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

CONTENTS

Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

>>
RSCL cogeneration expansion project
Version 3
Completed 30th October 2005

A.2. Description of the project activity:

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The proposed Clean Development Mechanism (CDM) project, the RSCL cogeneration expansion project, consists of the installation of a high pressure boiler and a 22MW turbine generator at Rajshree Sugar & Chemicals (RSCL) Unit 2 plant in Tamil Nadu, India. The turbine generator will be powered by steam produced by the combustion of bagasse. The installation of the new equipment will allow the factory to export GHG emission neutral renewable electricity to the Tamil Nadu and grid.

The Unit 2 plant was acquired by RSCL from South India Sugars in January 2002. Since this time it has successfully completed two crushing seasons under the new management. As part of the ongoing improvements at the plant RSCL has decided, with the assistance of the CDM, to invest in a new cogeneration system and a grid connection that will allow for export of electricity to the grid.

The current cogeneration set up at Unit 2 involves a number of low pressure boilers providing steam to the process and turbine generators. Historically the factory has not exported any power to the grid, and in some cases has had to generate power from diesel turbine generators to meet the requirements of the factory. The current set up is shown in the following table.

Table 1: Existing boilers and turbine generators

Boilers	Turbines
3 x 16 tph, 14 kg/cm2	1 x 2.5MW
1 x 30 tph, 14 kg/cm2	1 x 1.5MW
1 x 45 tph, 21 kg/cm2	1 x 1.25MW

Table 2: Historic generation of electricity, kWh

Year	1.25MW	1.5MW	2.5MW	DG set	Total
2000/01	152,614	4,806,400	8,677,150	51,048	13,687,212
2001/02	94,990	3,919,527	6,670,450	40,488	10,725,465
2002/03	1,140	6,234,663	10,949,330	54,648	17,239,781

Following implementation of the project activity, the existing boilers and turbines will be maintained for back up use whilst the project activity will supply steam and power for the factory's internal demand in addition to supplying electricity to the grid. The project level baseline is the maintenance of current practice - the existing boilers and turbines remain in use, the expansion investment does not take place and the factory does not export any electricity to the grid.

The RSCL sugar factory is a significant contributor to the development of the rural and local economy, both through direct and indirect employment effects. Unit 2 directly employs 485 people and serves over 20,000 farmers growing cane on an area of 25,000 acres including 655 villages. The cane growers in turn employ over 100,000 agricultural labourers, utilise 1,200 tractors and 250 bullock carts. RSCL employs

60 agricultural graduates and provides free extension advice to farmers as well as financial assistance and supply of inputs.

Given the rural location of the factory and the employees who live on site, the factory has established healthcare and education facilities. There is a higher secondary school within the factory compound, educating about 900 students. Initially the school was founded for children of employees but has subsequently expanded its catchment to the local community. There is also a medical clinic located in the factory, with full dispensary services and one doctor and nurse in permanent attendance.

Around 75% of the population in India is employed in rural pursuits and the agricultural sector accounts of one quarter of GDP. The creation of a more viable agricultural sector is therefore crucial to the development of the economy as a whole and the maintenance of livelihoods. The CDM project will provide sustainable benefits through the diversification of the RSCL sugar mill's revenue - the farmer no longer just produces sugar cane for the manufacture of sugar but also electricity and CERs. This will in turn enable the mill to further and continue the sustainable development benefits it provides to the rural economy. Importantly, CER revenue will allow the factory to further reduce the time it takes to pay farmers[1].

The provision of renewable electricity is also a major factor contributing to the project activity's role in sustainable development. Most of the rural electricity in India is consumed by farmers for utilisation in their irrigation pump sets. However a study by the World Bank "Why are Power Sector Reforms Important to the Poor", 2003 identified a number of other areas where rural electrification brought economic and social benefits to the rural community. The general problems surrounding electricity provision in India have been well documented; vertically integrated generation, transmission and distribution companies and a tariff structure that does not represent the cost of production in many cases. The grid generally is in a deficit situation and power cuts are not uncommon (in the area surrounding Unit 2, electricity is rationed to between 6-8 hours per day). For many a diesel generator is the only solution for the provision of continuous power. A more steady, renewable and local supply of electricity should permit displacement of this type of power generation and/or generation expansion based on fossil fuels.

A.3. Project participants:

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Name of Party involved	Private and/or public entity(ies) project participants (as applicable)	Kindly indicate if the Party involved wishes to be considered as a project participant
India (host)	Private entity: Rajshree Sugars & Chemicals Ltd Public entity: Ministry of Environment and Forests	No
United Kingdom	Private entity: Agrinergy Ltd. Public entity: Department of Environment, Food and Rural Affairs	No

A.4. Technical description of the project activity:

[1] Farmers are currently paid in around 15 days. This is far quicker than the time taken prior to the purchase of the factory by RSCL.

A.4.1. Location of the project activity:

>>

A.4.1.1. Host Party(ies):

>>
India

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

>>
Tamil Nadu

A.4.1.3. City/Town/Community etc:

>>
Mundiyampakkam village, Villupuram district.

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

>>
The RSCL Unit 2 sugar plant is located in Mundiyampakkam village, Villupuram district, Tamil Nadu, India. It is the only sugar mill located in the village and was established in 1965. It can therefore be easily uniquely identified.

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

>>
Energy industries (renewable sources)

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

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The new power unit is fuelled by bagasse which is provided from the sugar factory after the sugarcane is crushed. In the case of the project activity the bagasse is transported to the boiler via a covered conveyor with any excess bagasse diverted to the bagasse storage shed.

The technology employed in the new cogeneration plant comprises of a 120 TPH high pressure boiler and 22MW turbine generator. The high pressure boiler will be operating with boiler outlet steam parameters of 87 kg/cm^2 and 515^{o}C. The boiler is designed to have a travelling grate with hydraulic drive to burn bagasse. The new turbine generator will be a double extraction cum condensing machine. There will be one controlled extraction at 3 kg/cm^2 and one uncontrolled extraction at 9 kg/cm^2 for the provision of steam to the sugar manufacturing process. The remaining steam will pass to the condenser. During the off-season all the steam generated from the combustion of bagasse will pass to the condenser.

The power generation of the turbine generator will be at the 11kV level. The turbine will be operating in parallel with the Tamil Nadu Electricity Board (TNEB) grid. The entire power requirements of the sugar plant and the power requirements of the auxiliaries of the plant will be met by power generated by the turbine generator. Stepdown transformers will be used to step down the 11kV voltage to 433V for feeding the plant equipment and auxiliaries. The exportable power will be stepped up to 110kV at a step up station within the plant and will be connected to the nearby (750 metres) TNEB grid line via a “line in line out” connection.

The water feed for the boiler will be managed through an on-site water treatment plant. The raw water will be taken to the reverse osmosis (RO) plant and after treatment will be fed to the boiler. The rejects of the RO plant will be sent to the existing effluent treatment plant for further processing.

The turbine generator is manufactured by Skoda and will be imported from the Czech Republic. An air cooled condenser will be fitted to the turbine generator and an electrostatic precipitator fitted to the boiler.

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

>>
The proposed project consists of the expansion of the existing capacity for renewable electricity generation at the factory to supply surplus power to the grid. The RSCL Unit 2 factory currently generates electricity and steam from the combustion of bagasse, an important by-product of the sugar manufacture process, derived from the crushing of the sugarcane.

The combustion of biomass (any agricultural crop) has zero net emissions of carbon dioxide (CO2), due to the cycling of CO2 from the atmosphere into the plant material during growth and the return of that CO2 to the atmosphere during combustion. Using biomass as an energy source is therefore desirable due both to its zero net CO2 emissions and also its status as an energy source that will reduce reliance on fossil fuel imports and diversify electricity generation. This proposed project will supplement the grid, which is at present dominated by fossil fuel based generation. In the absence of the project, the power that the RSCL cogeneration expansion project will produce would instead have been generated from the existing and planned fossil fuel dominated generation mix.

Anticipated total emissions reductions over the 10 year crediting period are 801,573 tCO_2e.

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

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Years	Annual estimation of emission reductions in tonnes of CO_2e
2005	20,207
2006	80,831
2007	80,831
2008	80,831
2009	80,831
2010	80,831
2011	80,831
2012	80,831
2013	80,831
2014	80,831
2015	53,887
Total estimated reductions	**801,573**
Total number of crediting years	**10**
Annual average over the crediting	**80,157**

period of estimated reductions (tonnes of CO_2e)	

A.4.5. Public funding of the project activity:

>>
The project has received no public funding.

SECTION B. Application of a baseline methodology

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

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Approved baseline methodology AM0015, Version 1, 22 September 2004.
"Bagasse-based cogeneration connected to an electricity grid"

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

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The project activity involves the installation of a bagasse-based cogeneration power plant that will displace grid electricity and the bagasse to be used as a feedstock for cogeneration shall be supplied from the same facility where the project is implemented. The project activity meets all the applicability conditions for the methodology, specifically:

The bagasse to be used as the feedstock for cogeneration shall be supplied from the same facility where the project is implemented;
The power plant is attached to the sugar plant and no external bagasse will be used. This is reinforced through the following analysis which demonstrates that the supply of bagasse from the attached sugar plant is sufficient to meet the demand of the power plant. The power plant will require 290,000 tonnes of bagasse per year assuming it operates for 260 days during the season and 20 days in the off-season. The sugar factory will produce 308,000 tonnes of bagasse if it crushes cane for 260 days of which 10,000 tonnes is accounted for by bagacillo and losses (bagacillo is a process within the sugar factory).

Documentation is available supporting that the project activity would not be implemented by the public sector, project participants and other relevant potential developers, notwithstanding of the governmental policies/programs to promote renewables;
The project activity would not be implemented by the public sector, project participants or other relevant potential developers in the absence of the CDM (the latter two conditions are shown through the analysis in Section B.3.). In terms of the public sector involvement in bagasse cogeneration for the supply to the grid there is one Government of Tamil Nadu sugar mill in the state, Parambalur Sugar Mills Ltd, which has not installed grid based bagasse cogeneration[2]. There are also sixteen co-operative mills in Tamil Nadu which, whilst not directly state owned, have some state involvement through the equity participation of the state in the initial investment. Of these sixteen factories only three have grid based bagasse cogeneration – Subramaniya Siva Co-operative, M R Krishnamurthy Co-operative and Cheyyar Co-operative – all of which are small scale varying from 1.2MW to 7.5MW and therefore not comparable in terms of their scale or investment criteria.

[2] "List of Cane Sugar Factories and Distilleries, Season 2003-04", published by The Sugar Technologists' Association of India, pages 164 -185.

In terms of development of such projects by other relevant potential developers the low uptake of bagasse cogeneration in the state of Tamil Nadu is highlighted below. In Tamil Nadu there are 38 sugar factories, 12 of which export electricity to the grid[3]. However of the 12 units 6 are selling their bagasse and generating electricity for supply to the grid solely from coal. Of the remaining 6 units, 3 of the units belonging to the Thiru Arooran group are proposed as CDM projects and currently burn coal and the remaining 3 are the small scale projects implemented in the co-operative sector. In terms of other projects being commissioned in Tamil Nadu there are three bagasse cogeneration plants under commissioning which are of a similar scale but these are also being proposed as CDM projects. It can therefore be concluded that the project would not be promoted by other entities in the absence of CDM funding.

The implementation of the project shall not increase the bagasse production in the facility;
The implementation of the project will not increase the bagasse production of the facility as the current supply of bagasse from the existing crushing capacity of the sugar factory is sufficient to meet the demand of the boiler (this is demonstrated under point 1 of the applicability conditions).

The bagasse at the project facility should not be stored from more than one year;
The bagasse will not be stored for more than one year as the actual surplus in anyone year will be of the order of a couple of thousand tonnes assuming that the sugar factory crushes cane for 260 days and the power plant operates for 280 days. The limiting factor in the operation of the power plant is therefore the supply of bagasse to run during the off-season and hence the factory will run as long as possible in the off-season (currently estimated at 20 days) before closing with a stock of bagasse just enough to allow for start up operations at the start of the following season (start up operations entail the firing of the boilers before sugarcane is crushed and hence the stock of bagasse will be depleted by the time sugarcane crushing starts and bagasse is generated).

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

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The PDD follows the steps outlined in AM0015 in relation to the project activity. As outlined above, the project activity meets the applicability conditions. The project boundary is drawn around the export of power from the project activity as this is the generation for which CERs are claimed. Prior to implementation of the project activity RSCL did not (and were not able to) export power to the grid.

The baseline scenario set out in the methodology is that the current practice continues, in the case of the project activity this is the case. The existing generation and steam capacity at the sugar factory is adequate to meet captive demand. Thus the continuation of existing practice – the operation of low pressure boilers, self sufficiency in electricity generation and no electricity export to the grid is a plausible baseline option. 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 fossil fuel based systems. RSCL is a primarily a sugar company not a power company. Such investments are not therefore considered plausible given that the existing setup meets the energy requirements of the sugar factory. Thus the alternatives to the project activity are:

- The proposed project activity not undertaken as a CDM project activity
- Continuation of the current situation (no project activity or other alternatives undertaken)

In Tamil Nadu there is the practice among some sugar factories of transferring their bagasse to paper mills which in turn install coal based boilers for the generation of steam and electricity to the sugar plant

[3] "List of Cane Sugar Factories and Distilleries, Season 2003-04", Published by The Sugar Technologists' Association of India.

and provide surplus electricity to the grid. In the case of the project activity there was a proposal from a local paper company but this has been excluded as a plausible baseline scenario given the limited analysis and consideration of the proposal by RSCL and the fact that it would give rise to a less conservative baseline.

In terms of the guidance on retrofitting and modifying an existing facility agreed at the 8th CDM Executive Board meeting, this does not need to be considered as the baseline does not take account of any emissions arising from the existing facility[4].

The emission factor for the grid electricity displaced by the project activity is calculated using the combined margin method taking the average of the Simple Operating Margin and the Build Margin using the default weightings of 0.5 to calculate the average. The data for the consumption of fossil fuels by grid based plants and generation data is taken from the Central Electricity Authority which is part of the Ministry of Power, India[5].

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

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That the project is not part of the baseline is demonstrated using the "Tool for the demonstration and assessment of additionality" agreed by the EB. The narrowing of plausible baseline options is also carried out using elements of the additionality tool.

Step 0. Preliminary screening of projects started after 1 January 2000 and prior to 31 December 2005.

The project activity was submitted to the Austrian JI/CDM tender purchase tender in September 2003 whilst the plant is expected to be commissioned in 2005. There is therefore ample evidence that the incentive from the CDM was seriously considered in the decision to proceed with the investment.

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 existing generation and steam capacity at the sugar factory is adequate to meet captive demand. Thus the continuation of existing practice – the operation of low pressure boilers, self sufficiency in electricity generation and no electricity export to the grid is a plausible baseline option. 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 fossil fuel based systems. RSCL is a primarily a sugar company not a power company. Such investments are not therefore considered plausible given that the existing setup meets the energy requirements of the sugar factory. Thus the alternatives to the project activity are:

- The proposed project activity not undertaken as a CDM project activity
- Continuation of the current situation (no project activity or other alternatives undertaken)

Sub-step 1b

[4] The only emissions that could be considered in this regard are those arising from the use of DG sets, as outlined in section A". These emissions have not been considered to add to conservativeness.

[5] Section 73 of the Electricity Act 2003 states that the CEA shall, "collect and record the data concerning the generation, transmission, trading, distribution and utilization of electricity and carry out studies relating to cost, efficiency, competitiveness and such like matters".

Compliance with applicable laws and regulations. The above alternatives are both 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.

Sub-step 2a

As the project activity generates revenues other than those related to the CDM and the proposed project and plausible baseline alternatives do not involve investments of comparable scale, Option III (benchmark analysis) is undertaken.

Sub-step 2b – Option III

The selected benchmark used is the IRR. The project IRR is calculated as this is the hurdle that investments within RSCL must meet. The project IRR hurdle is set at 12.6% which is the WACC (Weighted Average Cost of Capital) for RSCL[6]. This is based on the current cost of debt within the group and a sector return of 15%[7].

Sub-step 2c

In the financial analysis the project is modelled as an independent unit, paying a price for bagasse and receiving revenue from the sugar factory for steam and power as well as revenue from TNEB for export of power[8].

The internal rate of return of the project activity is 11.9%, rising to 14.5% after the inclusion of CER revenue[9]. From these figures, it is clear that the CDM status of the investment is fundamental to the decision to invest, with CER revenue taking the IRR above the hurdle. RSCL has actively pursued CDM financing for the project, and the first PIN was submitted to an institutional buyer in January 2004. Moreover, the critical nature of carbon finance to the project is highlighted by the financial impact of the risk factors outlined below. The sensitivity analyses carried out on the financial performance of the project again highlights the relative importance of CER revenue as the bagasse price rises and electricity tariffs fall. The market environment for these two critical inputs and outputs are examined in Step 3.

Sub-step 2d

IRR Including CER revenue

	Electricity export price, Rs/kWh			
Bagasse price, Rs/mt	2.80	2.90	3.00	3.15
900	16.1%	17.7%	19.2%	21.3%
1000	13.5%	15.1%	16.7%	18.9%

[6] The weighted average cost of capital for EID Parry, a sugar company in Tamil Nadu, has been estimated at 15.7%. "Value Enhancement, Back to Basics" Aswath Damodaram, www.damodaram.com, p 14. Therefore the WACC for RSCL may be considered as conservative.

[7] The expected return on the share prices of two leading sugar companies in India has been estimated at 30% and 44% by Citigroup, a leading investment bank in India, reinforcing our conservative approach to the determination of the WACC hurdle rate. Citigroup, "Global Sugar, Structural changes offer a sweet deal", 6 October 2005.

[8] The assumptions inherent in the financial analysis are a plant load factor of 75% in the first year rising to 80% thereafter, a bagasse price of Rs 900/mt, an electricity tariff of Rs 3.15/kWh, 260 days operation during the season and 20 days in the off-season, a CER price of US$8/mt and a Rs/US$ exchange rate of 43.

[9] In line with the guidance of the Executive Board the data underlying the financial analysis were updated at the time of validation of the project. Under these assumptions the IRR of the project was 7.8% rising to 12.7%. The major changes were a reduced PLF in the first year supported by actual experience (60% due to the delay in implementation) and increase in the bagasse price and a reduction in the electricity tariff by TNEB.

1100	10.6%	12.4%	14.1%	16.5%
1200	7.6%	9.5%	11.3%	13.8%

IRR Excluding CER Revenue

Bagasse price, Rs/mt	Electricity export price, Rs/kWh 2.80	2.90	3.00	3.15
900	11.8%	13.5%	15.1%	17.5%
1000	8.8%	10.6%	12.4%	14.9%
1100	5.5%	7.5%	9.4%	12.1%
1200	1.9%	4.2%	6.3%	9.2%

Step 3 Barrier analysis

The project activity faces a number of risks and barriers which the CDM helps overcome. To an extent these barriers have been highlighted in section 2 through the current financial evaluation of the project at the time of validation and the reduction in the project IRR.

Bagasse availability

Tamil Nadu has experienced 3 successive years of drought, which has had a direct impact on sugar cane yields and the amount of cane crushed in the plant. It is expected that rainfall levels will recover during the lifetime of the project activity. However, the risk that this does not occur, and that therefore insufficient bagasse is available from Unit 2 to run the plant for an economic period, is significant. The price of bagasse has already increased by 30%, rising from Rs 900/mt when the project was considered to Rs 1,200/mt at the time of commissioning. Reduced availability of bagasse will directly and negatively impact the financial performance of the project activity. Revenue from the sale of CERs will act as a buffer in the financial performance of the project, acting to partially mitigate the risks of drought and limited bagasse availability.

Institutional risks and barriers

The institutional framework (specifically the electricity offtake agreement) has provided a barrier. Although the Electricity Act, 2003 brought some liberalisation to the electricity sector, its impact is taking time to filter through to the power market. The risk inherent in a PPA has been a major factor constraining development of bagasse cogeneration capacity. The problems associated with selling to the old SEBs cannot be underestimated and this fact is highlighted by the lack of investment in the power sector by independents.

Under the terms of the PPA granted to RSCL by TNEB for the project activity, TNEB can unilaterally alter the tariff paid for electricity exports to the grid. A reduction in the price received for electricity exports to the grid would severely negatively impact the financial performance of the project activity, and again CER revenue provides a buffer partially mitigating this risk. The experience of the project between planning and commissioning already highlights this problem. TNEB initially offered a tariff of Rs 3.15/kWh for the period December to June and Rs 3.08/kWh for the period July to November. This has now been amended by TNEB to a rate Rs 3.01/kWh for the period July to November.

In addition to the option to unilaterally reduce the price paid for electricity under the PPA, TNEB also have the right to instruct RSCL to reduce the volume of electricity exported to grid – a further risk impacting the project.

Technology barriers

The set-up of the new power plant contains some novel features, in particular an air cooled condenser. This is first installation of such a technology in the Indian sugar industry. Water cooled systems are the standard technology adopted in bagasse cogeneration and the air cooled system incurs a much higher investment cost. The investment cost associated with the air cooled system relative to a water cooled system is 30% higher[10]. The technology adopted also has significant environment benefits through the reduction in water consumption when compared to the conventional water cooled systems, this is an important environmental feature given the scarcity of water in the region and a positive step towards water conservation.

Furthermore RSCL 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 a total of 507 mills[11]. 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.

The project activity therefore involves two new technologies, both of which RSCL has no previous experience in installing and operating. CER revenue provides an added incentive to utilise these technologies, and assists on overcoming the costs and risk inherent in installing the technologies.

Step 4. Common practice.
In the state of Tamil Nadu there are 38 sugar factories, 12 of which export electricity to the grid[12]. However of the 12 units 6 are selling their bagasse and generating electricity for supply to the grid solely from coal. Of the remaining 6 units, 3 of the units belonging to the Thiru Arooran group are proposed as CDM projects and currently burn coal and the remaining 3 are small scale projects ranging from 1.2MW to 7.5MW. In terms of other projects being commissioned in Tamil Nadu there are three bagasse cogeneration plants under commissioning which are of a similar scale but are also being proposed as CDM projects. It can therefore be concluded that the project under consideration is not common practice in Tamil Nadu.

More generally the project should not be considered as common practise in India. In India the latest data available on bagasse cogeneration from the The Sugar Technologists' Association of India lists 13 mills with bagasse cogeneration greater than 10MW and less than 15 MW and 28 mills with bagasse cogeneration capacities greater than 15MW. Considering that there are 507 sugar mills in India the uptake of cogeneration on a similar scale, over 15MW, represents only 5.5% penetration of the potential in terms of the number of sugar mills employing such systems[13].

Step 5. Impact of CDM registration.
CDM registration and the resulting revenue from CER sales helps the project to overcome the investment and qualitative barriers outlined above. The impact of CER revenue improves the project IRR above the

[10] A water cooled system would entail an investment cost of Rs 750 lakhs whilst the air cooled system entails an investment cost of Rs 1,000 lakhs.
[11] Cogeneration Association of India states in VI newsletter, 2nd September 2005 that "Extra high-pressure and temperature configurations of 67 kg/cm2 and 495°C, 87 kg/cm2 and 515°C, and 105 kg/cm2 & 520°C have been successfully demonstrated in a number of sugar cogen plants."
[12] "List of Cane Sugar Factories and Distilleries, Season 2003-04", Published by The Sugar Technologists' Association of India.
[13] "List of Cane Sugar Factories and Distilleries, Season 2003-04", Published by The Sugar Technologists' Association of India.

required hurdle rate, the WACC. The risks outlined in the sensitivity and barrier analyses are also significant, and CER revenue acts as an important buffer against these.

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

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Under the proposed methodology the project boundary is drawn around the export of electrical power from the new generator. Using bagasse to generate steam and electricity for process operations is standard procedure in most modern sugar factories. Therefore power used by the factory is outside the boundary.

In the case of the RSCL project, the boundary is drawn around exports of electrical power from the new 22MW turbine to the 110kV grid. The export of electricity will be solely a result of the RSCL cogeneration project. The project boundary must also account for any fossil fuel consumption at the project site. (The boilers are not expected to burn coal, but this is included as part of the monitoring plan).

Turning to the boundary used to determine the appropriate build and operating margin emission factors, Tamil Nadu is part of the Southern Regional Grid in India. The regional grids in India consist of separate State grids managed by the State Electricity Boards (SEBs). The SEBs have their own generation capacity and also purchase power from IPPs situated within the state. In addition to this, the SEBs purchase generation from central sector power stations that are situated within the regional grid. Thus the Tamil Nadu State Electricity Board (TNEB) is allocated a proportion of the generation of central sector power stations situated in the Southern Region and this power is transmitted via the inter-regional transmission system. The Southern Region grid is becoming increasingly integrated and therefore the total Southern grid is selected as the project electricity system**.**

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

>>

Date baseline study completed: 09/08/2005
Persons completing baseline study: Ben Atkinson, contact details as per Annex 1.

SECTION C. Duration of the project activity / Crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

>>
01/01/2004

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

>>
20 years

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

A fixed crediting period has been chosen

C.2.1. Renewable crediting period

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

>>

C.2.1.2. Length of the first crediting period:

>>

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>
01/10/2005

C.2.2.2. Length:

>>
10 years 0 months

SECTION D. Application of a monitoring methodology and plan

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

>>

Approved monitoring methodology AM0015, version 1, 22 September
“Bagasse-based cogeneration connected to an electricity grid”

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

>>

The monitoring methodology is applied in conjunction with approved baseline methodology AM0015. The applicable conditions discussed in Section B 1.1 of the baseline methodology are the same and therefore the applicability conditions of the monitoring methodology have been met.

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

D.2.1.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:								
ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived and for what period will it be kept? (electronic/ paper)	Comment
1. $FF_{i,y}$	Quantity of fossil fuel i used at the project site due to the project activity.	Factory records	t	m	annually	100%	Electronic Data will be kept for the duration of the crediting period plus 2 years	As per the current consent from the TNPCB the factory is not permitted to burn other fuels in the boilers. Whilst there is no plan to amend this consent we have included monitoring of the potential for burning fossil fuels in case the situation arises.
2. $COEF_i$	CO_2 emission factor of the fossil fuel i	IPCC	tCO_2 /mass or volume of unit	c	annually	100%	Electronic Data will be kept for the duration of the crediting period plus 2 years	

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

>>

Given that the consent to operate from the Pollution Control Board does not permit fossil fuels to be combusted in the boiler these sources of emissions are expected to be zero. For completeness and in case this situation changes, the monitoring plan also includes data to calculate project emissions and the following equation should be used.

$$PE_y = \sum_i FF_{i,y}.COEF_i$$

Where:

PE_y are the project emissions during the year y in tons of CO2

$FF_{i,y}$ is the quantity of fuel type i combusted due to the project activity during the year y in a volume or mass unit

$COEF_i$ is the CO2 emission factor of the fossil fuel type I fired in the boiler in the absence of the project activity in tons CO2/mass or volume of the fuel. $COEF_i$ is calculated as in section D 2.1.4

D.2.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHGs within the project boundary and how such data will be collected and archived :								
ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived and for what period will it be kept? (electronic/ paper)	Comment
3. EG_y	Electricity supplied to the grid by the project	Electricity sales invoices	MWh	m	Monthly	100%	Electronic Data will be kept for the duration of the crediting period plus 2 years	TNEB will take the meter reading on the 27th of each month at their substation and this will form the basis of invoices raised. This data may be cross referenced with the check meter.
4. EF_y	CO_2 emission factor of the grid	Calculated	tCO_2/MWh	c	*Ex-ante* at validation	0%	Electronic Data will be kept for the duration of the crediting period plus 2 years	The combined margin option is selected, based on a 50:50 weighted average of the simple operating margin and the build margin and is determined on an ex-ante basis.
5. $EF_{OM,y}$	CO_2 operating margin emission factor of the grid	Grid and IPCC data	tCO_2/MWh	c	*Ex-ante* at validation	0%	Electronic Data will be kept for the duration of the crediting period plus 2 years	Used in the calculation of Simple OM margin.
6. $EF_{BM,y}$	CO_2 build margin emission factor of the grid	Grid and IPCC data	tCO_2/MWh	c	*Ex-ante* at validation	0%	Electronic Data will be kept for the duration of the crediting period plus 2 years	Calculated as $[\sum_i F_{i,y} * COEF_i] / [\sum_m GEN_{m,y}]$ Used in calculation of BM

7. $F_{i,y}$	Amount of fossil fuel consumed by each power source / plant	Latest local statistics	Mass or volume	m	*Ex-ante* at validation	0%	Electronic Data will be kept for the duration of the crediting period plus 2 years	Used in calculation of Simple OM/ BM
8. $COEF_i$	CO2 emission coefficient of each fuel type i	Plant or country specific values are preferred to IPCC default values	tCO_2/ mass or volume unit	m	*Ex-ante* at validation	0%	Electronic Data will be kept for the duration of the crediting period plus 2 years	Used in the calculation of Simple OM/ BM
9. $GEN_{j/k/n,y}$	Electricity generation of each power source / plant j, k or n	Latest local statistics	MWh/a	m	*Ex-ante* at validation	0%	Electronic Data will be kept for the duration of the crediting period plus 2 years	Used in the calculation of Simple OM/BM

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

>>

The operating margin and the build margin will be determined *ex-ante* and therefore the variables in this section that relate to their calculation will not actually be monitored but for the sake of completeness we have included them in the section D 2.1.3 and explained how they will be applied in the following section.

Calculation of operating margin

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

Where:

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

j refers to the power sources delivering electricity to the grid, not including low-operating cost and must-run power plants, and including imports[14] to the grid,
$COEF_{i,j\,y}$ is the CO_2 emission coefficient of fuel *i* (tCO_2 / mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources j and the percent oxidation of the fuel in year(s) y, and
$GEN_{j,y}$ is the electricity (MWh) delivered to the grid by source *j*.

The CO_2 emission coefficient $COEF_i$ is obtained as

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

Where:
NCV_i is the net calorific value (energy content) per mass or volume unit of a fuel *i*,
$OXID_i$ is the oxidation factor of the fuel (see page 1.29 in the 1996 Revised IPCC Guidelines for default values),
$EF_{CO2,i}$ is the CO2 emission factor per unit of energy of the fuel *i*.
Where available, local values of NCV_i and $EF_{CO2,i}$ should be used. If no such values are available, country-specific values (see e.g. IPCC Good Practice Guidance) are preferable to IPCC world-wide default values.

Calculation of build margin

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

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

Calculation of baseline emission factor

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

Where the weights w_{OM} and w_{BM}, are 50%.

[14] As described above, an import from a connected electricity system should be considered as one power source j.

Calculation of baseline emissions due to displacement of electricity

$$BE_{electricity,y} = EF_{electricity,y} . EG_y$$

Where:

$BE_{electricity,\,y}$ are baseline emissions due to displacement of electricity during the year y in tonnes of CO_2.
EG_y is the net quantity of electricity generated in the bagasse-based cogeneration plant due to the project activity during year y.
$EF_{electricity,y}$ is the CO_2 baseline emission factor for the electricity displaced due to the project activity.

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

This section has been left blank on purpose.

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

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

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

>>

This section has been left blank on purpose.

D.2.3. Treatment of leakage in the monitoring plan

The project activity will only utilise bagasse supplied from the RSCL factory and therefore there will not be any leakage.

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

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

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

>>

This section has been left blank on purpose.

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

>>

The following equation is used to calculate the total net emission reductions from the project activity:

$$ER_y = BE_{thermal,y} + BE_{electricity,y} - PE_y - L_y$$

This may be simplified to:

$$ER_y = BE_{electricity,y} - PE_y$$

Where:

ER_y are the emission reductions of the project activity during the year y in tons of CO_2

BE_y are the baseline emissions 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

D.3. Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored		
Data *(Indicate table and ID number e.g. 3.-1.; 3.2.)*	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
1	*low*	*Data will be verified by factory receipts*
2	*low*	*IPCC data*
3	*low*	*Meters will be subject to maintenance/calibration. Data will be verified by receipts.*
5-6	*low*	*Fixed ex-ante factor based on IPCC and CEA data*
7	*low*	*CEA data*
8	*low*	*IPCC data*
9	*low*	*CEA data*

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

>>

Records of all electricity exports and fuel purchases will be the responsibility of Mr. R. Annadurai, Vice-President of RSCL.

The operational management structure and related procedures for the project as described in the "Clean Development Mechanism Monitoring Manual" drawn up by RSCL Unit 2 which includes the following elements:

1. Procedure for calibration of monitoring equipment
2. Procedure for monitoring, measurements and maintenance of monitoring equipments
3. Procedure for Review of the monitored data and project performance
4. Procedure for internal audits of GHG project compliance with operational requirements
5. Procedures for training of monitoring personnel
6. Procedure for emergency preparedness for cases where emergencies can cause unintended emissions

More generally, the recording of electricity sales will be performed in conjunction with Tamil Nadu Electricity Board (TNEB). On the 27th of each month the Divisional Engineer of TNEB will visit the substation and along with the AGM Electrical RSCL take a meter reading. This meter reading will be from the main meter at the substation but it will be checked against the "Check meter" at the substation. RSCL may in turn cross reference this meter reading with their own meters situated on the control panel in the turbine hall of the power plant.

RSCL will enter meter reading into a register once it is notified by the Divisional Engineer of TNEB and conveyed to RSCL. This will in turn be passed to the accounts department of RSCL who will raise and invoice for payment by TNEB. The register and invoices will be kept on site.

Consents to operate will be provided and should there be a change in the consent to permit the combustion of fossil fuel in the boiler monitoring of such will be carried out. This will be performed through weigh bridge receipts issued for each delivery of fossil fuel and on the basis of purchase receipts. If the purchased fuel specifies a net calorific value, this value will be used in place of the IPCC default value for India.

A detailed set of procedures for the monitoring and management of the power plant have been drawn up and this will provide the basis of the checks and functions required during the operation of the plant. At the time of verification this document will be used as a complementary tool to the data monitoring required for the CDM project.

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

>>
Ben Atkinson, Agrinergy Ltd

SECTION E. Estimation of GHG emissions by sources

E.1. Estimate of GHG emissions by sources:

>>

Zero.

No fossil fuels will be combusted in the boiler as the current consent from the Tamil Nadu Pollution Control Board only permits the use of bagasse in the boiler. The combustion of bagasse in the boiler does not give rise to any emissions as this is a renewable source.

E.2. Estimated leakage:

>>

Zero.

No leakage is expected from the project activity as own bagasse is being utilised in the project activity.

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

>>

Zero.

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

>>

$$BE_{electricity,y} = EF_{electricity,y} .EG_y$$

Based on annual electricity exports of 86,977 MWh and a grid emission factor of 0.929 tCO_2/MWh, total annual emission reductions of the project activity are estimated as 80,831 tCO_2.

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

>>

$$ER_y = BE_{electricity,y} - PE_y$$

As discussed earlier PE_y is expected to be zero and therefore the emissions reductions of the project activity are analogous to section E.4., that is 80,831 tCO_2 per annum.

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

>>

Year	Estimated emission reductions, tonnes of CO_2e
2005	20,207
2006	80,831
2007	80,831
2008	80,831
2009	80,831
2010	80,831
2011	80,831
2012	80,831
2013	80,831

2014	80,831
2015	53,887

SECTION F. Environmental impacts

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

>>
Environmental impacts of the project are considered below and are shown to be minor.

Impacts on air
In terms of air pollution, the steam generator will be fitted with an electrostatic precipitator (ESP) which will contain dust emissions well below the level required by Tamil Nadu Pollution Control Board (the level of particulate emissions should not exceed 150 mg/Nm^3).

Impacts on water
Effluent water will be treated in the existing effluent treatment plant located at the sugar factory. As previously mentioned the plant will be fitted with an air cooled, rather than water cooled, condenser thus significantly reducing water consumption by the project.

Impact on land
The connection to the grid will be 750 m away from the generation plant. The power lines making the connection will run across a field owned by Unit 2, therefore impacts on land use are minimal.

Disposal of ash
The core waste product resulting from the project activity will be fly ash. This will be collected in hoppers and used as landfill and manure (as due to its high potash content it makes good fertiliser).

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

>>
An EIA is not required by the host party regulatory authorities and the anticipated environmental impacts of the project were not considered sufficient to warrant an EIA.

However the power plant has obtained the necessary air and water consents and will carry out environmental monitoring as per the requirements of these consents.

SECTION G. Stakeholders' comments

>>

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

>>

Given the factory's location, the key stakeholders identified were local villagers and farmers. A stakeholder meeting was convened at which representatives of cane growers and the village Panchayat attended (the Panchayat is a local elected representative). Twenty six stakeholders attended this meeting and the outline of the project explained and an overview of the CDM provided.

In addition to the stakeholder meeting, a written notice (in Tamil) has been placed in a local newspaper, outlining the project and inviting comments.

G.2. Summary of the comments received:

>>

Stakeholder meeting

Questions raised by the cane growers related to the impact of the project on cane recovery and cane payments. The VP of Unit 2 explained that there would be no impact on cane recovery, whilst the project activity would allow RSCL to pay growers even faster. A second batch of points were raised that reacted positively to the impact of the project on the stability of grid electricity supplies and on employment (construction is providing 125 jobs whilst 50 will be employed full time once the project is up and running). A final batch of questions raised related to opportunities for people to supply biomass to the project.

Written notice

To date no comments have been received from the written notification.

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

>>

Answers to stakeholder questions were provided at the stakeholder meeting by the management of Unit 2. These responses satisfied the questions raised, and no further action was required.

No comments were received with respect to the written notice and therefore no action has been taken in this regard.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

The project does not benefit from any public funding.

Annex 3

BASELINE INFORMATION

The electricity baseline emission factor ($EF_{electricity,y}$) is calculated as a combined margin (CM), consisting of the combination of the operating margin (OM) and build margin (BM).

The relevant grid for the determination of the combined margin is selected as the Southern Region grid. This is because although electricity generation and distribution remains largely in the hands of the Tamil Nadu Electricity Board (TNEB), the regional grid is becoming more integrated. Moreover, central sector generation from the entire Southern Region is transmitted to Tamil.

Simple Operating Margin

In the Southern Region, low cost and must run resources constitute less than 50% of total grid generation (averaging some 20% over the previous five years). The simple operating margin is therefore selected as the appropriate method to calculate the operating margin emission factor. An ex-ante OM figure is selected and therefore a 3 year average is calculated. The simple operating margin is calculated directly from actual Central Electricity Authority (CEA) data on generation and fuel consumption combined with IPCC NCV, oxidation and emission factors. The CEA provides coal consumption data for individual coal based power plants, and these data are therefore used. In the case of gas, diesel and lignite stations, aggregate consumption at the state and regional level is provided and these data are then used to derive region average emission factors (0.487 tCO_2/MWh for gas stations, 0.542 tCO_2/MWh for diesel stations and 1.134 tCO_2/MWh for lignite stations). The results of the OM calculation is outlined below:

Table 3 Southern Region Fuel Consumption, Emissions and Generation, 2001-2 to 2004-5 (excluding hydro and nuclear)

	Fuel Cons. 04-05 (kt)	Fuel Cons. 03-04 (kt)	Fuel Cons. 04-05 (kt)	Emissions 04-05 (kt)	Emissions 03-04 (kt)	Emissions 02-03 (kt)	Generation 04-05 (GWh)	Generation 03-04 (GWh)	Generation 02-03 (GWh)
Coal Plants									
ANDHRA PRADESH									
K'Gunden	3617	3395	3839	6700	6288	7111	5363	4183	4999
K'Gunden new	2699	2533	2865	5000	4693	5307	4141	3994	3730
Vijawada	6863	7161	7227	12712	13264	13387	9849	10104	10288
R'Gunden	317	312	272	587	578	504	496	471	390
Nellore	150	148	157	278	274	291	154	146	147
Rayal Seema	2149	2246	2300	3981	4160	4260	3354	3331	3488
R'Gunden STPS	10490	10167	10452	19431	18832	19360	17170	16332	16839
Simhadri	5556	5231	3428	10291	9689	6350	8122	7722	4979
KARNATAKA									
Raichur	6923	6982	6613	12824	12933	12249	10718	11400	10290
TAMIL NADU									
Ennore	1156	1186	1663	2141	2197	3080	1223	1258	1747
Tuticorin	5563	5292	5053	10304	9802	9360	8180	8084	8187
Mettur	4852	4918	4846	8987	9110	8976	6684	6735	6739
North Chennai	2816	3086	3276	5216	5716	6068	3916	4347	4405
Gas Plants									
ANDHRA PRADESH									
Vijeswaran GT				971	1046	990	1993	2147	2031
Peddapuram CCGT				556	609	414	1141	1249	850
Jegurupadu GT				692	733	771	1420	1505	1583
Kondapalli GT				1095	1090	1207	2246	2238	2477
Godavari GT				669	536	609	1373	1100	1250
KERALA									
Cochin CCGT				54	483	149	112	991	305
Kayam Kulam GT				302	1032	1036	621	2118	2127
KARNATAKA									
Tanir Bavi				307	795	624	630	1631	1280
TAMIL NADU									
Basin Bridge GT				20	43	134	41	89	276

Nariman GT	0	0	0	0	0	0
Valuthur GT	272	327	51	558	671	104
Kuttalam GT	312	53	0	641	108	0
Kovikalappal	372	363	354	763	745	726
Karuppar GT	0	0	0	0	0	0
P Nallur CCGT	226	640	1057	464	1314	2169
Valantharvi GT	0	0	0			
PONDICHERRY						
Karaikal	134	135	129	276	277	265
Diesel Plants						
ANDHRA PRADESH						
LVS Power DG	133	0	1	246	0	2
KERALA						
Bramhapuram DG	74	144	145	136	266	267
Kojikode DG	87	170	209	161	313	385
Kasargode DG	9	42	80	16	78	148
KARNATAKA						
Yelhanka DG	147	208	387	271	384	715
Bellary DG	22	23	35	40	42	64
Belgaum DG	129	127	192	238	235	355
TAMIL NADU						
Samayanallur DG	207	248	319	382	457	589
Samalpatti DG	194	248	338	357	458	623
B. Bridge DG	413	537	655	762	992	1209
LAKSHADWEEP						
Laksh DG	13	0	0	23	0	0
Others						
KARNATAKA						
Torangallu - coal, blast furnace gas	0	0	0	516	766	872
TAMIL NADU						
Neyveli TPS (lignite)	1515	1582	460	1336	1395	406
Neyveli ST I (lignite)	4828	4989	5013	4258	4400	4421
Neyveli ST II (lignite)	10485	11342	11900	9247	10003	10495
Neyveli FST Ext (lignite)	3671	2260	101	3238	1993	89
Total	126360	127342	123662	112876	116072	112311
Operating Margin				**1.1195**	**1.0971**	**1.1011**

3 year average OM	**1.106**

Source: CEA, IPCC

Build Margin

Commissioning dates have been obtained from various sources for all plants located in the Southern Region. Total generation in the Southern grid in the period April 2004 to March 2005 was 142316.09 GWh. The most recent 5 capacity additions in the grid account for only 0.27% of this, and the most recent capacity additions accounting for 20% of generation must be taken as the base for the build margin calculation. These capacity additions and the associated fuel consumption and emissions are outlined below. (Generation data, fuel consumption and emissions are obtained as for the approximate operating margin.)

Table 4 Recent Capacity Additions, Generation and Emisions

Plant	Plant Type	Capacity Addition (MW)	Commissioning Date	Generation 04-05 (GWh)	Emissions 04-05 (kt)
Kadra	Hydro	150	01/07/1999	231	0
Kodasali	Hydro	120	01/07/1999	215	0
Kaiga	Nuclear	220	01/07/1999	1463	0
Harangi	Hydro	9	19/07/1999	0	0
Singur	Hydro	7.5	05/11/1999	1	0
Kojikode	DG	128.8	06/11/1999	161	87
Torangallu	WHR/Coal	130	15/12/1999	258	0
Karaikal	GT	32.5	03/01/2000	276	134
Singur	Hydro	7.5	31/03/2000	1	0
Bellary DG	DG	25.2	15/05/2000	40	22
Kondapalli	GT	350	01/07/2000	2246	1095
Kayam Kulam	GT	350	01/07/2000	621	302
Kaiga	Nuclear	220	26/09/2000	1463	0
Kovilkalappal	GT	107	30/09/2000	763	372
Kuttiadi	Hydro	50	27/01/2001	148	0
Kasargode DG	DG	21.9	15/03/2001	16	9
Srisailam LB	Hydro	150	26/04/2001	235	0
Pillaiperumal Nallur	GT	330.5	26/04/2001	464	226
Tani Bavi	GT	220	15/05/2001	630	307
Kuthungal	Hydro	21	01/07/2001	36	0
Gerusuppa	Hydro	240	01/07/2001	438	0
Belgaum DG	DG	81.3	01/07/2001	238	129
Madhavamantri	Hydro	3	15/07/2001	23	0
Samalpatti	DG	105.7	15/07/2001	357	194
Samayanallur DG	DG	106	22/09/2001	382	207
Srisailam LB	Hydro	150	12/11/2001	235	0
Peddapuram	CCGT	140	30/11/2001	726	354
Peddapuram	CCGT	80	30/11/2001	415	202
LVS	DG	36.8	15/01/2002	0	0
Simhadri	Thermal	500	15/02/2002	4061	5146
Srisailam LB	Hydro	150	19/04/2002	235	0
Simhadri	Thermal	500	15/08/2002	4061	5146
Neyveli Extn	Lignite	210	15/09/2002	1619	1836
Srisailam LB	Hydro	150	29/11/2002	235	0
Raichur	Thermal	210	10/12/2002	1531	1832
Neyveli	Lignite	250	16/12/2002	1336	1515
Valuthur GT	GT	60	24/12/2002	352	172

Valuthur GT	GT	35	13/03/2003	205	100
Neyveli Extn	Lignite	210	15/03/2003	1619	1836
Srisailam LB	Hydro	150	28/03/2003	235	0
Srisailam LB	Hydro	150	04/09/2003	235	0
Kuttalam GT	GT	64	30/11/2003	410	200
Chembukadavu	Hydro	6.5	30/12/2003	6	0
Urumi	Hydro	6.2	30/12/2003	1	0
Mini Hydel	Hydro	7.6	01/01/2004	5	0
Kuttalam GT	GT	36	30/03/2004	231	112
Malankara	Hydro	10.5	30/05/2004	3	0
Karuppur	GT	119.8	09/02/2005	0	0
Almatti DPH	Hydro	125	30/07/2005	139	0
Total				28603	21532
Build Margin					**0.753**

Applicable Emission Coefficient

As outlined in AM0015, the baseline emission coefficient is taken as a weighted average of the operating margin and the build margin. The default weighting of 0.5, 0.5 is taken and therefore the CM is **0.929**[15].

[15] This is a conservative factor as indicated through a similar calculation using only data from Tamil Nadu based power plants, performing the analysis on this sample of plants we arrive at a CM of 1.074 tCO_2e/MWh. The CEF in the first PDD put up for international stakeholder comments used a CM of 0.908 tCO_2e/MWh, this has been amended due to an error in the calculation stemming from the density of naptha, it was initially reported as 0.00000078 kt/kl and this has been corrected to 0.00078 kt/kl. This correction resulted in an increase of the CEF for gas based plants from 0.361 tCO_2e/MWh to 0.487 tCO_2e/MWh.

Annex 4

MONITORING PLAN

Electricity exports and fuel purchases, if required, will be recorded by Mr. R. Annadurai, Vice-President of RSCL. Records of all electricity sales and of any fuel purchases will be kept at the offices of Unit 2.

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