CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006

CONTENTS

Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

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Dalmia Sugars Limited Nigohi project
16~~05~~/~~01~~05/2007
Version ~~3~~4

A.2. Description of the project activity:

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The project activity is being undertaken by Dalmia sugars part of Dalmia Cement (Bharat) Limited. The project activity involves the installation of a new power plant that will be installed adjacent to a new sugar factory being established in Uttar Pradesh, India. The power plant will combust mainly bagasse, a renewable biomass material, and the electricity generated will be supplied to the grid.

The project activity will install a high pressure/temperature boiler manufactured by Cethar Vessels, India. The outlet pressure and temperature of the boiler will be 86 kg/cm^2 and 515^{o}C respectively. A 27 MW turbine generator will be installed of double extraction condensing type. The turbine will be supplied by HTC of China. It is planned that a total capacity of 2.25MVA of diesel generator sets will be installed for back-up purposes.

Electricity will be generated at 11 kV and stepped up at the plant to 132 kV to parallel with the grid at this level. It will be supplied to the grid via the 220 kV Shahjahanpur sub-station which is located 18 km from the plant.

The project makes a significant contribution to development as any rurally based industry in India provides an important source of direct employment in the surrounding. Uttar Pradesh, where the plant is located, is one of the most populous states in India with 79.2% of the population located in rural areas[1]. Therefore the provision of direct employment will provide a much needed alternative to those situated in the locality of the plant. The sugar factory is expected to employ around 400 people, with more than 50 of these employed in the power plant, whilst not all of these will be from the local area, where it is possible the factory will employ locally.

The establishment of the factory will also provide farmers a greater choice in their cultivation of crops. The plant is located in a district with 3 existing sugar cane co-operatives which will permit existing farmers alternatives in their supply contracts. The co-operative sugar sector in India is typically inefficient due to the lack of investment in this sector. This arises as the profits of co-operatives are distributed through the cane price and this has resulted in a lack of investable funds for the modernisation and up-gradation of sugar plants in this sector and hence lower cane prices. Dalmia sugars should therefore provide a better return to local farmers as well as diversifying the returns of farmers.

The provision of electricity to the grid through the implementation of the project activity should strengthen the returns of the factory. No longer will the factory just be a manufacturer of sugar but it will also be a power producer and thus higher returns associated with a broadening of its activities should filter back to those supplying the factory through the cane price.

[1] www.censusindia.net

Through the generation and supply of renewable electricity to the grid the project activity will have a direct environmental benefit. The combustion of renewable biomass has long term benefits related to climate change given that the alternative is a fossil fuel based generation system. Local pollution will also be reduced through the combustion of biomass relative to the alternative fossil fuels for the supply of electricity, especially in relation to NOx, SOx and ash which arise in coal based generation (ash content of bagasse is of the order of 3-4% whilst Indian coal typically has an ash content of greater than 35%).

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)	If Party wishes to be considered as a project participant
India (host)	Private entity: Dalmia Cement (Bharat) Ltd	No
UK	Private entity: Agrinergy Ltd	No

The official contact for the project activity will be Dalmia Cement (Bharat) Ltd, contact details as listed in Annex I.

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

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A.4.1.1. Host Party(ies):

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India

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

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Uttar Pradesh

A.4.1.3. City/Town/Community etc:

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Village Areli, Tehsil Tilhar, District Shahjahanpur

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

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The plant is in Tehsil Tilhar, district Shahjahanpur at a distance of 20 km from the district headquarters. The site is situated off the Shahjahanpur-Pilibhit highway near Nigohi. The unit is uniquely identifiable due to being situated in the Dalmia sugar mill located at the same site.

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

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Category 1: Energy industries (renewable - / non - renewable sources)

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

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The technology employed is available in India and in the case of the project activity some of the technology is provided by local suppliers, the turbine generator is however supplied from China.

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

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Year	Annual estimation of emission reductions in tonnes of CO_2e
Year 2007	73,914
Year 2008	73,914
Year 2009	73,914
Year 2010	73,914
Year 2011	73,914
Year 2012	73,914
Year 2013	73,914
Year 2014	73,914
Year 2015	73,914
Year 2016	73,914
Total estimated reductions (tonnes CO_2e)	739,143
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	73,914

A.4.5. Public funding of the project activity:

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The project has not received any public funding.

SECTION B. Application of a baseline and monitoring methodology

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

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The project activity follows the following methodology:
Version 04 of ACM0006

In line with the application of the methodology the project draws on element of the following tools and methodologies:
Version 02 of the tool for the demonstration and assessment of additionality
Version 06 of ACM0002

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

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The project activity takes place at a site where currently no power generation occurs (greenfield power project). All the biomass used at the site qualifies under the definition of biomass residues as outlined in the methodology, i.e. the biomass residue is a by-product of agricultural activities and no other types of biomass will be used. In the case of the project the biomass residue will be bagasse, which is generated from the crushing of sugar cane and some supplementary rice husk depending on its cost of collection.

The implementation of the project does not result in an increase in the processing capacity of the raw input or any other changes in the sugar manufacturing process. The installation of the power plant is not a driver in the decision to establish the capacity of the sugar factory.

The biomass residue used by the project will not be stored for more than one year. The excess bagasse generated by the sugar plant will be stored during the crushing season to be used at the end of the season. However the season will be less than 180 days and storage will not be for longer periods as the alternative biomass (rice husk) will have a direct financial cost and therefore the incentive is to use all the own biomass residue first[2]. Purchased biomass residue (rice husk) will be delivered on a just in time basis but may be held across the period when the power plant is not operating (annual maintenance period) to be used as start up fuel for the next season, this would however only entail a storage of a maximum of 110 days. Therefore we can conclude that the biomass residue will not be stored for a period of more than one year.

The biomass residue is not prepared prior to its use in the boilers, the bagasse is transferred from the crushing process directly to the boiler or to the storage yard, from the storage yard the bagasse is returned to the boiler without any material change. The other biomass residue used, mainly rice husk, will not be processed prior to its use in the boiler.

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

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	Source	Gas	Included?	Justification/Explanation

[2] The bagasse generated has an opportunity cost but not a direct impact on cashflow.

Baseline	Grid electricity generation	CO_2	Yes	Main emission source
	Heat generation	CO_2	No	No emission reductions are claimed for heat generated by the project activity as under the baseline the same quantity of heat would be generated during the sugar crushing season
	Uncontrolled burning or decay of Surplus biomass.	CH_4	No	Emissions from uncontrolled burning or decay of biomass are not included in the application of the methodology to the particular baseline scenario identified and therefore these sources are therefore not accounted for in project activity emissions.
Project activity	On-site fossil fuel consumption due to the project activity	CO_2	No	No fossil fuel will be consumed at the project site
	Off-site transportation of biomass	CO_2	Yes	All biomass will be utilized from the sugar mill situated next to the project activity
	Combustion of biomass for electricity and/or heat generation	CH_4	No	If the baseline accounts for emissions from these sources then they must be accounted for in project activity emissions, we have not accounted for these in the baseline and therefore exclude them from the analysis of project activity sources.

The project boundary includes the equipment installed for the operation of the new 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 Northern regional grid. The boundary will also extend to the area where biomass is collected.

Fly ash is analysed in the context of the project boundary but it will be mainly used in composting at the plant site and disposed of in low lying areas in line with consents from local bodies. The point to note is that in the baseline scenario a far greater quantity of fly ash would be generated as Indian coal[3] has a much higher ash percentage than bagasse and this would have to be transported to the disposal site. The transport of bagasse to the boiler is via conveyor but this is a normal practise in any sugar mill and the boilers in the project activity are located within the sugar factory.

As the boundary for the determination of the grid carbon emission factor in India is not clearly defined we follow the guidance in the methodology, ACM0002. The DNA has to date not issued guidance on the delineation of grid boundaries and we therefore follow the guidance for the layered despatch systems and adopt a regional grid. The Indian electricity system is split into five regional grids, North, South, East, West and North East. The project activity falls under the Northern grid.

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

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The determination of the baseline scenario requires us to consider the most conservative baselines for the generation of power, the generation of heat and the use of biomass.

[3] http://www.coal.nic.in/

There are six power baselines detailed in the methodology, namely:

P1 The proposed project activity not undertaken as a CDM

P2 The proposed project activity (installation of a power plant), fired with the same type of biomass residues but with a lower efficiency of electrical generation (e.g. an efficiency that is common practice in the relevant industry sector)

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

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

P5 The continuation of power generation in an existing power plant, fired with the same type of biomass residues as (co-)fired in the project activity, and implementation of the project activity, not undertaken as a CDM project activity, at the end of the lifetime of the existing plant

P6 The continuation of power generation in an existing power plant, fired with the same type of biomass residues as (co-)fired in the project activity and, at the end of the lifetime of the existing plant, replacement of that plant by a similar new plant

Of the outlined baselines P5 and P6 may be ruled out as the new power plant is not a replacement for existing power generating units and is an addition to the capacity of power plants generating electricity from bagasse. P3 may be ruled out as setting up a similar sized fossil fuel power plant to supply to the grid is not feasible given the scale of the plant nor is it part of the core business of the company. P1 is not a credible baseline scenario as without the registration of the project as a CDM it would not occur, as demonstrated in section B5. P2 is a credible baseline as it would be possible for the plant to install a lower efficiency system and this would likely entail a back pressure system and a pressure reducing station (PRDS), using just bagasse as a fuel. P4 is also a credible baseline – the generation of power in existing and/or new grid connected plants – as the power from the project activity will be fed into the grid and is thus expected to displace power from existing and planned capacity additions of the grid.

Heat baselines

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

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

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

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

H5 The continuation of heat generation in an existing power plant, fired with the same type of biomass residues as in the project activity, and implementation of the project activity, not undertaken as a CDM project activity, at the end of the lifetime of the existing plant

H6 The generation of heat in boilers using fossil fuels

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

H8 Other heat generation technologies (e.g. heat pumps or solar energy)

As the project is a cogeneration plant we are required to establish the baseline for heat generation even though no emission reductions will be claimed by the project activity for the heat component. The project activity will generate low pressure process steam (heat) for the adjoining sugar plant. As the project is located next to a sugar factory we can rule out H3, H6, H7 and H8. H1 is not a credible baseline scenario as without the registration of the project as a CDM it would not occur, as demonstrated in section B5. H5 is not a credible baseline as the project takes place in a new plant where no existing generation takes place. We are therefore left with H2 and H4 as plausible baseline options. H2 is a realistic representation of the baseline situation when bagasse is being combusted as the normal practise is for sugar factories to generate process steam from the combustion of bagasse.

Biomass baselines

B1 The biomass residues are dumped or left to decay under mainly aerobic conditions. This applies, for example, to dumping and decay of biomass residues on fields.

B2 The biomass residues are dumped or left to decay under clearly anaerobic conditions. This applies, for example, to deep landfills with more than 5 meters. This does not apply to biomass residues that are stock-piled or left to decay on fields.

B3 The biomass residues are burnt in an uncontrolled manner without utilising it for energy purposes.

B4 The biomass residues are used for heat and/or electricity generation at the project site.

B5 The biomass residues are used for power generation, including cogeneration, in other existing or new grid connected power plants.

B6 The biomass residues are used for heat generation in other existing or new boilers at other sites.

B7 The biomass residues are used for other energy purposes, such as the generation of biofuels.

B8 The biomass residues are used for non-energy purposes, e.g. as fertilizer or as feedstock in processes.

From the alternatives listed above we can rule out B1, B2, B3, B5, B6, B7 and B8 as the biomass residue in the baseline scenario would be used by the sugar factory to generate power and heat. Therefore we are limited to B4, that the biomass residue would be used for heat and/or electricity generation at the project site. In terms of the other biomass residue (rice husk) used by the project activity it is likely that in the baseline scenario it will be collected from surpluses in the surrounding area and used for electricity generation at the project site. The baseline scenario that best describes this situation is therefore B1 and B4

From the above analysis the baseline that relates to bagasse is scenario 4 – P2 and P4, H2 and B4 and the baseline scenario that related to the other biomass is scenario 3 – P4 and B1/B4.

The baseline scenario is therefore that a new power plant would be established to provide electricity and steam to the adjacent sugar factory. The bagasse generated would be combusted in a less efficient manner to provide enough power for the operation of the sugar factory and the rice husk would be left to decay naturally.

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality): >>

That the project is not part of the baseline is demonstrated using the Tool for the demonstration and assessment of additionality, version 2, 28th November 2005.

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

As the project activity is not starting before registration the completion of step 0 is not required.

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

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

The alternatives to the project have been established in section B2 which may be summarised as:

- The proposed project activity not undertaken as a CDM project activity
- The installation of a lower efficiency plant

The proposed project activity not undertaken as a CDM is straightforward. The installation of a lower efficiency plant is a credible alternative. The project activity employs high pressure boilers which are not common practise in the sector and typically in the case of new plants lower pressure systems coupled with pressure reducing stations would be chosen. This is the case in other new plants in Uttar Pradesh. Other options that could supply comparable outputs to the project activity are restricted to investments in steam and electricity generation capacity. With the exception of the project activity, these are likely to be fossil fuel based systems and Dalmia is primarily a sugar company not a power company so such investments are not therefore considered plausible.

Sub-step 1b
Compliance with applicable laws and regulations.

The above alternatives are all in compliance with applicable legal and regulatory requirements. Moreover, there is no foreseeable regulatory change that would make the above alternatives non-compliant.

Step 2. Investment Analysis.

Barrier analysis of the project has been undertaken.

Step 3 Barrier analysis
Sub-step 3a
The institutional framework (specifically the electricity off-take agreement) has traditionally been the factor that has stopped the development of such projects in Uttar Pradesh – before 2004 no similar projects were implemented in Uttar Pradesh. Although the Electricity Act, 2003 brought some liberalisation to the electricity sector, its full implementation has been delayed and some of the more free market elements envisaged in the legislation have not been implemented or are not applicable to the project (the project activity will not wheel or bank power). In essence the risks prior to the passing into law of the Electricity Act, 2003 remain. A feature of the market that has changed is a more functioning state electricity regulatory commission but this was introduced in Uttar Pradesh in 2000 through the Electricity Regulatory Commissions Act, 1998. The main feature of the market that has changed since 2004 is the introduction of a carbon market and all similar projects in the state have been proposed as CDMs as demonstrated in the common practise section.

Under the terms of the power purchase agreement (PPA) granted to the project activity there remains uncertainty in the tariff, the tariff may be reviewed post 2009 as there is no specified rate beyond the 2009-10 season. This provides considerable uncertainty to the project developer as to future rates in force. The actual tariff in the first year for the project activity will be Rs 2.98/kWh which is far below the earlier Ministry of Non-Conventional Energy Sources (MNES)[4]. The MNES advised a tariff of Rs 2.25

[4] http://mnes.nic.in/frame.htm?majorprog.htm

in 1994-95 escalated at a rate of 5%, which currently equates to a tariff of Rs 3.60/kWh, whilst this was not implemented by states it does provide an unbiased example of the expectation of tariffs from the central government. The current tariff has been issued as a Tariff Order by the Uttar Pradesh Electricity Regulatory Commission and the discussions surrounding its issuance indicate the significant differences between the promoters of such projects and UPPCL[5]. Furthermore the realised tariff in Uttar Pradesh is low in comparison to other states[6]. The registration of the project as a CDM will "increase" the tariff by Rs 0.5/kWh and therefore provides a significant additional revenue stream that brings it up to more realistic levels considering the risks in the project and the uncertainty going forward.

Probably the most significant barrier to the project activity is the availability of bagasse. The project activity takes place next to a new sugar factory and the power plant is dependent on the sugar factory for its supply of bagasse. The first few years of establishing a sugar factory requires a great deal of extension work to develop the cane area therefore installing such a large scale power plant in a new factory poses a real risk related to the throughput of cane and this is in evidence from the other new sugar factories established in the state where there has been no such investment (the project is therefore "first of its kind" in this regard). In Uttar Pradesh there is a large concentration of sugar factories and therefore it could be argued that this risk is minimised by the supply of bagasse from other plants. However given the variability in cane crops and the diversion of cane to gur and khandsari the bagasse prices have been rising to a level where it is uneconomic to purchase for power generation[7].

The project does expect to collect surplus biomass from the surrounding region but this will require investment in collection systems and is seen as supplementary to the main fuel source bagasse. Any reduction in the supply of cane will reduce the plant load factor of the power plant and therefore in order to minimise this risk the additional CER revenue stream will be of importance. At current prices the carbon credit revenue stream will provide over Rs 0.5/kWh. This equates to 18% of the total price paid for electricity generation and will thus aid the project in overcoming this significant barrier.

Furthermore Dalmia has no experience in the installation and operation of high pressure (80 plus bar) boilers. Indeed in the whole of the Indian sugar industry only a small number of such high pressure boilers have been commissioned out of the total 111 mills in Uttar Pradesh[8]. The major complexity in the design of cogeneration systems with high pressure boilers is water treatment for the "make up" water – the use of a high pressure boiler at the project activity has therefore necessitated significant additional expenditure on the water treatment plant and the training of personnel to operate such plants. A feature of the grid that requires extra training is the grid instability – the project activity has undertaken as survey of grid instability and from its estimates from the Sidholi substation there is likely to be 10% downtime due to tripping.

Sub-step 3b

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[5] http://www.uperc.org/

[6] Maharashtra Electricity Regulatory Commission, Page 2, http://mercindia.org.in/pdf/Biomass%20Order-8.8.05.zip

Tamil Nadu Electricity Regulatory Commission, Page 29, http://tnerc.tn.nic.in/orders/nces%20order%20-approved%20order%20host%20copy.pdf

[7] During the last season, 2004/05, bagasse prices rose to over Rs 1,000/tonne ex factory.

[8] In UP only 3 such systems have been commissioned, two by Balrampur and one by Triveni, all of which have been proposed as CDM projects.

In summary it can be seen that there are significant barriers to the development of project activity. In some cases these are sector specific and the section on common practice indicates the measures other plants have taken to combat these barriers.

The barriers highlighted above are broadly categorised as those affecting the sales price of electricity and the fuel supply to the project activity. In the case of a low pressure system the barrier on the sales price of electricity does not have an impact as there would not be any export of electricity to the grid – a low pressure system would be designed purely to satisfy the captive power requirements of the adjacent sugar factory. In terms of the fuel supply risk this would also not be a factor as the power plant would only generate enough power (steam and electricity) for the use of the adjacent sugar factory and therefore be only required to operate when the adjacent sugar factory is crushing cane. As the crushing of cane in the sugar factory generates enough biomass (bagasse) to generate captive power (steam and electricity) there is no risk on fuel supply for such project types.

The identified barriers affect all similar types of plants and therefore the policy of similar plants has been to adopt cogeneration for their own captive consumption. This is true of existing as well as new plants[9].

Step 4. Common practice analysis

Sub-step 4a

The following table lists out the recently completed new sugar plants and whether these export to the grid. This demonstrates that all the plants that plan to export to the grid have been submitted as potential CDMs (and which are therefore excluded from the common practice analysis), all other new plants are not installing grid export at the point in time when the sugar factory was commissioned.

Plant	Year	Power export	CDM project
Mankapur (BCML)	2006-07	Yes	Yes, UN validation website 2 Feb – 3 Mar 2007
Barkhera (Bajaj)	2006-07	Yes	Yes, UN validation website 23 Sep – 22 Oct 2006
Khambakhera (Bajaj)	2006-07	Yes	Yes, UN validation website 23 Sep – 22 Oct 2006
Gagnoli (Bajaj)	2006-07	Yes	Yes, UN validation website 23 Sep – 22 Oct 2006
Dalmia Jawaharpur	2006-07	Yes	Yes, UN validation website (3 Aug – 1 Sep 2006)
M/s Dwarikesh Sugar Distt., Bareilly	2006-07 (Delayed)	Yes but expected in second year of operation	Yes, UN validation website (29 Sep – 28 Oct 2006)
Chandanpur (Triveni)	2006-07	No	
Milak Narainpur (Triveni)	2006-07	No	
Rani Nangal (Triveni)	2006-07	No	
Loni (DSCL)	2006-07	Yes but expected in second year of operation	Will be proposed as CDM[10]

[9] New plants in UP were commissioned by Bajaj Hinusthan in 2005/06 which did not have grid based cogeneration.

[10] Loni and Hariyawan are being developed by Agrinergy and DSCL jointly, copies of draft PDDs have been provided to demonstrate this.

Hariyawan (DSCL)	2006-07	Yes but expected in second year of operation	Will be proposed as CDM
Rajpura (DSM)	2006-07	No	
Khai Kheri (Uttam)	2006-07	No	
Nakhaur (Uttam)	2006-07	No	
Belwara (Rana)	2006-07	No	
Amirkhan Ka Majara (Rana)	2006-07	No	

In the state of Uttar Pradesh there are 111 sugar factories, 16 of which export electricity to the grid[11]. However of the 16 units 12 have capacities of less than 15 MW, the smallest being 1.8 MW at Monnet and the largest of 12 MW. Of the four plants of a similar scale, three are part of the Balrampur Chini group that has been active in pursuing CDM status for their projects and the fourth is part of Triveni which has also proposed the project as a CDM. It can therefore be concluded that the project under consideration is not common practice in Uttar Pradesh[12].

More generally the project should not be considered as common practise in India. In India the latest data available on bagasse cogeneration from The Sugar Technologists' Association of India lists 24 mills with bagasse cogeneration capacities greater than 15 MW. Considering that there are 517 sugar mills in India the uptake of cogeneration on a similar scale, over 15 MW, represents only 4.6% penetration of the potential in terms of the number of sugar mills employing such systems[13].

Sub-step 4b
As demonstrated earlier there is no evidence of any similar project being undertaken without the benefit of CDM.

Step 5. Impact of CDM registration.

CDM registration and the resulting revenue from CER sales helps the project to overcome the barriers outlined above, most notably the PPA risk and fuel supply risk. The impact of CER revenue improves the returns associated with undertaking the project and will act as an important buffer against these barriers.

The consideration of the incentive from the CDM did take place before the starting date of the project activity, 14th December 2005. The project report which was commissioned as part of the internal project appraisal process contained a section on the benefits that the CDM would offer to the project. Furthermore evidence of discussions on contractual arrangements for the development of Dalmia projects as CDMs were entered into in August 2005 and a final contract was concluded in January 2006, these evidences have be made available to the DOE responsible for validation.

[11] "List of Cane Sugar Factories and Distilleries, Season 2004-05", Published by The Sugar Technologists' Association of India, New Delhi.

[12] One Dhampur plant that was bought by Balrampur Chini Mills recently has a 30MW turbine generator, however this was installed in an existing plant and was also purchased second hand from a coal fired plant and converted to operate on bagasse.

[13] "List of Cane Sugar Factories and Distilleries, Season 2004-05", Published by The Sugar Technologists' Association of India, New Delhi. It should be further highlighted that five states account for this entire capacity and that five of the six plants in Tamil Nadu operate on fossil fuels.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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The application of the baseline methodology results in scenario 4 in relation to bagasse and scenario 3 in relation to other biomass residues. This requires the calculation of baseline emission associated with the electricity generation, the generation of heat and the usage of biomass. Broadly the emission reductions from the project are calculated from the application of the following equation:

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

In terms of emission reductions due to heat generation we do not claim for these in the case of the project activity but are required to show that emissions do not arise from the combustion of more biomass. In line with the methodology this may be shown by demonstrating that the efficiency of heat generation in the project is larger than the baseline scenario and assume $ER_{heat,y} = 0$, i.e.:

$$\varepsilon_{th,projectplant} > \varepsilon_{th,referenceplant}$$

In order to show this we have calculated the heat generated per unit of biomass in the project activity and shown that this is greater than or equal to the heat generated per unit of biomass in the baseline. This may be demonstrated on the basis of the specification of the boilers (operating temperatures and pressures) and the enthalpies.

Consideration of heat emissions

Baseline configuration, 45kg/cm², 410°C			***Project configuration, 87kg/cm², 515°C***		
Capacity	kg/hr	1	Capacity	kg/hr	1
Enthalpy out	Kcal	783	Enthalpy out	kCal	819
Enthalpy in	Kcal	105	Enthalpy in	kCal	183
NCV of fuel	kCal/kg	1,813	NCV of fuel	kCal/kg	1,813
Efficiency	%	60%	Efficiency	%	70%
Bagasse	kg/hr	0.623	Bagasse	kg/hr	0.5011
Steam/bagasse	mt/mt	1.604	Steam/bagasse	mt/mt	1.995

The net calorific value of bagasse is taken from E Hugot, Handbook of cane sugar engineering, 3rd edition, page 922 equation 41.20[14]. The above table therefore highlights that the project has a higher thermal efficiency than the baseline and therefore that $ER_{heat,\,y} = 0$.

In terms of baseline emissions, the main source in the project activity is through the generation of electricity. The calculation of these emissions are provided by the following equations.

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

[14] The net calorific value is given by: *NCV= 4,250-12s-48.5w*, where *s* is the % of sugar in bagasse and *w* is the % of moisture in bagasse. For the above calculation we have assume *s* = 1% and *w* = 50%.

For scenario 3 EG_y corresponds to the net quantity of electricity in the project plant ($EG_y = EG_{project\ plant,y}$).

And in line with scenario 4 EG_y is determined from:

$$EG_y = EG_{projectplant,y} - \varepsilon_{el,otherplant} \cdot \frac{1}{3.6} \sum_k BF_{k,y}.NCV_k$$

Where:

EG_y	is the net quantity of increased electricity generation as a result of the project activity (incremental to baseline generation) during the year y in MWh
$EG_{project\ plant,\ y}$	is the net quantity of electricity generated in the project plant during the year y in MWh
$\varepsilon_{el,\ other\ plants(s)}$	is the average net energy efficiency of electricity generation in (the) other power plant(s) that would use the biomass residues fired in the project plant in the absence of the project activity, expressed in $MWh_{el}/MWh_{biomass}$
$BF_{k,\ y}$	is the quantity of biomass type k used fuel in the project plant during the year y in tons of dry matter
NCV_k	is the net calorific value of the biomass type k (GJ/ton of dry matter)

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.

In terms of baseline emission arising from the natural decay or uncontrolled burning of biomass we do not claim for these under scenario 4 as the biomass would be combusted in the baseline scenario, therefore as set out in the methodology for scenario 4 $BE_{biomass,\ y} = 0$. For scenario 3 we have a choice as to whether to include these or not, we have chosen not to include these (in line with this choice we do not account for emissions from the combustion of biomass in the project emissions).

The project emissions arising from the project activity are limited to four sources; combustion of fossil fuels for the transport of biomass to the site, on-site consumption of fossil fuels, emissions due to the electricity consumption in the project activity and methane emissions from the combustion of biomass. As some biomass may be taken from outside sources we have to consider the emissions arising from the transportation of biomass. The project activity does not plan to co-fire any fossil fuels in the boiler and during slow firing of the boiler at start-up this will be carried out solely on biomass, therefore emissions from these sources are not included. In terms of electricity consumption arising as a result of the project activity this is not included as the only consumption will be from the auxiliaries which already accounted for in the baseline calculation. Lastly, as we do not seek to claim baseline emissions from the decay of biomass we are not required to account for the methane emissions from the combustion of biomass.

In determining the project emissions that arise from transport there is a choice of two approaches, we have outlined both for the sake of completeness.

Option 1

$$PET_y = N_y.AVD_y.EF_{km,CO2}$$

Option 2

$$PET_y = \sum_i F_{Trans,i,y}.COEF_{CO2,i}$$

The last area of analysis required in the determination of the emission reductions is leakage, in line with the methodology leakage is not considered for scenario 4, as the diversion of biomass to the project activity is already considered in the calculation of the baseline reductions but we account for leakage under scenario 3 for the biomass residue, rice husk.

It is required to demonstrate that the use of rice husk as a fuel does not result in increased fossil fuel consumption elsewhere. To date there is no updated and official report on biomass availability in India. The Ministry of Non-conventional energy resources (MNES) is in the final stages of preparation of a report but it has not yet been published. Until the time official data on biomass availability is available, we assume leakage based on the assumption that 30% of rice husk gives rise to leakage for the purposes of providing conservative calculations but the monitoring of leakage will take place annually in line with the guidance in the methodology.

Therefore, in line with the methodology, the leakage is calculated using the following equation:

$$L_y = EF_{CO2,LE} .\sum_k BF_{PJ,k,y} .NCV_k$$

Where:

Ly	Leakage emissions during the year y (tCO_2/yr)
$EF_{CO2,LE}$	CO_2 emission factor of the most carbon intensive fuel used in the country (tCO_2/GJ)
$BF_{PJ,k,y}$	Incremental quantity of biomass residue type k used as a result of the project activity in the project plant during the year y (tons of dry matter or litre)
k	Types of biomass residues for which leakage effects could not be ruled out with one of the approaches L_1, L_2, or L_3
NCV_k	Net calorific value of the biomass residue type k (GJ/ton of dry matter)

In light of the analysis above the equation to calculate the emission reductions may be simplified to:

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

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

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	For thermal power plants the CEA provides coal consumption data for each

choice of data or description of measurement methods and procedures actually applied :	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
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
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

Data / Parameter:	**$\varepsilon_{el,otherplant}$**
Data unit:	$MWh_{el}/MWh_{biomass}$
Description:	Average net efficiency of electricity in the baseline plant
Source of data used:	Calculated from consumption of biomass and electricity generation in the baseline plant

Value applied:	0.039
Justification of the choice of data or description of measurement methods and procedures actually applied :	The calculation of the $MWh_{el}/MWh_{biomass}$ is carried on the basis of industry norms for the operation of a sugar factory. The operating parameters for steam consumption per tonne of cane and electrical consumption per tonnes of cane have been taken as 48% and 28kWh/mt respectively.
Any comment:	Full data set provided in Annex 3

Data / Parameter:	$\mathbf{EF_{km,CO2}}$
Data unit:	tCO_2/km
Description:	Emissions factor for transport of biomass
Source of data used:	Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual Table 1-32
Value applied:	0.001108
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data from the plausible options in Table 1-32 has been chosen most conservatively, i.e. we have chosen data that results in the highest emission factor which will result in the largest transport emissions.
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

>>

For the purposes of determining the emission reductions for the project activity we apply the following equation:

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

As outlined in section B6.1 this may be simplified to:

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

Where:

ER_y	are the emission reductions of the project activity during the year y in tons of CO_2
$ER_{electricity,\ y}$	are the emission reductions due to the displacement of electricity during the year y in tons of CO_2
PE_y	are the project emissions during the year y in tons of CO_2
Ly	Leakage emissions during the year y (tCO_2/yr)

In order to calculate the baseline emissions we apply the following equations.

$$EG_y = EG_{projectplant,y} - \varepsilon_{el,otherplant} \cdot \frac{1}{3.6} \sum_k BF_{k,y}.NCV_k$$

The above equation covers both scenarios 3 and 4, as for scenario 3 EG_y corresponds to the net quantity of electricity in the project plant ($EG_y = EG_{project\ plant,y}$) and is therefore incorporated explicitly in the equation above.

$EG_{projectplant,y}$ is estimated at 126,187 MWh. The determination of $\varepsilon_{el,projectplant(s)}$ is set out in Annex 3, this is equal to 0.039. The total biomass used under scenario 4 is estimated at 177,000 tonnes and the bagasse has a calorific value of 17.731GJ/ton. Therefore EG_y = 92,604 MWh.

The emission reduction due to electricity generation are the product of EG_y determined above and the grid based emission factor, EF_y, as set out in ACM0002.

$$ER_{electricity} = EG_y \cdot EF_y$$

Where:

$ER_{eletricity,\ y}$	are the emission reductions relating to the electricity generation from the project activity tCO_2e
EG_y	is the net quantity of increased electricity generation as a result of the project activity (incremental to baseline generation) during the year y in MWh
EF_y	is the grid based emission factor, determined through the combined margin approach as set out in ACM0002 tCO_2e/MWh

EF_y has been set at 0.914 tCO_2e/MWh as shown in Annex 3 and combining this with EG_y (92,604 MWh) gives $ER_{electricity,\ y}$ = 84,640 tCO_2e

Project emissions relate to the transport of biomass to the plant. In the initial years of operation some biomass may be combusted from outside sources but as the cane area develops this source will be reduced and it is expected that once the sugar factory has stabilised this will be zero. We provide an estimate of initial consumption of biomass as 30,000 tonnes and assume that this will be procured from a radius of 50km from the plant, with each truck carrying a load of 10 tonnes, therefore the number of trips will be 3,000, the average return distance will be 100km and a CO2 emission factor of 0.001108 tCO_2/km will be applied.

Therefore from:

$$PET_y = N_y.AVD_y.EF_{km,CO2}$$

PET_y = 332 tCO_2e

For the calculation of leakage the $EF_{CO2,LE}$ for coal has been taken as 0.0958 tCO2/GJ from India's National Communication to UNFCCC.
$BF_{PJ,k,y}$ is the dry weight of 30% of the rice husk imported taking into account of the moisture is 13,500 ton.
NCV_k for dry rice husk is 13.392 GJ/ton.

Therefore, in line with the methodology, the leakage is calculated using the following equation:

$$L_y = EF_{CO2,LE} \cdot \sum_k BF_{PJ,k,y} \cdot NCV_k$$

Hence, L_y = 10,393 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	332	84,640	10,393	73,914
Year 2008	332	84,640	10,393	73,914
Year 2009	332	84,640	10,393	73,914
Year 2010	332	84,640	10,393	73,914
Year 2011	332	84,640	10,393	73,914
Year 2012	332	84,640	10,393	73,914
Year 2013	332	84,640	10,393	73,914
Year 2014	332	84,640	10,393	73,914
Year 2015	332	84,640	10,393	73,914
Year 2016	332	84,640	10,393	73,914
Total tonnes of CO_2e	3,324	846,397	103,930	739,143

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

B.7.1 Data and parameters monitored:

Data / Parameter:	**$EG_{Projectplant, y}$**
Data unit:	MWh
Description:	Net electrical energy generated by the project activity
Source of data to be used:	Plant records
Value of data applied for the purpose of calculating expected emission reductions in section B.5	126,187
Description of measurement methods and procedures to be applied:	The project activity will install a DCS system which will permit continuous monitoring and measurement. Hourly recordings of data will be taken from energy meters located at the project activity site. This data will be recorded hourly by the Switch Board attendant and entered into logbooks on site. This hourly data will be signed off at the end of every shift by an engineer in charge of the shift and again at the end of each day and signed off by the power plant manager. The data will be kept for the later of, two years after the end of the crediting period or the last issuance of CERs for the project activity. 100% of the data will be monitored.
QA/QC procedures to	This may be cross checked from the quantity of biomass fired in the boiler using

be applied:	energy balance.
Any comment:	No electricity is imported from the grid and therefore the use of net generation, power plant generation less consumption by auxiliaries will be used to provide this data.

Data / Parameter:	**$BF_{k,y}$**
Data unit:	T
Description:	Quantity of biomass residue(bagasse) used at the project activity site
Source of data to be used:	Plant records
Value of data applied for the purpose of calculating expected emission reductions in section B.5	177,000
Description of measurement methods and procedures to be applied:	A belt weigher will be installed to measure the quantity of bagasse. Recordings from this meter will be taken daily. These readings will then be adjusted to a dry weight basis through sample of bagasse tested in the laboratory on-site. The data will be kept for the later of, two years after the end of the crediting period or the last issuance of CERs for the project activity. 100% of the data will be monitored.
QA/QC procedures to be applied:	For the biomass consumed from the adjacent sugar plant the quantity of biomass will be calculated from the measured quantity of cane. In the manufacture of sugar water is added to cane during the crushing process after which bagasse is produced along with mixed juice. The mixed juice, added water and cane are all measured and therefore the quantity of bagasse generated in the plant can be measured. The biomass combusted in the boilers may be further cross checked through an energy balance undertaken each year for the project activity.
Any comment:	For bagasse

Data / Parameter:	**NCV_k**
Data unit:	GJ/ton
Description:	Net calorific value of biomass residue type *k*
Source of data to be used:	Laboratory Measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	17.731 for bagasse 13.392 for rice husk
Description of measurement methods and procedures to be applied:	The calorific value of bagasse is provided by the sucrose content and the moisture content of the bagasse. These parameters are measured for the bagasse and the following equation applied: NCV = 4250-12s-48.5w where s is the % sugar content and w is the % moisture content, which yields a NCV in kCal/kg. The kCal/kg may be simply converted to GJ/t. This equation is provided from The Handbook of Sugar Cane Engineering, 3rd Edition, E Hugot, page 922, equation 41.20. The measurement of the NCV of biomass residues used will be undertaken by the

	laboratory located at the plant and the Chief Chemist will be responsible for reporting this data. The measurement of the NCV of rice husk is required for the determination of leakage emissions. The data will be kept for the later of, two years after the end of the crediting period or the last issuance of CERs for the project activity.
QA/QC procedures to be applied:	This may be checked against other local or national values and if these are not available from IPCC default values.
Any comment:	The PDD has two terms for NCV_k, one as detailed above and the other for rice husk which is detailed below.

Data / Parameter:	**N_y**
Data unit:	Integer
Description:	Number of trips undertaken to transport biomass to the project site
Source of data to be used:	Transporter receipts
Value of data applied for the purpose of calculating expected emission reductions in section B.5	3,000
Description of measurement methods and procedures to be applied:	Each truck that enters the site will be recorded at the weighbridge from which the number of trucks and will be established. The data will be kept for the later of, two years after the end of the crediting period or the last issuance of CERs for the project activity. 100% of the data will be monitored.
QA/QC procedures to be applied:	Procedures to cross check this with financial statements may be provided.
Any comment:	

Data / Parameter:	**AVD_y**
Data unit:	Km
Description:	Average return distance
Source of data to be used:	Transporter receipts
Value of data applied for the purpose of calculating expected emission reductions in section B.5	100
Description of measurement methods and procedures to be applied:	The average return distance will be recorded for each truck on entry to the site. The data will be kept for the later of, two years after the end of the crediting period or the last issuance of CERs for the project activity. 100% of the data will be monitored.
QA/QC procedures to be applied:	This data may be cross checked with payments for transportation of the material.
Any comment:	

Data / Parameter:	**$EF_{CO2,LE}$**
Data unit:	tCO_2/GJ
Description:	CO_2 emission coefficient for most intensive fuel
Source of data to be used:	CEA and IPCC
Value of data applied for the purpose of calculating expected emission reductions in section B.5	The value of the data will be determined annually if leakage has to be applied ex-post.
Description of measurement methods and procedures to be applied:	The calculation will be made on the basis of fuel consumption and electricity generation undertaken for each plant operating in the Northern regional grid. The data will be kept for the later of, two years after the end of the crediting period or the last issuance of CERs for the project activity. 100% of the data will be monitored.
QA/QC procedures to be applied:	Check consistency with IPCC default values
Any comment:	For the calculation of Leakage

~~**Data / Parameter:**~~	~~**NCV_k**~~
~~Data unit:~~	~~GJ/ton~~
~~Description:~~	~~Net calorific value of rice husk for leakage estimation~~
~~Source of data to be used:~~	~~Measurement or local record.~~
~~Value of data applied for the purpose of calculating expected emission reductions in section B.5~~	~~13.392~~
~~Description of measurement methods and procedures to be applied:~~	~~If measurement is chosen samples of rice husk will be taken and tested in a laboratory.~~ ~~The data will be kept for the later of, two years after the end of the crediting period or the last issuance of CERs for the project activity.~~
~~QA/QC procedures to be applied:~~	~~The values will be checked against IPCC standard values and if the latter are more conservative they will be used.~~
~~Any comment:~~	~~For rice husk used~~

Data / Parameter:	**$BF_{PJ,k,y}$**
Data unit:	tons –dry weight
Description:	Quantity of rice husk used at the project activity site for leakage estimation
Source of data to be used:	Plant records
Value of data applied for the purpose of calculating expected emission reductions in section B.5	8,100
Description of	The quantity of biomass will be measured from the weighbridge receipts for

measurement methods and procedures to be applied:	biomass that is brought in from outside the plant. The weighbridge will be calibrated annually by an outside independent third party. The data will be adjusted to a dry weight basis. The data will be kept for the later of, two years after the end of the crediting period or the last issuance of CERs for the project activity. 100% of the data will be monitored.
QA/QC procedures to be applied:	The biomass combusted in the boilers will be cross checked through an energy balance undertaken each year for the project activity.
Any comment:	For rice husk

Data / Parameter:	**Moisture content of biomass residues**
Data unit:	% water content
Description:	Moisture content of each biomass residue k
Source of data to be used:	On-site measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	It has been assumed that the biomass residues used do not give rise to leakage and therefore this value has not been set out in section B5.
Description of measurement methods and procedures to be applied:	Samples of the biomass residues will be weighed before and after drying to determine the moisture content. This will be carried out by the laboratory on-site.
QA/QC procedures to be applied:	Left blank on purpose
Any comment:	For rice husk, data will be held for a period of 2 years after the end of the crediting period.

Data / Parameter:	**-**
Data unit:	-
Description:	Demonstration that the biomass residue type k from a specific source would continue not to be collected or utilised e.g. by an assessment whether a market has emerged for that type of biomass residue or by showing that it would still not be feasible to utilise the biomass residues for any purposes.
Source of data to be used:	Information by the site where the biomass is generated.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	This will be monitored ex-post
Description of measurement methods and procedures to be applied:	Monitored annually
QA/QC procedures to be applied:	-

Any comment:	Used for approach L_1 of leakage test.

Data / Parameter:	**-**
Data unit:	Tons
Description:	Quantity of biomass residues of type k that are utilised in the defined geographical region
Source of data to be used:	Surveys or statistics
Value of data applied for the purpose of calculating expected emission reductions in section B.5	This will be determined ex-post
Description of measurement methods and procedures to be applied:	Monitored annually
QA/QC procedures to be applied:	-
Any comment:	Used for approach L_2 of leakage test.

Data / Parameter:	**-**
Data unit:	Tons
Description:	Quantity of available biomass residues of type k that in the region
Source of data to be used:	Surveys or statistics
Value of data applied for the purpose of calculating expected emission reductions in section B.5	This will be determined ex-post
Description of measurement methods and procedures to be applied:	Monitored annually
QA/QC procedures to be applied:	-
Any comment:	Used for approach L_2 of leakage test.

Data / Parameter:	**-**
Data unit:	-
Description:	Availability of a surplus of biomass residue type k at the ultimate supplier to the project and a representative sample of other suppliers in the defined geographical region
Source of data to be used:	Surveys
Value of data applied for the purpose of	This will be determined ex-post

calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Monitored annually
QA/QC procedures to be applied:	-
Any comment:	Used for approach L_3 of leakage test.

B.7.2 Description of the monitoring plan:

>>
The monitoring of electricity data revolves around the electricity generation from the turbine generators and the auxiliary consumption of the power plant. All auxiliary units at the power plant will be monitored and the meters will be checked and calibrated each year to ensure the quality of the data. There will also be main meters attached to each turbine generator to determine their total generation which again will be calibrated each year.

The monitoring frequency will be done on a continuous basis through a DCS system for the project activity but records will be maintained on an hourly basis for the power plant. These records will then be collated at the end of every shift and then again at the end of every day and signed off by the Power Plant Manager.

The recording of data will be carried out by switchboard operators who will report this to the shift engineer, the shift engineers will report to the power plant manager. The daily electricity generation will be part of the overall management information systems of the factory.

As indicated in section B 7.1 the biomass used from the adjacent sugar plant will be monitored through a belt weigher. This may be checked through the measurement of cane crushed, water added in the crushing process and mixed juice produced. The latter are standard measurements in a sugar factory and provide a complete measurement of the bagasse generated which is the resultant variable. Further, annual energy balance will be undertaken for the bagasse consumed and energy produced.

The amount of biomass brought in by the plant will be monitored through transporters receipts and the weighbridges located at the plant. This data will be collected continuously and daily reports prepared. This data may be crosschecked through the purchase receipts of rice husk. The overall responsibility for this data will be with the Head of Purchase at the plant.

In line with the methodology there will be a reconciliation of the biomass used and the energy generated at the end of each year.

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

>>
31/07/2006
Robert Taylor, Agrinergy Ltd, project participant, contact details as listed in Annex I.
Pankaj Rastogi, Dalmia Cement (Bharat) Ltd, project participant, contact details as listed in Annex I.

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:

>>
14/12/2005
This is the date on which the order for the turbine generator was placed.

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

>>
20y 0m

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

A fixed 10 year crediting period has been chosen.

C.2.1. Renewable crediting period

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

>>
Not applicable

C.2.1.2. Length of the first crediting period:

>>
Not applicable

C.2.2. Fixed crediting period:

Chosen crediting period

C.2.2.1. Starting date:

>>
15/03/2007 or the date of registration whichever is later.

C.2.2.2. Length:

>>
10y 0m

SECTION D. Environmental impacts

>>

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

>>

In relation to the baseline scenario no negative environmental impacts will arise as a result of the project activity. The baseline scenario involves the combustion of coal and other fossil fuels for the generation of grid based power (there is some hydro and nuclear in the grid but only about 25%). The baseline scenario therefore generates carbon dioxide, NOx, SOx and ash.

The positive environmental impacts arising from the project activity are therefore:

- 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
- A reduction in ash in comparison to the baseline scenario due to the lower ash content of bagasse relative to coal (5% versus 45% respectively).

The factory will meet all environmental legislations as set out by the State Pollution Control Board and there will be on-going monitoring of the plant by this state body. A "Consent to Establish" the project activity was issued on 18th November 2005 and a "Consent to Operate" will be obtained prior to commissioning of the plant.

The plant will install an electrostatic precipitator at the exit of the boiler as per the consents from PCB to limit suspended particulate matter in the flue gases to less than 150 mg/Nm^3. There will also be investment in waste water systems to treat the water de-mineralisation plant effluent and also the blow down water from the cooling tower and steam generator.

Monitoring of air and water quality will be undertaken on a regular basis as per the State Pollution Control Board guidelines after the plant is commissioned and will be reported at verification. The testing of the environmental parameters will be undertaken by an independent third party.

An EIA is not required for the power plant.

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:

>>
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 (the Indian DNA) and consent to operate from the Uttar Pradesh 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 May 2006 and received their approval on 3rd January 2007.

A notice has been placed in local newspapers in both Hindi and English providing information on the project and inviting comments. A notice was placed in Hindi in the Dainik Jagran, Lucknow edition on 9th June 2006 and in English in The Hindusthan Times, Lucknow edition, on 4th June 2006.

A letter was sent by the factory to the local panchayat on 22nd May 2006, detailing the project and inviting them to comment or issue a no objection certificate. Subsequent to this correspondence a no objection letter was issued by the panchayat.

The Uttar Pradesh Pollution Control Board has issued a "Consent to Establish" with some conditions.

Other stakeholders that have been notified of the project, through consents and approvals required for the investment, are the Uttar Pradesh Power Corporation Limited through the issuance of a PPA and the State Boiler and State Electrical Inspectorate which have visited the site to approve the plans and construction.

E.2. Summary of the comments received:

>>

No adverse comments have been received on the project to date.

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

>>

The conditions laid down by the Uttar Pradesh Pollution Control Board will be complied with and these will be checked at the time the "Consent to Operate" is given.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Dalmia Cement (Bharat) Limited
Street/P.O.Box:	11th Floor, Hansalaya,
Building:	15, Barakhamba Road
City:	New Delhi
State/Region:	
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

The project has not received any public funding.

ANNEX 3

BASELINE INFORMATION

In line with the methodology to calculate the carbon dioxide emissions factor, 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 OM, 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.

The first step 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[15]. 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 Northern 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 Northern 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.

Table 3: Units operating in the Northern Region

	2005-6 Generation, GWh	2004-5 Generation, GWh	2003-4 Generation, GWh	2002-3 Generation, GWh
Thermal	131,504	131,482	123,737	118,337
Nuclear	6,444	7,338	7,364	8,642
Hydro	41,713	36,105	37,288	30,221
Hydro/nuclear as % of total	26.80%	24.84%	26.52%	24.72%

Source: CEA Generation report, http://www.cea.nic.in/god/opm/Monthly_Generation_Report/18col_05_03.pdf

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.

[15] 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

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 Northern Region emission factor.

Table 4: 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:
Acquired directly from the dispatch center or power producers, if available; or
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.
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
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 calculated. 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 2004-5 therefore we use these data to derive an average emission factor for gas stations in the Northern Region. The average emission factor is then applied to 2004-05 generation in the calculation of the CM[4].

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

Table 5: Fuel Consumption and generation from gas stations in the Northern Region 2004-05

State	Natural gas consumption (mmscm)	HSD consumption (kl)	Naptha consumption (kl)	Total Generation (GWh)
Delhi	968	11	0	4,091
Jammu & Kashmir	0	5,209	0	24
Rajasthan	220	4,083	0	354
Central	2,870	265,744	243,961	15,522
Total				19,991

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:

Table 6: Total emissions from gas stations in Northern Region, 2004-05

State	Emission from natural gas (tCO_2)	Emissions from HSD (tCO_2)	Emissions from Naptha (tCO_2)	Total Emissions (tCO_2)
Delhi	2,161,331	31	0	2,161,362
Jammu & Kashmir	0	14,564	0	14,564
Rajasthan	491,212	11,416	0	502,627
Central	6,408,079	743,007	621,814	7,772,900
Total	9,060,621	769,018	621,814	10,451,453

Dividing total emissions by total generation from gas stations gives an average emission factor for gas stations in the Northern Region of 0.5228 tCO_2/MWh for 2004-05.

Annual generation data for each power plant in the Northern Region is provided by the CEA[16]. (http://cea.nic.in/god/opm/Monthly_Generation_Report/18col_05_03.pdf).

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.

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[4] 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.

[16] 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

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):
0 tCO2/MWh, or
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
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
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:

Table 9: Net Imports from Other Regional Grids to the Northern Region (GWh)

	2004/05	2003/04	2002/03
From Southern	120	0	0
From Western	320	0	0
From Eastern	3043	117	827
From N Eastern	0	0	0

Source: http://cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm

Table 10: 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
Eastern CEF	1.22	1.23	1.17

Calculated as per the combined margin technique outlined in ACM0002

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[17]:

[17] 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.

Table 11: Calculation of the Simple OM

	Generation, GWh			Coal Consumption (kt)			Emissions (tCO2)		
Plant	2004-5	2003-4	2002-3	2004-5	2003-4	2002-3	2004-5	2003-4	2002-3
Coal Plants									
Delhi									
Faridabad	5,464	5,432	5,284	3,732	3,605	3,554	6,912,805	6,677,563	6,583,095
I.P.Stn.(DVB)	921	771	619	789	639	497	1,461,469	1,183,623	920,596
Rajghat(DVB)	696	775	837	541	629	705	1,002,097	1,165,100	1,305,876
Haryana									
Faridabad	869	795	973	822	740	880	1,522,595	1,370,706	1,630,029
Panipat	6,008	5,949	4,994	4,447	4,473	3,718	8,237,204	8,285,364	6,886,873
Punjab									
Bhatinda	1,993	2,553	2,497	1,469	1,835	1,763	2,721,037	3,398,981	3,265,615
Lehra Mohabbat	3,308	3,379	2,907	1,995	2,041	1,820	3,695,350	3,780,556	3,371,197
Roper	9,082	8,303	8,246	6,056	5,585	5,418	11,217,564	10,345,128	10,035,793
Rajasthan									
Kota	7,751	6,758	6,551	5,213	4,477		9,656,070	8,292,773	8,038,763
Suratgarh	9,363	8,303	7,289	5,920	4,984		10,965,651	9,231,892	8,104,452
Uttar Pradesh									
Anpara	11,511	11,982	11,693	8,339	8,342	8,074	15,446,378	15,451,935	14,955,517
Harduaganj	632	733	769	670	785	805	1,241,045	1,454,060	1,491,106
Faridabad	5,550	6,247	6,528	4,761	5,372	5,566	8,818,828	9,950,587	10,309,934
Panki Extn.	1,043	1,065	1,016	913	953	995	1,691,155	1,765,247	1,843,044
Paricha	966	655	961	876	590	847	1,622,620	1,092,860	1,568,903
Tanda (NTPC)	3,320	2,912	2,223	2,596	2,331	1,990	4,808,586	4,317,725	3,686,089
Unchahar (NTPC)	6,781	6,454	6,151	4,604	4,396	4,153	8,528,016	8,142,736	7,692,626
Rihand STPS	7,987	7,958	7,752	4,768	4,742	4,787	8,831,794	8,783,634	8,866,988
Singrauli(STPS)	15,806	15,644	16,168	10,336	9,742	10,213	19,145,433	18,045,163	18,917,600
NCTPP(Dadri)	6,830	6,185	6,043	4,432	4,136	4,005	8,209,419	7,661,137	7,418,485
Gas Plants	Generation, GWh						Emissions (tCO2)		

Delhi						
I.P GT	1,162	957	935	607,662	500,329	488,827
I.P. WHP	378	253	280	197,821	132,271	146,387
Pragata CCGT	2,551	2,405	825	1,333,531	1,257,358	431,318
Haryana						
F'bad CCGT	3,162	2,792	2,697	1,653,073	1,459,686	1,410,019
Jammu & Kashmir						
Pampore GT	24	29	58	12,412	15,161	30,323
Rajasthan						
Ramgarh GT	343	241	161	179,287	125,997	84,172
Ramgarh ST	17	0	0	8,888	0	0
Anta GT (NTPC)	2,785	2,777	2,760	1,456,026	1,451,843	1,442,956
Uttar Pradesh						
Auraiya GT	4,120	4,252	4,272	2,153,820	2,222,988	2,233,444
Dadri GT	5,458	5,062	5,212	2,853,445	2,646,464	2,724,886
Imports	Generation, GWh			Emissions (tCO2)		
From Southern	120	0	0	103,529	0	0
From Eastern	3,043	117	827	3,706,768	143,521	963,905
From Western	320	0	0	365,045	0	0
From North Eastern	0	0	0	0	0	0
Totals	129,364	121,738	117,528	146,942,241	137,062,878	133,647,702
Simple OM				1.14	1.13	1.136
Average Simple OM						**1.133**

The final Simple OM, $EF_{OM, y}$, based on the average of the last three years for which data is available is therefore 1.13 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 Northern 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 179662.76 GWh (http://cea.nic.in/god/opm/Monthly_Generation_Report/18col_05_03.pdf), 20% of which is 35932.55 GWh. The five most recent plants only account for 594 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 Northern 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:

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

Table 12: Identification of plants in BM

Plant	Capacity Addition, MW	Date of Addition	Generation, GWh	Emissions
Suratgrah	250	2/1/1999	1873	2193
F'bad CCGT	143	9/26/1999	1054	551
Unchahar	210	10/15/1999	1695	2132
F'bad CCGT	143	10/18/1999	1054	551
RAPS I-IV	220	6/1/2000	1361	0
Ranjit Sagar	600	7/1/2000	1145	0
Ghanvi	11.25	7/30/2000	37	0
F'bad CCGT	143	7/31/2000	1054	551

Suratgrah	250	10/1/2000	1873	2193
Ghanvi	11.25	12/7/2000	37	0
RAPS I-IV	220	12/23/2000	1361	0
Panipat	210	3/31/2001	928	1272
Malana	86	6/15/2001	270	0
Upper Sindh	70	12/30/2001	98	0
Suratgrah	250	1/15/2002	1873	2193
Pragati	104.6	3/15/2002	808	422
Suratgrah	250	7/31/2002	1873	2193
Upper Sindh	35	9/30/2002	49	0
Pragati	104.6	11/9/2002	808	422
Pragati	121.2	1/31/2003	936	489
Baspa	300	6/15/2003	1193	0
Chamera II	300	7/1/2003	1347	0
Suratgrah	250	8/19/2003	1873	2193
Ramgarh GT	37.5	9/15/2003	171	90
Ramgarh ST	37.8	9/15/2003	17	9
Nathpa Jhakri	250	10/6/2003	852	0
Chenani III	9.8	1/1/2004	23	0
Gumma	3	1/1/2004	4	0
Nathpa Jhakri	250	1/2/2004	852	0
Nathpa Jhakri	250	3/30/2004	852	0
Nathpa Jhakri	250	3/31/2004	852	0
Nathpa Jhakri	250	5/6/2004	852	0
Nathpa Jhakri	250	5/18/2004	852	0
Kota	195	8/1/2004	1446	1802
Panipat	250	9/28/2004	1104	1514
WY Canel	14.4	1/1/2005	67	0
Rihand	500	1/15/2005	2662	2944
Panipat	250	1/28/2005	1104	1514
Totals			36305	25229
BM CEF, tCO2/MWh				**0.695**

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

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 0.914tCO2/MWh.

Table 13: Calculation of the combined margin

	tCO_2/MWh
Simple OM, $EF_{OM, y}$	1.133
Build margin $EF_{BM, y}$	0.695
Combined margin, EF_y	0.914

In the case of scenario 4 $\varepsilon_{el, other plants(s)}$ corresponds to the average net efficiency of electricity generation in the "reference plant" that would be installed in the absence of the project activity. This factor is determined from the baseline scenario that would arise in the absence of the project activity, i.e. the installation of a low pressure boiler and backpressure turbine generator that would be sufficient to meet the requirements of the sugar factory. This has been detailed in the following table against the actual situation. We assume that in the baseline there is a pressure reducing station and also that the fibrizer turbine is powered by steam.

Baseline plant set-up

Capacity	Tcd	7,500
Crush rate	Tph	312.5
Crush	Mt	1,200,000
Net Bagssse (dry weight)	Assume 29.5% on cane	177,000
Steam consumption	% on cane	48%
Steam consumption	Mt	150
Condensed steam	Tph	
Steam generation	Tph	150
Steam pressure	kg/cm2	46
Power generation	MW	8.75
Steam to generate power	Tph	70
Steam to fibrizer	Tph	25
Steam to PRDS	Tph	55
Hours	Hr	3840
Efficiency		0.0385
Calorific value of bagasse	kcal/kg (dry)	4,238
Calorific value of bagasse	GJ/t	17.73
Baseline, MWh		**33,600**

Therefore the factor, $\varepsilon_{el, otherplants}$, is set at 0.0385 and on the basis of the above assumptions on cane throughput and implicit operating days the deduction relating to $(1/3.6)\varepsilon_{el, otherplants}.\Sigma BF_k$. NCV_k is 33,600 MWh. That the above is a realistic interpretation of the likely baseline scenario is reinforced by the current steam and power balance at an existing sugar factory owned and operated by the same sugar company. In this factory there is a PRDS and the backpressure steam generation accounts for 53% of the total steam requirement.

Annex 4

MONITORING INFORMATION

In addition to the measures for monitoring listed in section B 7.2 the following systems will be put in place to monitor the project activity.

In terms of the storage of data logbooks will be kept for the generation of power. Transport records will also be held for each truck that delivers biomass to the site. This data will however be collated into a daily format and held in an electronic format. Records of the testing of the boiler efficiency will be held at the plant after these tests have been undertaken. As outlined the environmental monitoring will be undertaken by qualified independent third party agencies and records of these reports will be kept on site along with the necessary consents from the Uttar Pradesh Pollution Control Board.

All meters will be calibrated annually by an accredited independent third party. The calibration records will be maintained on site.

The Power Plant Manager will be responsible for the collection and storage of the electrical data, supported by the shift engineers and the switchboard attendants. The Head of Purchase will be responsible for the collection and storage of the biomass data. The Chief chemist will be responsible for the environmental testing and measurement of the other parameters required. An energy balance will be carried out by Agrinergy before completion of the annual monitoring reports.

In line with the methodology the calorific value will be calculated yearly but the underlying data will be collected daily. The energy balance will be performed as part of the annual appraisal of the project prior to verification and will be undertaken by Agrinergy. The quantity of biomass will be taken from the reports generated for the state sugar directorate, the RT8C report, which is a statutory requirement for sugar plants.

The bagasse sucrose and moisture content are measured through the use of a polarimeter and a weigher. To measure sucrose content a sample of bagasse is taken, diluted with water, filtered and then the optical rotation of the solution is measured against a standard. The device (a prism) is calibrated against standard optical rotations. The moisture is measured by weighing the sample before and after drying.

The archiving and preservation of records will be in paper and electronic form and these will be held for a minimum of two years after the crediting period.

The monitoring of the project activity will be the responsibility of Mr Pankaj Rastogi, based in the head office. The monitored data will be reported through Mr Rastogi to Agrinergy on a monthly basis for the calculation and estimation of emission reductions. This data will be checked against initial estimates and a summary report will be provided quarterly by Agrinergy. If the project is not performing as expected, on the basis of the monthly data, a report will be sent to Dalmia outlining where the project is deviating in its generation of emission reductions. Should there be significant changes to the set-up or operation of the plant these will be notified to Agrinergy and amendments to the PDD will be requested through a DOE.

At the end of each year of operation Agrinergy will prepare a monitoring report that will be submitted to a DOE for verification, however visits to the site may be undertaken by Agrinergy during the first year to check that the procedures and monitoring plan are being followed.

The registration of the project activity will be the responsibility of Mr Pankaj Rastogi but assistance will be provided by Agrinergy.

Emergency situations

In terms of emergency preparedness the main risk is risk of fire. A fire fighting system will be installed at the site, comprising fire hydrants and fire extinguishers. The fire hydrants will be tested daily and the extinguishers will be tested in line with the manufacturer's guidelines. A safety committee will be established at the plant and the Security Officer is the designated Fire Officer.

Training

Complete training for the operation of the boiler and turbine and their auxiliaries will be provided at the time of commissioning by the manufacturers. A complete set of documentation will be provided to support this training and the on-going operation and maintenance of the equipment. Additional training will be provided to the operators and it is expected that they will gain additional recognised technical qualifications through this training.

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Annex 5

Evidences

Evidence- Crushing Days

Indian Sugar Vol No LVI, No. Five, August 2006.

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STATEWISE AVERAGE DURATION OF CRUSHING SEASON IN INDIA

STATES	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97
Assam	81	62	61	58	42	57	54	35
Andhra Pradesh	108	147	150	91	107	149	136	111
Bihar	99	115	147	82	58	123	105	90
Goa	92	74	130	103	70	122	144	92
Gujarat	166	203	162	144	148	117	203	157
Haryana	175	205	208	124	111	133	193	169
Kerala	84	61	61	45	20	68	151	60
Karnataka	134	155	177	132	127	182	199	130
Madhya Pradesh	89	129	167	70	45	75	137	97
Maharashtra	200	193	176	136	109	180	199	123
Nagaland	74	63	67	49	25	16	21	-
Orissa	35	78	94	71	59	74	116	89
Punjab	145	129	129	129	91	90	178	177
Pondicherry	132	167	206	147	125	212	197	125
Rajasthan	80	99	136	82	64	72	117	91
Tamil Nadu	175	207	205	155	174	290	249	141
East U.P.	149	155	185	128	99	151	155	132
West U.P.	198	180	212	131	146	148	213	156
Central U.P	182	160	189	127	110	145	183	139
West Bengal	9	70	69	41	41	72	88	36
All INDIA	158	166	173	123	111	161	181	130

STATES	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05
Assam	28	25	59	35	-	-	-	-
Andhra Pradesh	111	142	142	114	119	130	106	97
Bihar	104	108	130	103	116	125	81	82
Goa	73	126	101	114	60	99	85	69
Gujarat	131	160	169	149	152	172	151	105
Haryana	117	129	136	165	162	144	125	96
Kerala	76	106	157	82	65	26	-	-
Karnataka	126	171	174	159	145	158	110	99
Madhya Pradesh	73	95	103	103	64	69	79	70
Maharashtra	138	162	176	150	127	123	77	66
Nagaland	-	-	-	-	-	-	-	-
Orissa	66	85	72	69	55	85	86	59
Punjab	87	84	105	118	147	139	90	64
Pondicherry	147	190	182	147	139	121	131	117
Rajasthan	99	97	94	71	61	28	111	62
Tamil Nadu	172	207	185	180	194	173	111	143
East U.P.	93	91	125	100	129	144	84	90
West U.P.	148	143	143	161	178	183	157	154
Central U.P.	120	118	133	126	151	156	115	120
West Bengal	48	40	28	30	35	91	81	58
Uttranchal				122	138	151	116	110
Chhatisgarh						31	94	58
All INDIA	123	141	152	139	140	141	100	96

Evidence - Grid Tripping

Grid Failure Report - Sidhauli Sub-station			
	Duration		
Date	From	To	Mins
22-Apr-05	12.20	12.35	15
	16.50	17.00	10
23-Apr-05	22.15	23.05	50
24-Apr-05	22.05	00.20	135
25-Apr-05	21.10	00.15	185
28-Apr-05	22.30	00.15	105
29-Apr-05	22.35	00.35	120
30-Apr-05	22.50	00.50	120
1-May-05	22.50	00.48	118
6-May-05	21.20	00.45	205
10-May-05	20.10	00.30	260
12-May-05	22.15	00.30	135
15-May-05	21.40	00.30	170
16-May-05	23.00	00.00	60
17-May-05	12.55	13.15	20
	21.45	00.15	150
19-May-05	14.00	14.20	20
	21.20	21.25	5
20-May-05	21.15	01.50	275
21-May-05	22.05	01.50	225
22-May-05	5.00	05.50	50
	22.05	01.20	195
23-May-05	16.45	17.30	45
	21.00	01.50	290
24-May-05	20.15	00.50	275
25-May-05	5.00	8.15	195
26-May-05	4.30	6.55	205
	13.20	00.00	640
27-May-05	00.00	5.45	345
	21.15	00.10	175
28-May-05	4.40	7.00	140
	11.00	11.20	20
	21.50	23.30	100
29-May-05	21.35	00.40	185
30-May-05	21.45	00.10	145
31-May-05	10.00	11.00	60
	21.10	00.10	180
1-Jun-05	21.30	00.05	155
2-Jun-05	5.40	7.10	90
	21.35	00.50	195

3-Jun-05	6.00	7.00	60
	12.25	13.15	50
	21.20	00.55	215
4-Jun-05	4.35	5.30	55
	21.35	00.40	185
5-Jun-05	5.40	9.20	220
7-Jun-05	18.15	18.30	15
	22.15	00.00	105
8-Jun-05	21.15	22.30	75
10-Jun-05	21.30	00.30	180
11-Jun-05	4.50	6.30	100
	21.10	00.30	200
12-Jun-05	21.30	00.30	180
13-Jun-05	8.35	9.00	25
	20.35	00.30	235
14-Jun-05	19.50	01.00	310
15-Jun-05	20.00	00.40	280
16-Jun-05	19.40	00.25	285
17-Jun-05	4.00	7.00	180
	10.35	11.15	40
	17.30	18.15	45
	19.45	1.55	310
19-Jun-05	19.30	1.10	340
	10.15	10.30	15
	10.42	12.05	83
	20.00	00.15	255
20-Jun-05	7.05	8.55	110
	11.40	12.15	35
21-Jun-05	4.30	9.05	275
	19.40	00.20	280
22-Jun-05	5.10	8.30	200
	19.50	00.25	245
23-Jun-05	21.20	23.40	140
24-Jun-05	19.50	23.15	205
	23.25	00.40	75
25-Jun-05	4.50	7.15	145
	19.15	00.35	320
26-Jun-05	22.15	00.30	135
27-Jun-05	22.25	00.40	135
28-Jun-05	22.05	00.25	140
30-Jun-05	19.50	00.25	275
2-Jul-05	11.00	11.30	30
8-Jul-05	12.55	13.25	30
	14.10	14.35	25
9-Jul-05	18.40	20.15	95
10-Jul-05	19.40	00.15	275

11-Jul-05	19.55	23.55	240
12-Jul-05	15.02	15.15	13
13-Jul-05	19.20	23.05	225
15-Jul-05	19.50	23.15	205
16-Jul-05	19.50	22.55	185
17-Jul-05	20.10	23.50	220
18-Jul-05	19.40	23.50	250
19-Jul-05	19.35	23.50	255
20-Jul-05	19.35	23.50	255
21-Jul-05	19.45	23.30	225
22-Jul-05	18.45	00.35	350
23-Jul-05	11.25	11.30	5
	19.45	00.25	280
24-Jul-05	19.45	23.50	245
25-Jul-05	16.05	16.45	40
	19.20	00.20	300
26-Jul-05	19.45	20.15	30
27-Jul-05	19.20	00.00	280
28-Jul-05	19.40	00.35	295
29-Jul-05	9.15	10.10	55
	19.00	00.10	310
30-Jul-05	5.45	6.00	15
	8.45	9.00	15
	10.30	11.30	60
	15.15	16.30	75
	19.15	00.30	315
31-Jul-05	5.00	6.00	60
	19.20	01.05	345
1-Aug-05	5.00	8.05	185
	19.20	01.00	340
2-Aug-05	5.00	8.05	185
	19.25	01.00	335
3-Aug-05	5.10	11.05	355
	18.55	02:35	460
4-Aug-05	3.20	3.30	10
	10.00	11.00	60
	16.30	17.30	60
	19.30	01.30	360
5-Aug-05	8.30	10.15	105
	14.10	14.35	25
	19.00	00.40	340
6-Aug-05	19.40	00.00	260
7-Aug-05	19.40	23.35	235
9-Aug-05	19.25	00.15	290
10-Aug-05	6.40	7.00	20
	19.25	00.10	285

11-Aug-05	10.36	11.45	69
	17.30	18.15	45
	19.25	00.15	290
12-Aug-05	18.25	00.05	340
13-Aug-05	18.45	00.35	350
14-Aug-05	5.20	8.05	165
	19.33	01.10	338
15-Aug-05	5.00	5.45	45
	19.35	00.30	295
16-Aug-05	19.08	00.46	338
18-Aug-05	20.22	00.00	218
19-Aug-05	19.45	00.00	255
20-Aug-05	23.38	00.38	60
21-Aug-05	19.15	00.40	325
23-Aug-05	18.00	18.20	20
	19.45	19.53	8
24-Aug-05	4.45	5.20	35
	18.25	00.45	380
25-Aug-05	13.20	00.00	640
26-Aug-05	5.10	5.45	35
	10.45	12.10	85
	18.45	00.15	330
27-Aug-05	12.40	14.00	80
	18.45	01.00	375
28-Aug-05	18.15	01.15	420
29-Aug-05	6.30	10.15	225
	18.15	00.45	390
30-Aug-05	6.05	9.10	185
	10.35	11.35	60
	18.15	00.45	390
31-Aug-05	18.40	00.15	335
1-Sep-05	13.55	14.20	25
2-Sep-05	11.05	12.05	60
	17.35	00.22	407
3-Sep-05	4.20	7.20	180
	19.25	00.45	320
4-Sep-05	4.27	7.10	163
	19.25	00.10	285
5-Sep-05	4.40	7.10	150
	18.55	00.15	320
6-Sep-05	4.40	7.00	140
	12.05	13.45	100
	18.45	19.15	30
	19.20	23.10	230
7-Sep-05	5.10	11.05	355
	14.20	16.00	100

	18.20	23.30	310
8-Sep-05	4.15	11.15	420
	18.25	23.35	310
9-Sep-05	4.00	10.20	380
	18.15	22.40	265
10-Sep-05	6.10	10.15	245
	18.30	23.45	315
11-Sep-05	22.10	00.05	115
12-Sep-05	16.50	17.00	10
	18.30	23.00	270
18-Sep-05	22.00	22.20	20
19-Sep-05	18.45	19.05	20
	22.00	22.55	55
20-Sep-05	21.55	00.40	165
21-Sep-05	19.00	00.50	350
22-Sep-05	18.30	01.05	395
23-Sep-05	8.32	11.20	168
	18.00	00.45	405
24-Sep-05	18.45	23.45	300
25-Sep-05	18.45	23.45	300
26-Sep-05	18.45	00.00	315
27-Sep-05	17.25	23.55	390
28-Sep-05	17.30	00.00	390
29-Sep-05	5.25	6.25	60
	16.25	23.55	450
30-Sep-05	9.25	13.15	230
	17.15	00.15	420
1-Oct-05	18.00	00.40	400
2-Oct-05	18.30	00.30	360
3-Oct-05	5.40	9.05	205
	15.20	16.05	45
	17.45	00.05	380
4-Oct-05	4.45	10.00	315
	17.00	00.40	460
5-Oct-05	17.45	00.40	415
6-Oct-05	5.40	6.55	75
	11.50	12.20	30
	17.25	00.15	410
7-Oct-05	9.05	11.00	115
	17.20	00.00	400
8-Oct-05	3.25	8.25	300
	19.25	23.52	267
9-Oct-05	15.40	16.35	55
	20.45	07.10	655
10-Oct-05	17.05	00.10	425
11-Oct-05	17.15	06.00	765

13-Oct-05	17.38	06.00	742
14-Oct-05	17.45	07.40	835
15-Oct-05	17.20	23.50	390
16-Oct-05	4.00	10.00	360
	18.15	23.50	335
17-Oct-05	6.30	10.00	210
	18.00	23.45	345
18-Oct-05	19.30	23.20	230
19-Oct-05	4.20	6.35	135
	17.45	23.00	315
20-Oct-05	19.10	23.20	250
21-Oct-05	5.30	7.20	110
	17.35	23.15	340
22-Oct-05	4.20	8.10	230
	17.45	22.40	295
23-Oct-05	5.45	7.05	80
	21.00	00.00	180
24-Oct-05	17.30	18.20	50
27-Oct-05	17.30	19.00	90
28-Oct-05	18.00	20.00	120
29-Oct-05	5.35	8.15	160
31-Oct-05	5.00	6.10	70

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18%