority are used the calculation carried out by the project participants shall be verified by the DOE and the CDM-PDD may only show the resultant carbon emission factor and the corresponding list of plants.
3. calculated, as above, but using estimates such as: default IPCC values from the IPCC 1996 Revised Guidelines and the IPCC Good Practice Guidance for net calorific values and carbon emission factors for fuels instead of plant-specific values (note that the IPCC Good Practice Guidance includes some updates from the IPCC 1996 Revised Guidelines); technology provider's name plate power plant efficiency or the anticipated energy efficiency documented in official sources (instead of calculating it from fuel consumption and power output). This is likely to be a conservative estimate, because under actual operating conditions plants usually have lower efficiencies and higher emissions than name plate performance would imply; conservative estimates of power plant efficiencies, based on expert judgments on the basis of the plant's technology, size and commissioning date; or
4. calculated, for the simple OM and the average OM, using aggregated generation and fuel consumption data, in cases where more disaggregated data is not available."

In India, the CEA is not a dispatch centre, and therefore Option 1 above cannot be done. Option 2 can be taken in so far as the CEA does provide coal consumption data for each plant. However, the CEA does not provide coal NCV figures for each plant and therefore IPCC data has been used. The following equation is applied to the fuel consumption and generation to arrive at the Simple OM.

$$EF_{OM,y} = \frac{\sum_{i,j} F_{i,j}.COEF_{i,j}}{\sum_{j} GEN_{j,y}}$$

[2] http://natcomindia.org/pdfs/chapter2.pdf

[3] http://www.gailonline.com/customerzone/power.htm. NCV 90% of GCV.

In the case of gas stations, individual fuel consumption for each plant is not available. Aggregate consumption at the state and regional level is instead provided by the CEA. These data are only available for 2003-4 and therefore we use these data to derive an average emission factor for gas stations in the Eastern Region. The average emission factor is then applied to 2004-05 generation in the calculation of the CM[7].

The data on fuel consumption and generation for gas stations in the Eastern Region is outlined below:

Fuel Consumption and generation from gas stations in the Eastern Region, 2004-05

	Natural gas (mcbm)	HSD (kl)	Naptha (kl)	Total generation (GWh)
Bihar	0	0	0	0
Jharkhand	0	0	0	0
Orissa	0	0	0	0
W. Bengal	0	0	0	0
DVC	0	2596	0	6.61
Sikkim	0	0	0	0
Central	0	0	0	0
Total				**7**

Source: Source: CEA General Review 2005, Table 6.1, pp. 117

These data are combined with the above data on fuel specific gravities, calorific values, emission factors and oxidation factors to determine total emission from the above gas stations:

Total emissions from gas stations in Eastern Region, 2004-05

	Nat Gas	HSD	Naptha	Total
Bihar	0	0	0	0
Jharkhand	0	0	0	0
Orissa	0	0	0	0
W. Bengal	0	0	0	0
DVC	0	7101	0	7101
Sikkim	0	0	0	0
Central	0	0	0	0
Total				**7101**

Dividing total emissions (7101 (tCO2)) by total generation from gas stations (7 GWh) gives an average emission factor for gas stations in the Eastern Region of 1.074 tCO2/MWh.

Annual generation data for each power plant in the Eastern Region is provided by the CEA[8].
(http://cea.nic.in/god/opm/Monthly_Generation_Report/18col_05_03.pdf

[7] Steam stations use coal but gas may be also used as auxiliary fuel at these stations. The volume used is small and exclusion of this gas from fuel consumption calculation is conservative.

[8] http://cea.nic.in/god/opm/Monthly_Generation_Report/18col_05_03.pdf and http://cea.nic.in/god/opm/Monthly_Generation_Report/18col_04_03.htm

Coal consumption data for thermal power plants is also provided by the CEA report "Performance Review of Thermal Power Stations". (http://cea.nic.in/Th_per_rev/start.pdf). The CEA year runs from April to March.

Net imports from connected grid systems must also be considered. As outlined in ACM002, net imports from connected systems are only accounted for in the Operating Margin calculation. In terms of the applicable emissions factor, ACM002 states that:
"For the purpose of determining the Operating Margin (OM) emission factor, as described below, use one of the following options to determine the CO2 emission factor(s) for net electricity imports (COEFi,j,imports) from a connected electricity system within the same host country(ies):
(a) 0 tCO2/MWh, or
(b) the emission factor(s) of the specific power plant(s) from which electricity is imported, if and only if the specific plants are clearly known, or
(c) the average emission rate of the exporting grid, if and only if net imports do not exceed 20% of total generation in the project electricity system, or
(d) the emission factor of the exporting grid, determined as described in steps 1,2 and 3 below, if net imports exceed 20% of the total generation in the project electricity system."

Net imports from other regional grids account for less than 20% of total generation and therefore the average emission rate of the exporting grid may be selected. The determination of the carbon emissions factors for the exporting grids is based on an average grid emission rate as outlined in the methodology. The following tables outline the net import data and the emission factors for each grid:

Net Imports from Other Regional Grids to the Eastern Region (GWh)

	2004/05	2003/04	2002/03
Northern	0	0	0
Western	0	0	0
Southern	0	57	24
N Eastern	0	0	0

Source: http://cea.nic.in/god/gmd/Inter-regional_Energy_Exchanges.pdf

Average emission rates for other Regional Grids (tCO2/MWh)

	2004/05	2003/04	2002/03
Northern CEF	0.83	0.81	0.84
Southern CEF	0.86	0.90	0.89
Western CEF	1.14	1.14	1.14
N Eastern CEF	0.36	0.41	0.40

Source: http://mnes.nic.in/baselinepdfs/chapter2.pdf

Combining the above emission factors for coal and for gas based stations and imports, with generation (and in the case of coal plants fuel consumption data) data from the CEA provides the following[9]:

[9] It should be noted that the CEA also provide data on specific secondary fuel oil consumption in coal plants. For conservativeness we have no included these emissions in calculation of the OM and BM.

Calculation of the Simple OM

Plant	Generation, GWh			Coal Consumption (kt)			Emissions (tCO_2)		
	2004-5	2003-4	2002-3	2004-5	2003-4	2002-3	2004-5	2003-4	2002-3
Coal Plants									
BIHAR									
Barauni	154	274	266	169	304	292	305	563	541
Muzaffarpur	0	78	265	0	76	264	0	141	489
Kahalgaon	6082	5972	4995	5524	5452	4525	9974	10099	8382
JHARKHAND									
Patratu	744	1066	0	715	1023	0	1291	1895	0
Tenughat	1326	1346	1369	902	895	950	1629	1658	1760
Bokaro	2467	2707	3078	2067	2178	2402	3732	4034	4449
Chandrapur (DVC)	1894	1306	1128	1457	1196	1068	2631	2215	1978
W. BENGAL									
Durgapur (DVC)	1472	1668	1108	1049	1162	787	1894	2152	1458
Mejia (DVC)	4751	4028	3338	3124	2727	2275	5641	5051	4214
Bandel	2150	1693	2044	1311	993	1100	2367	1839	2038
Santaldih	1337	1212	1264	938	822	840	1694	1523	1556
Kolaghat	7382	6900	6602	5296	5286	4800	9562	9791	8891
Barkeshwar	4176	4315	4025	2258	2370	2180	4077	4390	4038
New Cossipore	481	475	454	431	481	519	778	891	961
Titagarh	1791	1733	1638	1171	1067	990	2114	1976	1834
South Gen.	997	930	840	688	613	568	1242	1135	1052
Budge Budge	3784	3507	3321	2220	2111	2003	4008	3910	3710
Durgarpur (DPL)	2027	1916	1476	1668	1526	1042	3012	2827	1930
Farakka STPS	9703	9486	8951	8895	8822	7521	16061	16341	13931
ORISSA									
Talchar	3197	2743	2248	2577	2224	1951	4653	4120	3614
Talchar STPS	16247	10999	6523	12028	7647	4479	21717	14165	8296
IB Valley	3165	3012	2613	2641	2628	0	4769	4868	0
Gas Plants									
JHARKHAND									
Maithon GT	0	6	7				0	6	8
WEST BENGAL									

Kasba GT	0	0	0	0	0	0
Siliguri GT	0	0	0	0	0	0
Haldia GT	0	0	0	0	0	0
Diesel Plants						
SIKKIM						
Gantok DG	0	0	0	0	0	0
Ranipool DG	0	0	0			
Net Imports						
Northern	0	0	0	0	0	0
Western	0	0	0	0	0	0
Southern	0	50976	20951	0	57	24
N Eastern	0	0	0	0	0	0
Total	**75329**	**67372**	**57553**	**103151**	**95591**	**75130**
Simple OM	**0.957**	**0.808**	**1.369**			
Average Simple OM		**1.045**				

The final Simple OM, $EF_{OM,\,y}$, based on the average of the last three years for which data is available is therefore 1.045tCO2/MWh.

In considering the BM we are required to calculate the carbon emissions factor based on an examination of recent capacity additions to the Eastern region grid. These capacity additions should be chosen from the greater generation accounted for:

- The five power plants that have been built most recently, or
- The power plants capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

The total generation of the grid under consideration is 85,820GWh (http://cea.nic.in/god/opm/Monthly_Generation_Report/18col_05_03.pdf), 20% of which is 17,164GWh. The five most recent plants only account for 8651GWh and therefore the sample to determine the build margin is selected on the basis of the "power plants capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently". The full set of generating plants in the Eastern Region is provided by the CEA generation report (http://cea.nic.in/god/opm/Monthly_Generation_Report/18col_05_03.pdf).

Commissioning dates for all generation units included in the CEA generation report have been obtained. The following table shows in chronological order the commissioning dates for the most recent 20% of commissioned plants and the total generation they supply.

The calculation of the BM requires us to undertake a generation weighted average of the emissions factors of the individual plants; this is shown in the following table. We have chosen to calculate the BM using Option 1 therefore the BM emission factor will be held constant over the crediting period chosen. The following equation is applied to calculate the BM emission factor:

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y}.COEF_{i,m}}{\sum_{mj} GEN_{m,y}}$$

Identification of plants in BM

Plant	Capacity addition, MW	Date of addition	Generation, GWh	Emissions, tCO_2
Indravati	150	7/1/1999	713	0
Indravati	150	7/1/1999	713	0
Teesta	22.5	7/1/1999	36	0
Rangeet	60	7/1/1999	370	0
Mejia	210	9/15/1999	1188	1410
Bakreswar	210	10/15/1999	1392	1359
Indravati	150	7/1/2000	713	0
Bakreswar	210	7/15/2000	1392	1359
Jojobera Imp	120	1/1/2001	406	396
Bakreswar	210	5/15/2001	1392	1359
Indravati	150	7/1/2001	713	0
Jojobera Imp	120	8/15/2001	406	396

Chandil	8	7/1/2002	0	0
Talcher STPS	500	1/15/2003	4062	5429
Talcher STPS	500	10/15/2003	4062	5429
Mejia	210	2/15/2005	122	145
Total			**17678**	**17283**
BM				**0.978**

Source: List of all plants and generation from CEA generation report. Commissioning data from CEA, state electricity boards and NTPC website.

The weights applied to the operating and build margin are fixed at 0.5, therefore in order to calculate the combined margin we apply these to the Simple OM and BM as calculated above in line with the following equation:

$$EF_y = w_{OM}.EF_{OM,y} + w_{BM}.EF_{BM,y}$$
$$EF_y = 0.5.EF_{OM,y} + 0.5.EF_{BM,y}$$

The following table shows this calculation arriving at the combined margin of 1.011 tCO_2/MWh.

Calculation of the combined margin

	tCO_2/MWh
Simple OM, $EF_{OM, y}$	1.045
Build margin $EF_{BM, y}$	0.978
Combined margin, EF_y	**1.011**

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered small-scale CDM project activity:

In line with attachment A to appendix B of the simplified M&P for small-scale CDM project activities, demonstration of additionality focuses on the barriers facing the project. In showing that the project is additional we demonstrate that it is not part of the baseline scenario, which in the case of the NSSM would be the continuation of the present practice of power generation for captive consumption with no export to grid.

In terms of the specific barriers facing the project these fall under the prevailing practice and institutional barriers as outlined in Attachment A to Appendix B of the simplified modalities and procedures for small-scale CDM project activities, namely:

(c) Barrier due to prevailing practice: prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions;

(d) Other barriers: without the project activity, for another specific reason identified by the project participant, such as institutional barriers or limited information, managerial resources, organizational capacity, financial resources, or capacity to absorb new technologies, emissions would have been higher.

The major barrier associated with the project activity is that it is first of its kind in the state of Bihar, the list of sugar factories in the state are shown in the following table and it can be seen there is currently no grid supply from any sugar factory in the state.

Name of factory	Capacity, tcd	Grid supply
Bharat Sugar Mills	2,500	No
Harinagar Sugar Mills	8,500	No
Tirupati Sugars	2,500	No
Motihari Chini Udyog	2,500	No
Motilal Padampat Udyog	3,500	No
New India Sugar Mills	1,750	No
New Swadeshi Sugar Mills	5,000	No
Riga Sugar Co	3,500	No
Sasa Musa Sugar	1,750	No
Vishnu Sugar Mills	3,500	No

Source: "List of Cane Sugar Factories and Distilleries, Season 2005-06", Published by The Sugar Technologists' Association of India, New Delhi.

The risks that have arisen through being the first project supplying electricity to the grid have been most evident through the lack of any institutional environment to accommodate such types of projects. The most severe problem relates to the Power Purchase Agreement (PPA). Whilst the BSEB was supposed to sign a PPA with the project in December 2006, to date they have only agreed on an MOU for the purchase of power leading to significant uncertainty in the final terms going forward. The Bihar Electricity Regulatory Commission has just been constituted and the rules and regulations for PPAs are yet to be framed which adds further uncertainty in that the final terms of the PPA that the project activity will sign. The project activity has requested the BSEB to adopt the tariff structure similar to that of Paschimanchal Vidyut Vitran Nigam Limited[10] (PVVNL) and this is currently the framework under which the plant operates. The terms and ultimate PPA are therefore uncertain and in the interim pose a serious risk to the project activity.

A further barrier evident from the institutional framework is that the evacuation of electricity at 132 kV is not yet possible as BSEB have not constructed the transmission lines. This has resulted in the project activity connecting to the grid at 11 kV through a substation 2 km from the plant. The cost of transmission line and evacuation has been undertaken by the project activity, a cost not envisaged when developing the project. Whilst the BSEB is still expected to construct the line there are likely to be further delays. BSEB issued a tender in September and the technical aspects of this tender have been finalised but as yet the commercial aspects have not been tendered. It therefore seems unlikely that the project activity will be able to export at 132 kV in its first year of operation. The main problem in supplying at 11 kV is that the demand fluctuates wildly and the plant is unable to supply the expected electricity when the project was envisaged or even a known constant amount of electricity. The fluctuation in demand has made it very difficult to operate the power plant, the fluctuations initially impacted the adjacent sugar factory as backpressure steam was not available for the sugar plant and the plant is now limited to exporting at certain times of the day. The overall result of this is that the project activity has had to scale back its exports of electricity and is now running at levels much lower than initially envisaged.

There are also significant fluctuations in the availability of sugarcane around the plant region which poses additional barriers to the project activity. The amount of sugarcane will determine the biomass available

[10] PVVNL is an operating public utility in the state of Uttar Pradesh and has license to supply power in parts of state and whereas the PVVNL in its board of directors meeting held on 24/08/05 has authorised Uttar Pradesh Power Corporation Limited (UPPCL) to execute/sign the power purchase agreement and also authorised UPPCL to do the necessary relevant works on behalf of PVVNL.

to the project activity, any reduction in the amount of sugarcane will reduce the amount of biomass and hence affect the plant load factor of the project activity. The sugar cane yield has shown wide variations during the past years as outlined in the table below. The lack of irrigation facilities is the main reason behind this fluctuation, almost 70% of the area surrounding the plant is without irrigation and therefore is grown under rainfed condition. The uncertainty in weather conditions will therefore also play a role in determining the operational performance of the power plant.

	2001-02	2002-03	2003-04	2004-05	2005-06	Mean
Area Under Cane (ha)	21,300	25,100	16,800	20,272	27,120	22,118
Sugar Cane Production (t)	747,790	1,020,175	623,700	545,500	921,600	771,753
Sugar Cane Yield (t/ha)	35.11	40.64	37.13	26.91	33.98	34.75

Source: factory surveys and estimates

There has also been significant price fluctuation[11] in agriculture markets over the recent years in the state and due to this the continuous availability of cane for the sugar industry is a risk that the project will face. As outlined above any shortfall in the availability of cane will have an impact on the supply of electricity to the BSEB and hence the returns of the project.

The prospect of CER revenue will therefore help the project proponents overcome the barriers, and risks inherent in these barriers, to the project activity.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

>>

Baseline emissions:

As per appendix B the baseline emission reductions for Type ID projects that generate renewable electricity are calculated as the product of energy baseline and the CO_2 emission coefficient for the fuel displaced, in the case of the project the grid emission factor.

$$BE_y = EG_y . EF_y$$

Where:

BE_y = Baseline emissions in year y, tCO_2e
EG_y = Electricity exported to the grid in year y, MWh
EF_y = Grid carbon dioxide emissions factor, tCO_2e/MWh

Using the fixed carbon dioxide emissions factor determined in section B4, this equation may be simplified to the following:

$$BE_y = EG_y \times 1.011$$

Project emissions

The project activity will not give rise to project emissions as no fossil fuel will be combusted in the project activity. Project emissions are therefore zero.

[11] http://agricoop.nic.in/farmprices/MSP.pdf

Leakage
As has been demonstrated earlier leakage is not expected to arise from the project activity. Leakage is therefore zero.

From the analysis above the emission reductions attributable to the project are equal to the baseline emissions, therefore:

$$ER_y = BE_y$$

Where:

ER_y = Emissions reductions generated in year y, tCO_2e
BE_y = Baseline Emissions in year y, tCO_2e

Substituting from above this is equal to:

$$ER_y = EG_y \times 1.011$$

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

Data / Parameter:	$\mathbf{F_{i,j,y}}$
Data unit:	Mt, mcbm, kl
Description:	Consumption of fossil fuel by existing grid connected power plants
Source of data used:	Central Electricity Authority
Value applied:	Varies for each plant
Justification of the choice of data or description of measurement methods and procedures actually applied :	For thermal power plants the CEA provides coal consumption data for each grid based unit, whilst for gas based plants aggregate fuel consumption data is available. The choice of data therefore satisfies the guidance in the methodology, ACM0002.
Any comment:	Full data set provided in Annex 3

Data / Parameter:	$\mathbf{GEN_{j,y}}$
Data unit:	GWh
Description:	Generation of electricity by existing grid connected power plants
Source of data used:	Central Electricity Authority
Value applied:	Varies for each plant
Justification of the choice of data or description of measurement methods and procedures actually applied :	The CEA provides data on the generation of electricity by grid based units.
Any comment:	Full data set provided in Annex 3

Data / Parameter:	$\mathbf{NCV_i}$

Data unit:	TJ/kt
Description:	Net calorific value of the fuel combusted in grid based power plants used in the determination of the emission factor
Source of data used:	India's National communication to UNFCCC
Value applied:	Varies for each fuel type
Justification of the choice of data or description of measurement methods and procedures actually applied :	India specific values. Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories (IPCC, 1996) has been used for a transparent and comparable emission inventory.
Any comment:	Full data set provided in Annex 3

Data / Parameter:	$EF_{CO2,i}$
Data unit:	tCO2/TJ
Description:	Tonnes of carbon dioxide per energy unit of fuel in grid based plants used in the determination of the emission factor
Source of data used:	India's National communication to UNFCCC
Value applied:	Varies for each fuel type
Justification of the choice of data or description of measurement methods and procedures actually applied :	India specific values. Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories (IPCC, 1996) has been used for a transparent and comparable emission inventory.
Any comment:	Full data set provided in Annex 3

Data / Parameter:	$OXID_i$
Data unit:	%
Description:	Oxidation factor applied to the combustion of fuels in grid based plants for the determination of the emission factor
Source of data used:	Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual Table 1-6
Value applied:	98% for coal and 99.5% for gas
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	No comments

Data / Parameter:	$F_{i,m,y}$
Data unit:	Mt, mcbm, kl
Description:	Consumption of fossil fuel by existing grid connected power plants
Source of data used:	Central Electricity Authority
Value applied:	Varies for each plant

Justification of the choice of data or description of measurement methods and procedures actually applied :	For thermal power plants the CEA provides coal consumption data for each grid based unit, whilst for gas based plants aggregate fuel consumption data is available. The choice of data therefore satisfies the guidance in the methodology, ACM0002.
Any comment:	Full data set provided in Annex 3

Data / Parameter:	$\mathbf{GEN_{m,y}}$
Data unit:	GWh
Description:	Generation of electricity by existing grid connected power plants
Source of data used:	Central Electricity Authority
Value applied:	Varies for each plant
Justification of the choice of data or description of measurement methods and procedures actually applied :	The CEA provides data on the generation of electricity by grid based units.
Any comment:	Full data set provided in Annex 3

B.6.3 Ex-ante calculation of emission reductions:

>>

From the equations above emission reductions are calculated from the following equation:

$$ER_y = EG_y \times 1.011$$

EGy is expected to be 12,960 MWh and therefore we arrive at emission reductions of 13,102 tCO_2e per annum.

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

>>

Year	Estimation of project activity emission reductions (tonnes of CO_2 e)	Estimation of baseline emission reductions (tonnes of CO_2 e)	Estimation of leakage (tonnes of CO_2e)	Estimation of emission reductions (tonnes of CO_2 e)
2007/08	0	13,102	0	13,102
2008/09	0	13,102	0	13,102
2009/10	0	13,102	0	13,102
2010/11	0	13,102	0	13,102
2011/12	0	13,102	0	13,102
2012/13	0	13,102	0	13,102
2013/14	0	13,102	0	13,102
Total	0	91,718	0	91,718

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

B.7.1 Data and parameters monitored:

(Copy this table for each data and parameter)

Data / Parameter:	**EG_y**
Data unit:	MWh
Description:	Electricity supplied to BSEB
Source of data to be used:	Electricity meters at the BSEB substation for exports of electricity at 132 kV and plant meters for export of electricity at 11 kV.
Value of data	12,960
Description of measurement methods and procedures to be applied:	This parameter will be measured using electronic measurement meters at the power plant and substation. The data will be kept for 2 years after the end of the crediting period. The meters on the site will be regularly calibrated, the BSEB meters will be calibrated independently by BSEB.
QA/QC procedures to be applied:	The actual values of the electricity exports will be taken from the invoices raised by the project activity and payments made by BSEB. The meter readings will underlie these invoices and there is therefore strong QA/QC on this monitored variable. The meter readings are also taken jointly by a member of BSEB and the project activity.
Any comment:	During the period of export at 11 kV meters on site will be used whilst for exports at 132 kV meters at the substation will be used. Check meters on site will however permit daily recording of the exported electricity for 132 kV.

B.7.2 Description of the monitoring plan:

>>

The monitoring of data revolves around the electricity exported to grid (EG_y). The emission factor will be applied to the export of electricity to arrive at a figure for which emission reductions will be claimed. The carbon dioxide emission factor applied is held constant throughout the life of the project (in line with the guidance of ACM0002) and will therefore not be part of the monitoring plan.

Further details on the monitoring plan are set out in Annex 4.

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

>>

Baseline section completed: 06/02/2007
Completed by
Ben Atkinson, contact details as per Annex 1
Charu Gupta, contact details as per Annex 1

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:

>>

21/03/2006, this is taken from the date on which the purchase order for the turbine generator was made.

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

>>
21 y 00m

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

A renewable crediting period has been chosen.

C.2.1. Renewable crediting period

Chosen crediting period.

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

>>
01/04/2007 or the date of registration whichever is later.

C.2.1.2. Length of the first crediting period:

>>
7 y 00m

C.2.2. Fixed crediting period:

A renewable crediting period has been chosen.

C.2.2.1. Starting date:

>>
This section has been left blank on purpose.

C.2.2.2. Length:

>>
This section has been left blank on purpose.

SECTION D. Environmental impacts

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D.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

>>
Under Indian law an EIA is not required for the type of project but the plant did undertake a rapid EIA.

There are no negative environmental impacts arising as a result of the project activity. The positive environmental impacts arising from the project activity are:

- Reduced carbon dioxide emissions because of displacement of fossil fuel dominated grid electricity by biomass based renewable electricity.

- Reduced NOx and SOx emissions that arise from the combustion of coal in power generation
- Reduced generation of ash as the biomass used has a lower ash content than that of Indian coal, coal typically has an ash content of 30 to 40% whilst bagasse has an ash content ranging from 1% to 2%.

Each year the plant will obtain a consent from the Bihar Pollution Control Board (BPCB) for air and water pollution. These consents will be incorporated into the monitoring plan and compliance with BPCB legislation will be reported at annual verifications.

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

>>

Environmental impacts are not considered significant.

SECTION E. Stakeholders' comments

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

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The local population and the cane growers/farmers are considered the major stakeholders with respect to the project activity. The consent of the local stakeholders was sought by:

1. Publishing a notice outlining the project and inviting comments in a local news paper, the Hindusthan Times, on 12th August 2006.
2. Organising a stakeholder meeting at the sugar mill and inviting members of the local community (local Member of Legislative Assembly, village "*sarpanch"*, leaders/members of local bodies and local residents) on 6th October 2006..

The other stakeholders consulted are the Bihar Pollution Control Board (BPCB) and the Bihar Power Corporation Ltd (BPCL). The BPCB has issued "Consents to Establish"and "Consents to Operate" To the project activity. The BPCL will ultimately issue a PPA to the project activity but to date this is limited to an MOU.

E.2. Summary of the comments received:

>>

During the stakeholder meeting the question was raised as to whether the electricity generated from the project activity would be supplied locally and to farmers. The representatives of the project activity explained that the electricity is supplied to BSEB who in turn decide how to distribute the electricity but that increased supplies of electricity should result in greater local availability.

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

>>

Details from the proceedings of the stakeholders meeting were provided to the validator.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

The project has not received any public funding.

Annex 3

BASELINE INFORMATION

See section B4 for baseline data.

Annex 4

MONITORING INFORMATION

The monitoring of data revolves around the electricity exported to grid (EG_y). The emission factor will be applied to the export of electricity to arrive at a figure for which emission reductions will be claimed. The carbon dioxide emission factor applied is held constant throughout the life of the project (in line with the guidance of ACM0002) and will therefore not be part of the monitoring plan.

Electrical generation and export from the project activity will be metered at the plant and recorded on an hourly and shiftwise basis. The actual meter used to monitor the electricity export will be the BSEB meter located at their substation. However, the project activity may export electricity at 11 kV and in this case the meter on site will be used to monitor the electricity export.

In either case the export of electricity will be independently recorded by the BSEB and the measured figure will form the basis of invoicing. There is therefore a strong QC/QA feature attached to the monitored variable. The meter readings for the basis of the measurement of export of electricity to the grid will be taken jointly by a representative of the project activity and a representative of BSEB.

In addition to the measurement at the substation the plant will record the exports of electricity to the grid and these will be collated into a daily report. This report and the monitoring procedures will be incorporated into the ISO 9000 systems of the plant.

All data will be kept for a minimum of 2 years following issuance of certified emission reductions or the end of the crediting period, whichever is later, and the maintenance of the data will be the responsibility of the project developers.

The electricity readings will be monitored on a daily basis compiled in the form of daily energy report. This report will be compiled form the data gathered from the hourly log sheets maintained in the cogeneration plant. The shift engineers will sign off on the shift reports and the power plant manager will sign off on the daily report.

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