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:

>>
Shree Chhatrapati Shahu RE Project
Version 1
17/02/2007

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

>>
The project activity is undertaken by Shree Chhatrapati Shahu Co-operative Sugar Factory Ltd., Kagal, Kolhapur, India. The project seeks to generate renewable electricity from bagasse, a renewable biomass material, that is produced from the milling of the sugar cane. The electricity generated will be exported to the state electricity grid which in the absence of project activity would be generated primarily through the combustion of fossil fuels leading to emissions of greenhouse gas. The factory will also make significant contribution to the sustainable development of the area surrounding the plant.

The project activity involves the installation of a new boiler and turbine generator at the 4000TCD (tones of cane per day) sugar factory. This will enable the export of 7MW of electricity to the grid in the season and 10MW in the off-season.

New	Boiler	Turbine
Capacity	70TPH	12.5MW
Operating Temperature	485^{o}C	480^{o}C
Operating pressure	67kg/cm^2	64kg/cm^2
Manufacturer	KCP	Siemens
Type	Water Tube	Condensing cum extraction

The existing power demand at the factory is satisfied by the following boilers and turbines.

Existing	Boiler	Turbine
Capacity	2 X 27TPH ,40TPH and 20TPH	1.5MW and 2.5MW
Operating Temperature	340^{o}C	310-320^{o}C
Operating pressure	21kg/cm^2	18-20kg/cm^2
Manufacturer	Backan/Wolf and KCP	BHEL & Triveni
Type	Water Tube	Back pressure

In the existing system, two boilers with capacities of 27TPH and one with a 20TPH capacity will be decommissioned. The 40TPH boiler will produce steam for the mills of sugar plant. All the existing turbines will be decommissioned after stabilization of the new power plant.

Contribution to Sustainable development

The factory makes a significant contribution to sustainable development not just indirectly through its co-operative structure but also directly. The co-operative structure of the sugar factory results in all the profits of the factory being returned to the members (who are all farmers supplying cane to the factory) in the form of a higher cane price. Therefore any improvements carried out at the factory will filter back to the farmers. The factory is also directly involved in a number of extension activities with the farmers and provides educational and health facilities to its workers. The project itself is expected to result in direct employment of about 25 people.

The extension work carried out by the factory is wide ranging – from the guaranteeing of loans provided to farmers by banks through to the provision of seed and fertilizer at nominal rates. The factory serves about 25,000 farmers from 91 villages located in the surrounding areas.

The project will contribute to the sustainability of the factory and thus foster further economic development in the surrounding area through the strengthening of agricultural activities. The generation of renewable electricity will also reduce the dependence on existing and planned grid based fossil fuel based generation. This will have a positive impact not only through the reduction in emissions of greenhouse gases associated with such generation, which is predominantly coal based (see section on determination of the baseline), but also through a reduction in the emissions of other harmful gases (NOx and SOx) that arise from the combustion of coal.

The proposed CDM project is undertaken in the co-operative sugar sector in Maharashtra and will act as a catalyst to others wishing to install grid based generation. This is of significant importance in the state given that there are over 150 co-operative factories that contribute to the livelihoods of the rural population.

A.3. Project participants:

>>

Name of Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	If Party wishes to be considered as a project participant
India (host)	Cooperative entity: Shree Chhatrapati Shahu Co-operative Sugar Factory Ltd	No
UK	Private entity: Agrinergy Ltd	No

The official contact for the project activity will be Shree Chhatrapati Shahu Co-operative Sugar Factory Ltd as listed in Annex I.

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

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.:

>>
Maharashtra state

A.4.1.3. City/Town/Community etc:

>>
Kolhapur district, Kagal town

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

>>
The complete postal address of the sugar factory is:
Shree Chhatrapati Shahu Co-operative Sugar Factory Ltd
Shrimant Jayashingrao Gatge Bhavan
Kagal – 416 216
District Kolhapur
Maharashtra, India

The geographical location of Kolhapur[1] is Latitude: 16.42^{o}N and Longitude: 74.16^{o}E.

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

>>
Type I – Renewable Energy Projects
I D – Grid connected renewable electricity generation

All the required guidelines will be met for compliance with local safety and environment legislation. Consents from state pollution board in the past demonstrate that the project proponents have followed these guidelines and all future consents will be based on any new guidelines specified by the pollution control board. The technology is available in India and the technical support/training will be provided at commissioning.

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

>>
A 7 year renewable crediting period has been chosen.

Year	Estimation of annual emission reductions in tonnes of CO_2e
Year 2007/8	43,390
Year 2008/9	43,390
Year 2009/10	43,390
Year 2010/11	43,390
Year 2011/12	43,390
Year 2012/13	43,390
Year 2013/14	43,390

[1] http://www.mapsofindia.com/lat_long/maharashtra/maharashtra.htm

Total estimated reductions (tonnes of CO_2e)	303,728
Total number of crediting years	7
Annual average of the estimated reductions over the crediting period (tCO_2)	43,390

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

>>
No public funds will be invested in the project activity.

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

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:

>>
I D – Grid connected renewable electricity generation
Version 10, 23 December 2006[2]

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

>>
Grid connected renewable electricity generation
The project activity will establish a grid connection and the electricity supplied from the project activity, through the combustion of bagasse (a renewable biomass material), would be expected to supplement existing and planned electricity generation from the grid, the majority of which is fossil fuel based. The

[2] http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html

project activity therefore satisfies the applicability condition relating to renewable biomass and supply of electricity to a distribution system that is currently operating on fossil fuel.

In the project activity, the new turbine generator has a capacity of 12.5MW, which therefore qualifies under the small scale rules as this is below the eligibility limit of 15MW. No emission reductions are being claimed for heat generation from the new boiler, therefore we do not need to account for the thermal capacity of the boiler.

The new renewable electricity generating unit is physically distinct and the existing units will not be operated once the new unit starts generating.

B.3. Description of the project boundary:

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In line with the guidance in "Appendix B of the simplified modalities and procedures for small-scale CDM project activities" the boundary for category I.D. projects "encompasses the physical, geographical site of the renewable generation source". The project boundary includes the equipment installed for the operation of the power plant, the main elements of which are the boiler, turbine generator, condenser, water treatment plant, effluent treatment plant, electrostatic precipitator, step up plant/transformers, transmission lines and the Western grid.

For the purposes of the project activity the relevant grid is defined by the power generating units serving the same grid as the project activity. In the case of India there are regional grids which facilitate the transfer of electricity between states and which are supplied by central sector power stations operating in the region. Maharashtra is part of the Western Region (along with Gujarat, Madhya Pradesh, Chhattisgarh and Goa) and we have therefore undertaken an analysis of the Western grid to determine the carbon emission factor. This provides a complete analysis of the power plants that the project will affect. We do not believe that the national grid is appropriate given the limited interconnectivity of the regional grids and the size of the project relative to national power generation capacity.

B.4. Description of baseline and its development:

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Referring to Appendix B of the Simplified Baseline and Monitoring Methodologies the baseline for the project activity is the MWh exported to the gird multiplied by the grid emission coefficient (tCO_2/MWh) calculated using approach 9 (a)[3] - 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. The detailed calculations for the combined margin are presented in Annex 3. We do not include power to the factory as our baseline assumes that sugar factories are power independent. In the specific case of the project activity, the baseline scenario is that the sugar factory remains self sufficient in power. That this is the case and that the project activity is not the baseline has been demonstrated in section B.5

Data used to determine the baseline scenario

Baseline data	Key information	Source
Grid generation	Generation data of grid based generating units	Central Electricity Authority
Grid emissions	Fossil fuel consumption of grid	Central Electricity

[3] AMS-1.D - http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html

	based generating units	Authority
Capacity expansions	Timing of expansions to determine build margin	State electricity boards and generating companies
Net calorific value of fossil fuel used in grid plants		India's National Communication to UNFCCC or IPCC
Emissions factor of fossil fuel used in grid plants		India's National Communication to UNFCCC or IPCC
Oxidation factor of fossil fuel used in grid plants		IPCC

All the key assumptions underlying the baseline calculations have been detailed in Annex 3.

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 - technological barriers, investment barriers and a brief analysis of prevailing practice in the state. In showing that the project is additional we demonstrate that it is not part of the baseline scenario, which in the case of Shree Chhatrapati Shahu RE Project is that the grid continues to operate and expand based on predominantly fossil fuel generation.

The main barrier in undertaking bagasse based grid supply using a high-pressure configuration (which is more capital intensive as compared to low pressure configuration) is the financial returns associated with the project and access to finance. In the case of co-operative sugar factories relative to other private mills, the access to finance is more of a barrier. The reasons for this are that co-operative sugar mills distribute their entire profits through the cane price to their members (the farmers). This therefore limits access to equity which is required to undertake investments. Co-operative sugar mills therefore find it extremely difficult to invest due to their underlying structure and their resultant access to capital. The situation is compounded by the fact that members typically prefer short term returns over longer term returns which investments in bagasse based grid supply entail.

All assumptions inherent in the financial analysis will be made available to the validator but the following is a summary of the main points and results. The electricity price is set at Rs 3.02/kWh, escalated at a compounded rate of 2% per annum, which relates to the current terms in the power purchase agreement (PPA) with the Maharasthra State Electricity Board. The costs relate to maintenance, salaries and administrative expenses. A further expense is the cost of fuel but this has only been calculated on an opportunity cost basis, i.e. what the plant expects to purchase rather than the total fuel fed to the boiler[4]. Analysing the project IRR in the light of these revenues and costs we arrive at an IRR of 8.4% without the inclusion of CER revenue and 12.6% when CER[5] revenues are included[6].

[4] Costs: Salaries - 5% of revenues, Admin - 1% of revenues, Maintenance -2% of capital cost, Bagasse cost - Rs 1000/mt.

[5] CER price- 10$/t$CO_2$, 1$ = Rs 45.

Furthermore the risks in the pricing and supply of bagasse are a substantial barrier to the project activity. The factory is planning to purchase some bagasse on the open market, an amount equivalent to 36 days of operation. Not only have bagasse prices exhibited volatility in the recent past there are also risks to outright supply. We have assumed a bagasse price going forward of Rs 1,000/mt, but in 2004/05 the average price was much higher Rs 1400/mt. High opportunity costs for bagasse will make the project activity unviable and in order for the project to achieve an acceptable rate of return the price of bagasse would have to fall to Rs 750/tonne[7].

The project activity is assumed to operate for 232 days to achieve the financial results indicated above, any reduction in the days of operation will have an impact on the project's viability. The following table shows the impact of adjusting the days of operation and the bagasse price. It should be noted that the assumptions on prices of bagasse and operating days are already quite aggressive and it is unlikely that the days will be increased beyond the estimate.

		Days of operation		
		180	220	250
Bagasse price, Rs/mt	800	4.11%	10.17%	14.26%
	1000	1.09%	7.28%	11.41%
	1200	-2.21%	4.23%	8.42%

In relation to the access to finance barrier the project has approached a government buyer of certified emission reductions and the project has been accepted into their programme. As part of the terms of the sale agreement the project is expecting to receive 30% of the value of certified emission reductions as an up-front payment. This will be used by the project activity as quasi equity to overcome the barriers it faces to accessing capital.

The CER revenues (which can be priced forward and is euro or dollar denominated) will act as a buffer to, at least partially mitigate, the risks and barriers facing the project.

The alternative to the project activity is to continue to operate low pressure cogeneration system. The project activity will use high pressure boiler and this presents a new set of operational challenges for the management. Normally sugar factories generate power through low pressure configurations, which are technically easier to operate. The factory has not historically exported to the grid and further operational barriers facing the project relate to supply of power to the grid. Whilst synchronization, variations in the grid voltage and frequency and grid failure affect all power plants the relative impact on the project is higher given that the primary activity of the factory is the manufacture of sugar and not electricity.

In line with the small scale guidance the national policies relevant to the project have been included and revolve around the power tariff. These have been incorporated into the financial analysis and are therefore explicitly presented.

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[6] The benchmark against which these returns should be judged has been taken as the PLR in India, the rates at which banks extend loans, national newspapers detail these rates, and at the time of determining the investment decision was 11.5%.

[7] Operating on a price of Rs 750/mt would yield a project IRR without CER revenues of 12.1%, an acceptable rate based on the current Prevailing Lending Rate of India banks.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

>>

Emission Reductions

The emission reductions from the project activity are calculated by the application of the following equation:

$$ER_y = ER_{electricity,y} - PE_y - L_y$$

Where:

ER_y	emission reductions of the project activity during the year y in tons of CO_2
$ER_{electricity,\ y}$	emission reductions due to the displacement of electricity during the year y in tons of CO_2
PE_y	project emissions during the year y in tons of CO_2
L_y	leakage caused due to project activity in tons of CO_2

$ER_{electricity,y}$

In terms of emission reduction due to electricity ($ER_{electricity,y}$), the only source in the project activity is through the generation of electricity. The calculation of these emission reductions is as follows:

$$ER_{electricity} = EG_y . EF_y$$

Where:

EG_y	quantity of electricity exported to the grid (MWh)
EF_y	grid based emission factor, determined through the combined margin approach as set out in ACM0002 tCO_2e/MWh

The calculation of EF_y is carried out through the application of relevant sections of methodology ACM0002, version 6. The combined margin, representing EF_y is explicitly presented in Annex 3 and consists of the calculation of the average of the Operating Margin (OM) and the Build Margin (BM). In calculating the OM, we select the Simple OM option as despatch data is not available and low cost/must run sources make up less than 50% of the generation. The application of the methodology does require the use of default values for the weightings applied to the Simple OM and BM and we have applied the standard weightings of 50:50. The combined margin has been calculated ex-ante and will be held constant over the life of the project activity.

Project Emissions

Project emissions are assumed to be zero as the methodology does not explicitly require us to consider such sources. However no fossil fuel will be used to generate steam in the new boiler.

Leakage

As the energy generating equipments are not transferred from another activity leakage is assumed to be zero.

Therefore, the emission reduction equation reduces to:

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

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

(Copy this table for each data and parameter)

Data / Parameter:	**$F_{i,j,y}$**
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:	**$GEN_{j,y}$**
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:	**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:	Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual Table 1-2 and India's National Communication, chapter 2, page 37 for coal.
Value applied:	Varies for each fuel type
Justification of the choice of data or description of measurement methods and procedures actually applied :	National net calorific values are not available and therefore we have used country specific IPCC data.
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:	Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual Table 1-1 and India's National Communication, chapter 2, page 37 for coal.
Value applied:	Varies for each fuel type
Justification of the choice of data or description of measurement methods and procedures actually applied :	The values in Table 1-1 have been converted to a carbon dioxide equivalent by multiplying by 44/12.
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:	

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:	**$GEN_{m,y}$**
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 section B.6.1 the emission reductions are given as:

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

$$ER_{electricity} = EG_y . EF_y$$

Where:

EG_y quantity of electricity exported to the grid annually (MWh)

EF_y grid based emission factor, determined through the combined margin approach as set out in ACM0002 tCO_2e/MWh

EG_y = 46,455 MWh

EF_y = 0.934 tCO_2/MWh

Therefore, ER_y= 43,390 tCO_2

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

>>

Year	Estimation of project activity emissions (tonnes of CO_2e)	Estimation of baseline emissions (tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of overall emission reductions (tonnes of CO_2e)
Year 2007	0	43,390	0	43,390
Year 2008	0	43,390	0	43,390
Year 2009	0	43,390	0	43,390
Year 2010	0	43,390	0	43,390
Year 2011	0	43,390	0	43,390
Year 2012	0	43,390	0	43,390
Year 2013	0	43,390	0	43,390

Total tonnes of CO_2e	0	303,728	0	303,728

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:	MWh exported to the grid
Source of data:	Plant records maintained by the power plant manager and sales to MSEB
Value of data	46,455.84 MWh
Description of measurement methods and procedures to be applied:	Data from the turbine generator will be continuously recorded by the turbine operator. This will be collated at the end of each day and reported to the head of power plant. This will form the basis for calculations and will be tallied against the data record by the MSEB which will be taken monthly by the factory and officials from MSEB. In case there is a difference between the factory records and the MSEB record, the MSEB record will prevail.
QA/QC procedures to be applied:	The invoices generated for the sale of power to the grid will form a QA/QC check.
Any comment:	Data will be kept for the crediting period and two years thereafter.

B.7.2 Description of the monitoring plan:

>>

The CDM data will be collected monthly and held on the attached spreadsheet tool which has been designed for the project activity. This will permit the monitoring and reporting of emission reductions on a monthly basis. Data input is required in the blue cells with resultant calculations of the emission reductions performed automatically.

A detailed monitoring and verification report will be produced by the plant and this will form the basis of the roles and responsibilities and collection frequency of the data required to monitor the project activity.

More generally the generation data from the turbine will however be continuously recorded by current transformers and a manual hourly record will be made by the turbine operator. This data will be collated at the end of each day and reported in the daily operating report to the factory management, the responsibility for which will be with the Head Electrical. This data will form the basis of the ongoing calculation which will then be tallied against the monthly recordings taken by the MSEB and a representative of the factory.

The organization has trained the staff to ensure that the monitoring process is appropriate and effective.

MVP - ***to be completed monthly***

Data in blue should be entered by project administrator in a timely manner, data in yellow is fixed.

Static data	
CEF, tonnes CO2e/MWh	0.934

	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
Electricity exports MWh										
Jun										
July										
Aug										
Sep										
Oct										
Nov										
Dec										
Jan										
Feb										
Mar										
Apr										
May										
Total exports	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CERs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

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

>>
27/12/2006
Robert Taylor, Agrinergy Ltd - Project Participant
Ajit Kulkarni, Shree Chhatrapati Shahu
Contact information as listed in 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:

>>
01/03/2006 - Date of order of turbine generator.

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

>>
20years 0 months

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

A renewable crediting period has been chosen.

C.2.1. Renewable crediting period

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

>>
15/06/2007

C.2.1.2. Length of the first crediting period:

>>
7 years

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>
Not applicable.

C.2.2.2. Length:

>>
Not applicable.

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:

>>
In relation to the baseline scenario no negative environmental impacts will arise as a result of the project activity.
The positive environmental impacts arising from the project activity are:

- A reduction in carbon dioxide emissions from the replacement of fossil fuels which would be generated under the baseline scenario
- A reduction in the emissions of other harmful gases (NOx and SOx) that arise from the combustion of coal in power generation

The factory will meet all local and national environmental legislation and this will be verified by the continuous monitoring by the Maharashtra Pollution Control Board.

A "Consent to Establish" has been obtained by the factory . The "Consent to Operate" has been provided to Shree Chhatrapati Shahu Co-operative Sugar Factory Ltd in previous years when they operated a bagasse based captive power plant and thus shows that the factory complied with existing environmental legislation. The consent is given on the basis that the factory operates within the prescribed limits of the Air and Water Act. In the case of the factory these are air emissions of less than 150 mg/Nm^3 for particulate matter and trade effluent not exceeding 30 m^3/day and limits on BOD and COD will not exceed 100mg/l and 250mg/l respectively.

The "Consent to Operate" will be obtained annually from the MPCB and this will be provided at the time of each annual verification.

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

>>
The 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:

>>
The stakeholder review has been conducted on three levels:

- A local stakeholder review
- A national stakeholder review which will be undertaken through the approval by the Ministry of Environment and Forests and consent to operate from the Maharashtra Pollution Control Board
- An international stakeholder review which will be conducted at the time of validation

The institutions are already in place for the national and international stakeholder review and any comments arising from these processes will be incorporated prior to registration. The project was submitted to the Indian designated national authority (the Ministry of Environment and Forests) in February 2007 and the approval will be provided prior to registration.

The local stakeholder review has been conducted by the publication of notice on 31st January, 2007 in Indian Express (Pune Edition) and Daily Sakal (local marathi newspaper). The comments if any will be incorporated in the PDD prior to registration. A no objection certificate has been obtained from the local municipality.

E.2. Summary of the comments received:

>>

No comment has been received till date.

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

>>

As no comments have been received till date, no action has been undertaken.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Shree Chhatrapati Shahu Co-operative Sugar Factory Ltd
Street/P.O.Box:	
Building:	Shrimant Jayashingrao Ghatge Bhavan
City:	Kagal, Dist- Kolhapur
State/Region:	Maharashtra
Postfix/ZIP:	416 216
Country:	India
Telephone:	+91-2325 244211 to 244214
FAX:	+91-2325 244241
E-Mail:	kpr_shahukgl@sancharnet.in
URL:	
Represented by:	
Title:	Mr.
Salutation:	
Last Name:	Kulkarni
Middle Name:	V.
First Name:	Ajit
Department:	
Mobile:	+91-9422045312
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

The project has not received any public funding.

Annex 3

BASELINE INFORMATION

In order to determine the CO_2 emissions coefficient we are required to calculate the approximate operating margin and the build margin where the approximate operating margin is defined as:

> "the weighted average emissions (in kgCO_2equ/kWh) of all generating sources serving the system, excluding hydro, geothermal, wind, low-cost biomass, nuclear and solar generation;"

and the build margin is defined as:

> "the weighted average emissions (in kgCO_2equ/kWh) of recent capacity additions to the system, based on the most recent information available on plants already built for sample group m at the time of PDD submission. The sample group consists of either the five power plants that have been built most recently, or the power plant capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently. Project participant should use from these two options that sample group that comprises the larger annual generation. Power plant capacity additions registered as CDM project activities should be excluded from the sample group m. If 20% falls on part capacity of a plant, that plant is included in the calculation.

Approximate Operating Margin

In calculating the Approximate Operating Margin emission factor we use Option 1, a 3 year weighted average emissions factor and hold this constant throughout the life of the crediting period.
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 4 years of data[8]. 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 Western 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 Western 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 Western Region

[8] 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

	2002-3 Generation,GWh	2003-4 Generation,GWh	2004-5 Generation,Gwh	2005-6 Generation,Gwh
Thermal	116701	140,296	141,678	164959
Nuclear	8642	5,673	6,203	6081.57
Hydro	30221	9,393	8,061	15830.95
Total	155564	155,362	155,942	186871.5
Hydro/nuclear as % of total	33%	9.70%	9.15%	11.75%

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 CO2 emission coefficient for thermal power plants based on the type of fuel used.

As per the methodology, the CO2 emission coefficient COEFi is obtained from the following equation:

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

Where:

NCVi is the net calorific value (energy content) per mass unit of a fuel i,
OXIDi is the oxidation factor of the fuel,
EFCO2,i is the CO2 emission factor per unit of energy of the fuel i.

In line with the methodology where available, local values of NCVi and EFCO2,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 Western Region emission factor.

Factors used in calculation of the CO2 emission coefficient

	NCVi,		OXIDi, %		EFCO2,i, tC/TJ	
	Factor	Source	Factor	Source	Factor	Source
Coal	19.98 TJ/kt	IPCC	98	IPCC	25.8	IPCC
Gas	37.68 TJ/cbm	Gail and IPCC9	99.5	IPCC	15.3	IPCC
HSD	43.33	IPCC	99	IPCC	20.2	IPCC
Naptha	45.01	IPCC	99	IPCC	20	IPCC
Lignite	9.29	India's initial national communication to the UNFCCC, 2004 (lower bound)10	98	IPCC	28.95	India's initial national communicatio n to the UNFCCC, 2004

[9] http://www.gailonline.com/customerzone/power.htm. NCV 90% of GCV.
[10] This is lower than IPCC value for Lignite of 9.8

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.

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

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 Western Region. The average emission factor is then applied to 2004-05 generation in the calculation of the CM[11].

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

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

	Gas,mcbm	HSD, kl	Naptha, kl	Generation, GWh
Gujarat	2635	932	92964	12886
Maharashtra	1153			5450
Goa	0		65252	336
Central Sector	879	693	618692	6854
Total				25526.35

[11] 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.

Source: Source: CEA General Review 2006, 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 Western Region, 2004-05

	Gas	HSD	Naptha
Gujarat	5542316	2606	236949
Maharashtra	2425158		
Goa	0		
Central Sector	1848841	1938	1576938
Total			11634746

Dividing total emissions (11634746 tCO_2) by total generation from gas stations (25562.35 GWh) gives an average emission factor for gas stations in the Western Region of 0.456 tCO_2/MWh.

Similarly, in the case of lignite stations, individual fuel consumption for each plant is not available from the CEA. As above, lignite consumption in steam stations is provided in the CEA General Review 2005. Lignite is only used in stations in Gujarat, and the generation of these stations is provided by the CEA. The following table outlines lignite consumption in Gujarat, generation from lignite stations and associated emissions:

Lignite consumption, generation and emissions in Western Region, 2004-05

State	Lignite Consumption	Emissions	Generation
Gujarat	2609 kt	2535118 tCO2	2638 GWh

Source: CEA General Review

Dividing total emissions (2525118 tCO2) from lignite stations by generation (2638 GWh) gives an average emission factor for lignite stations of 0.961tCO_2/MWh.

In addition to gas and lignite stations, the CEA does not provide fuel consumption for Tata Trombay plants. We derive plant specific emission factors for the Tata Trombay units as outlined below:

Calculation of Emission Factors for Tata Trombay Units

Unit	Capacity	Fuel	Generation (2004-05)	Heat Rates (kCal/KWh) (2004-05)	Emission Factor (tCO2/MWh
4	150	LSHS	869	2602	0.866
5	500	Coal	3808	2447	
6	500	LSHS	3028	2376	
7	180	Gas	1197	2019	0.474

Source: http://www.tatapower.com/regfilling/ARR2004_05.pdf

Annual generation data for each power plant in the Western Region is provided by the CEA12. (http://cea.nic.in/god/opm/Monthly_Generation_Report/18col_05_03.pdf

[12] 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.

As discussed above, 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 tCO_2/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 Western Region (GWh)

	2004/05	2003/04	2002/03
Southern net exports	1608.9	524	579.3
Eastern net exports	9361.5	8500.5	2810.9
Northern net exports	0	624.8	1527.1
N Eastern net exports	0	0	0

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

Average emission rates for other Regional Grids (tCO_2/MWh)

	2004/05	2003/04	2002/03
Northern CEF	0.8429	0.8138	0.8330
Southern CEF	0.8870	0.8990	0.8590
Western CEF	1.1393	1.1367	1.1390
N Eastern CEF	0.3703	0.4240	0
Eastern CEF	1.2183	1.2300	1.1655

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

Combining the above emission factors for coal and gas based stations and imports, with generation data (and in the case of coal plants fuel consumption data) from the CEA provides the following[13]:

[13] 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	Capacity	Type	Generation (GWh) 2004-5	2003-4	2002-3	Coal Consumption (kt) 2004-5	2003-4	2002-3	Emissions (tCO2) 2004-5	2003-4	2002-3
GUJARAT											
DHUVARAN	534	Gas	2,110	1,454	1,385				1,039,168	716,127	682,143
UKAI	850	Coal	5,063	4,569	5,312	3,440	3,108	3,577	6,211,188	5,611,736	6,458,552
GANDHI NAGAR	660	Coal	3,416	3,379	4,222	3,158	3,216	3,554	5,702,015	5,806,738	6,417,023
WANAKBORI	1,260	Coal	9,224	9,124	8,893	7,404	7,261	7,250	13,368,498	13,110,300	13,090,439
SIKKA REP.	240	Coal	1,408	1,000	1,131	1,000	674	717	1,805,578	1,216,959	1,294,599
KUTCH LIG.	215	Lignite	831	972	1,036				783,997	916,790	977,154
AKRIMOTA LIG	125	Lignite	0	0	0				-	-	-
G.S.E.C.L.(G.5)	210	Coal	1,561	1,691	1,636		Inc. in Ganghi Nagar			Inc. in Ganghi Nagar	
G.S.E.C.L.(W.7)	210	Coal	1,656	1,612	1,762		Inc. in Wanakbori			Inc. in Wanakbori	
DHUVARAN GT	27	Gas	0	0	0				-	-	-
UTRAN GT	144	Gas	1,176	724	890				579,088	356,586	438,345
DHUVARAN CCPP	106	Gas	702	211	0				345,578	103,922	-
HAZIRA CCPP	156	Gas	1,151	791	878				566,987	389,585	432,435
UKAI	305	Hydro	466	757	579						
KADANA	240	Hydro	362	101	8						
S.SAROVAR RBPH	200	Hydro	111	0	0						
S.SAROVAR CHPH	200	Hydro	150	0	0						
TORR POWER AEC	60	Coal	449	475	438	1,651	1,529	1,541	2,981,009	2,760,728	2,782,395
TORR POW VAT GT	100	Gas	557	6	209				274,192	2,955	102,937
TORR POWER SAB	330	Coal	2,590	2,473	2,523		Total above			Inc. above	
ESSAR GT IMP	515	Gas	1,516	543	1,055				746,890	267,440	519,611
G.I.P.C.L. GT	305	Gas	2,258	1,782	1,951				1,112,027	877,675	960,911
SURAT LIG	250	Lignite	1,806	1,651	1,599				1,703,691	1,557,222	1,508,176
G.T.E. CORP	655	Gas	3,633	3,678	1,535				1,789,314	1,811,497	756,022
KAWAS GT	644	Gas	2,824	3,893	4,208				1,390,784	1,917,389	2,072,534
GANDHAR GT	648	Gas	4,033	3,222	3,372				1,986,244	1,586,907	1,660,785
KAKRAPARA	440	Nuclear	2,514	3,176	3,659						

MADHYA PRADESH											
SATPURA	1,143	Coal	7,684	7,720	7,874	6,753	6,647	6,550	12,193,067	12,001,675	11,826,534
AMAR KANTAK	50	Coal	172	184	226	1,052	1,004	1,112	1,899,468	1,812,800	2,007,802
AMAR KANTAK EXT	240	Coal	1,025	987	1,214		Total above			Inc. above	
SANJAY GANDHI	840	Coal	5,478	5,124	5,232	4,047	3,931	4,095	7,307,173	7,097,726	7,393,841
GANDHI SAGA	115	Hydro	343	142	38						
BARGI	90	Hydro	489	585	453						
PENCH	160	Hydro	233	464	337						
RAJGHAT (MP)	45	Hydro	87	141	56						
BANSAGAR (I)	315	Hydro	888	1,122	870						
BANSAGAR (II)	30	Hydro	66	86	43						
BANSAGAR (III)	60	Hydro	79	108	36						
BIRSINGHPUR	20	Hydro	39	64	24						
TAWA	14	Hydro	30	0	0						
VINDH_CHAL STPS	2,260	Coal	17,822	16,377	16,935	10,860	9,849	10,567	19,608,575	17,783,135	19,079,540
INDIRA SAGAR	875	Hydro	1,349	192	0						
CHATTISGARH											
KORBA-II	160	Coal	1,582	995	863	2,237	1,860	1,803	4,039,077	3,358,375	3,255,457
KORBA-III	240	Coal	902	1,010	1,159		As above			Inc. above	
KORBA-WEST	840	Coal	5,442	5,616	5,570	4,053	4,373	4,298	7,318,007	7,895,792	7,760,373
HASDEOBANGO	120	Hydro	382	295	247						
GANGREL	5	Hydro	4	0	0						
KORBA STPS	2,100	Coal	17,049	16,333	16,466	12,388	11,769	11,472	22,367,497	21,249,845	20,713,588
MAHARASHTRA											
NASIK	910	Coal	5,693	5,641	5,386	3,654	3,596	3,465	6,597,581	6,492,858	6,256,327
KORADI	1,080	Coal	6,445	6,255	6,161	4,973	4,625	4,574	8,979,138	8,350,797	8,258,713
K_KHEDA II	840	Coal	6,287	6,000	6,148	4,909	4,464	4,896	8,863,581	8,060,099	8,840,109
PARAS	58	Coal	393	417	298	324	320	227	585,007	577,785	409,866
BHUSAWAL	478	Coal	3,295	3,317	2,591	2,342	2,269	1,800	4,228,663	4,096,856	3,250,040
PARLI	690	Coal	4,895	4,314	4,583	3,314	3,017	3,082	5,983,685	5,447,428	5,564,791

CHANDRAPUR	2,340	Coal	15,923	16,220	15,184	12,234	11,656	10,900	22,089,438	21,045,815	19,680,798
URAN GT	672	Gas	2,667	2,671	2,571				1,313,616	1,315,527	1,266,275
URAN WHP	240	Gas	1,446	1,326	1,327				712,064	653,084	653,577
KOYNA	1,920	Hydro	3,347	3,319	3,393						
VAITARNA	62	Hydro	107	150	128						
TILLARI	60	Hydro	10	64	44						
BHIRA TAIL RACE	80	Hydro	85	84	70						
ELDARI	23	Hydro	7	32	56						
VEER	9	Hydro	40	15	46						
BHATGARH	16	Hydro	34	34	14						
PAITHON	12	Hydro	3	7	1						
BHANDARDHARA	44	Hydro	35	34	33						
PAWANA	10	Hydro	11	10	14						
RADHANAGRI	5	Hydro	9	10	4						
KVASLA(PANSHET)	16	Hydro	37	35	38						
K_VASLA(VARSA)	8	Hydro	25	24	17						
BHATSA	15	Hydro	66	53	64						
KANHER	4	Hydro	8	5	10						
UJJAINI	12	Hydro	25	3	9						
SURYA	6	Hydro	13	7	3						
MANIKDOH	6	Hydro	4	4	4						
DHOM	2	Hydro	7	5	9						
DIMBE	5	Hydro	9	13	16						
WARNA	16	Hydro	64	51	44						
DUDH GANGA	24	Hydro	62	30	15						
DHANU	500	Coal	4,440	4,319	3,899	2,414	2,324	2,171	4,358,665	4,196,163	3,919,909
DHABOL GT	740	Gas	0	0	0						
TROMBAY	1,150	Coal	8,175	7,612	7,931				7,077,084	6,589,583	6,865,736
TROMBAY GT	180	Gas	1,335	1,446	1,152				633,057	685,725	546,303
BHIRA	132	Hydro	337	355	282						
BHIRA PSS	150	Hydro	580	539	565						
BHIVPURI	72	Hydro	236	231	247						
KHOPOLI	72	Hydro	286	222	244						

TARAPUR	320	Nuclear	2,587	2,497	2,544				
GOA									
RELIANCE ENERGY	48	Gas	336	0			165,473	-	-
Net Imports									
From SR			3524	3524	3524		2,643	2,643	2,643
From ER			7542	7542	7542		8,975	8,975	8,975
From NER			471	471	471		170	170	170
TOTAL			177,988	168,670	168,341		188,717,950	177,733,411	177,715,428
OM							1.060	1.054	1.056
Average Simple OM									1.057

The final Simple OM, $EF_{OM,y}$, based on the average of the last three years for which data is available is therefore 1.057 tCO_2/MWh.

In considering the BM we are required to calculate the carbon emissions factor based on an examination of recent capacity additions to the Western 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 186871.54 GWh (http://cea.nic.in/god/opm/Monthly_Generation_Report/18col_05_03.pdf), 20% of which is 37,374.9 GWh. The five most recent plants only account for 2626.1 GWh 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 Western 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. For the plants commissioned during 2005 and early 2006 some of the data is not available on the commissioning date, however given that the determination of the sample size includes all these plants their exact order of commissioning is immaterial to the calculation.

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	Date	Generation, GWh	Emissions, tCO2
KAKRAPARA	220	Sep-95	1,257	0
KUTCH LIG.	75	Mar-97	290	275
TAWA	14	Mar-97	30	0
CHANDRAPUR	500	Oct-97	3,402	4,748
G.I.P.C.L. GT	160	Nov-97	1,184	583
KADANA	60	Feb-98	91	0
MANIKDOH	6	Feb-98	4	0
GANDHI NAGAR	210	Mar-98	1,561	1,799
KADANA	60	May-98	91	0
WARNA	16	Sep-98	64	0

DIMBE	5	Oct-98	9	0
DHABOL GT	480	Oct-98	0	0
WANAKBORI	210	Dec-98	1,318	1,629
GTEC	655	Dec-98	3,633	1,789
DHABOL GT	260	Dec-98	0	0
SURYA	6	Jan-99	13	0
SANJAY GANDHI	210	Feb-99	1,369	1,837
VINDH_CHAL STPS	500	Mar-99	3,943	4,364
BHANDARDHARA	34	May-99	27	0
BHIRA PSS	150	Jun-99	580	0
RELIANCE ENERGY	48	Jul-99	336	165
RAJGHAT (MP)	15	Sep-99	29	0
RAJGHAT (MP)	15	Oct-99	29	0
SURAT LIG	125	Nov-99	903	857
SANJAY GANDHI	210	Nov-99	1,369	1,837
RAJGHAT (MP)	15	Nov-99	29	0
KOYNA	500	Nov-99	872	0
SURAT LIG	125	Jan-00	903	857
VINDH_CHAL STPS	500	Feb-00	3,943	4,364
DUDH GANGA	12	Feb-00	31	0
KOYNA	500	Mar-00	872	0
K_KHEDA II	210	May-00	1,572	2,229
DUDH GANGA	12	Jul-00	31	0
K_KHEDA II	210	Jan-01	1,572	2,229
BANSAGAR (III)	20	Jul-01	26	0
BANSAGAR (III)	20	Aug-01	26	0
HAZIRA CCCP	156.1	Dec-01	1,151	567
BHIVPURI	72	Mar-02	236	0
BANSAGAR (II)	15	Aug-02	33	0
BANSAGAR (II)	15	Sep-02	33	0
BANSAGAR (III)	20	Sep-02	26	0
DHUVARAN CCPP	68	Jun-03	451	222
DHUVARAN CCPP	38	Sep-03	252	124
GANGREL	2.5	Apr-04	2	0
GANGREL	2.5	Jun-04	2	0
S.SAROVAR CHPH	250	Dec-04	150	0
S.SAROVAR RBPH	200	Feb-05	111	0
AKRIMOTA LIG	125	Mar-05	0	0
KORBA-II	40	03.10.03	322.126	526.9337
S Sarovar CHPH	50	23.07.04	41.73	0
Indira Sagar	125	23.07.04	321.6213	0
S Sarovar RBPH	800	01.02.05	1402.288	0
Akrimota Lig	125	31.03.05	84.145	79.85361
Tarapur	540	12.09.05	2332.442	0
Koradi	20	10.04.06	117.4607	164.6095
Paras	4.5	25.11.06	34.53984	51.6716
Bhira	18	-	57.5748	0
Totals			38,569	31,298

BM CEF, tCO2/MWh	0.811466

Source: List of all plants and generation from CEA generation report. Commissioning data from CEA, state electricity boards and NTPC website.
http://cea.nic.in/power_sec_reports/general_review/0405/ch2.pdf

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 0.934 tCO2/MWh.

Calculation of the combined margin

	tCO_2/MWh
Simple OM, $EF_{OM, y}$	1.057
Build margin $EF_{BM, y}$	0.811
Combined margin, EF_y	0.934

Annex 4

MONITORING INFORMATION

This section has been left blank on purpose.

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