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

CONTENTS

Annexes

Appendices

Enclosures

SECTION A. General description of project activity

A.1 Title of the project activity:

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Bagasse based Cogeneration Project at Pudukkottai

Tamil Nadu, India

Version 04

02/07/2007

A.2. Description of the project activity:

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Purpose of the project activity

This project activity involves implementation of a bagasse based cogeneration plant ("project activity"), which commenced operation in March 2006. The primary objective in developing the project activity is to increase the efficiency of energy generation from sugar mill generated bagasse by replacing the existing low efficiency cogeneration system with a higher efficiency system. The resulting incremental electricity generation is exported to the grid.

EID Parry India Limited (EID Parry) belongs to the Murugappa Group, which has evolved into one of the biggest industrial houses in India. The company has been a pioneer in many fields, setting up of India's first Sugar plant at Nellikuppam (1842), fertiliser plant at Ennore and sanitary ware plant at Ranipet. EID Parry has now four sugar mills at Nellikuppam, Pugalur, Pudukkottai and Pettavaithallai. EID Parry has won the Green Tech Award on Safety in Sugar mills and has obtained ISO 14001 certification for its sugar plants in Pudukkottai & Nellikuppam. EID Parry is well known for conformance to environmental standards even before they become mandatory. EID Parry being progressive and to be competitive in the open market economy of India, took initiatives in developing this project under the Clean Development Mechanism (CDM) of United Nations Framework Convention for Climate Change.

The project activity is located at Kurumbur village-Aranthangi Taluk, Pudukkottai district in the Indian subcontinent. The cogeneration plant is a part of the existing sugar mill at Pudukkottai. The co-generation plant includes a double extraction cum condensing turbo generator of 18 MW capacity with a 100 ton per hour boiler (bi-drum, natural circulation water tube type) with outlet steam parameters, 86 kg/cm^2 and 510 ± 5^0C. The cogeneration plant would operate for around 250 days during the crushing season and around 50 days in the off-season. The power export to the TNEB from this project would be around 11 MW in season period and 15 MW in the off-season. The project activity during the identified

crediting period (2007-2016), would result in an incremental electricity of approximately 102.22 MU every year.

Project's contribution to sustainable development:

Conservation of natural resources and environment:

The project activity reduces exploitation of natural resources (fossil fuels) for energy generation by supplementing the local electricity grid with a sizeable quantity (102.22 MU/annum) of clean power. The project uses the most efficient and environment friendly technology and reduces 86,623 tonnes of carbon dioxide emissions over ten years. Further, the project reduces other negative environmental aspects of conventional power plants like emission of particulate matter, ash disposal etc. The project promotes the usage of renewable sources for power generation by successful demonstration of biomass based power generation.

Contribution to Socio-economic development:

The export of electricity to the grid aids to reduce power outages thereby improving industrial output resulting in economic development of the region. The improved power situation encourages new small and medium industries that improve the rural employment scenario.

The project aids in socio-economic development even as it conserves natural resources and provides environmental benefits and thus it may be considered as contributing to sustainable development.

A.3. Project participants:

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Name of Party involved (*) (host indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant
India (Host Country)	EID Parry India Limited (Private Entity)	No

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):

>>
India

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

>>
Tamil Nadu

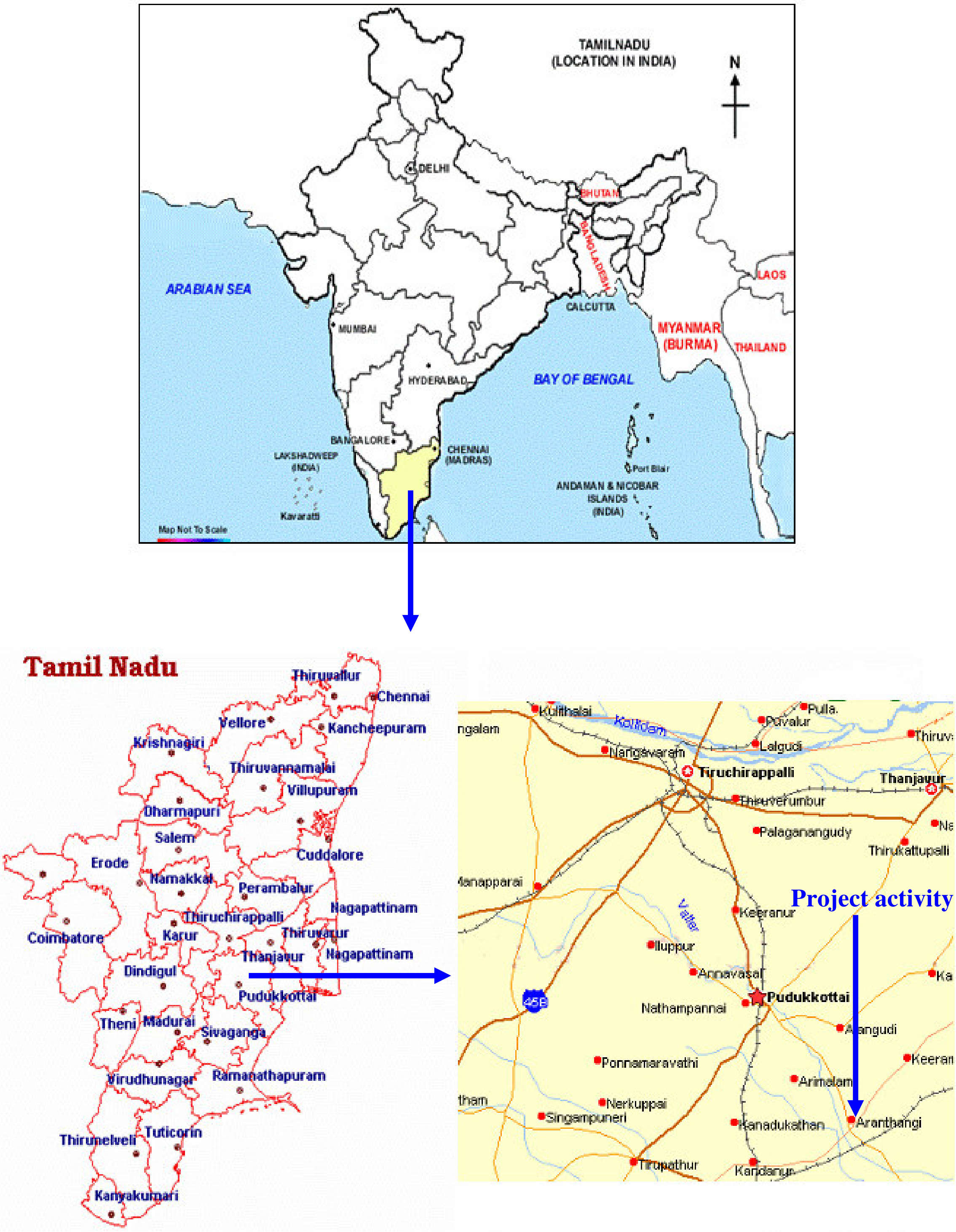
A.4.1.3. City/Town/Community etc:

>>
Kurumbur Village – Aranthangi Taluk, Pudukkottai district

Land Survey Numbers 110/1, 2A, 2B, 2C, 447, 448 & 449

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

>>
The project activity is located at Kurumbur Village-Aranthangai Taluk, Pudukkottai district in the Indian state of Tamil Nadu. The specific land survey numbers of the project location are 110/1, 2A, 2B, 2C, 447, 448 & 449. The specific geographical co-ordinates are Longitude 78°58'12" East and Latitude 10°15'02" North. The project site is located on the road connecting Pudukkotai town and Aranthangi town at a distance of around 23 kms from Pudukkotai town. The area is sparsely populated with industries. The nearest major railway station is Pudukkottai, which is approximately 20 kilometres away from the project site and Pudukkottai district has a coastline of 39 kilometres along Bay of Bengal. Power produced by the project activity will be stepped from 11 KV to 110KV to synchronise it with the grid and will be supplied to sub station at Alianilai, which is around 6 kilometres from Project site. Site conditions, availability of space, transport facility, fuel, water, convenience of interconnection with electrical grid for the power evacuation etc., were studied before implementation of the project.


TAMILNADU
(LOCATION IN INDIA)
N
DELHI
BHUTAN
BANGLADESH
LAOS
ARABIAN SEA
CALCUTTA
MUMBAI
MYANMAR
(BURMA)
THAILAND
HYDERABAD
BAY OF BENGAL
BANGALORE
CHENNAI
(MADRAS)
LAKSHADWEEP
(INDIA)
Port Blair
ANDAMAN & NICOBAR
ISLANDS
(INDIA)
Kavaratti
Map Not To Scale
Tamil Nadu
Thiruvallur
Chennai
Vellore
Kancheepuram
Krishnagiri
Thiruvannamalai
Villupuram
Dharmapuri
Salem
Erode
Cuddalore
Namakkal
Perambalur
Nagapattinam
Coimbatore
Thiruchirappalli
Karur
Thiruvarur
Thanjavur
Nagapattinam
Dindigul
Pudukkottai
Theni
Madurai
Sivaganga
Virudhunagar
Ramanathapuram
Thirunelveli
Tuticorin
Kanyakumari
Kulithalai
Kollidam
Pulla.
Puvalur
Thiruv
Nangavaram
Lalgudi
Tiruchirappalli
Thanjavur
Thiruverumbur
Palaganangudy
Thirukattupalli
Manapparai
Project activity
Keeranur
Iluppur
Annavasal
Pudukkottai
Nathampannai
Alangudi
Ponnamaravathi
Keeran
Arimalam
Nerkuppai
Singampuneri
Kanadukathan
Aranthangi
Tiruppathur
Kandanur

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

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The project activity may be classified as a renewable energy project since it uses renewable biomass to generate electricity and export to the grid. Therefore the project activity is categorized under Category 1: Energy industries (renewable - / non-renewable sources) as per the scope of the project activities enlisted in the latest 'List of Sectoral Scopes' for accreditation of operational entities.

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

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EID Parry has installed a high pressure Steam-Rankine cycle replacing the existing low pressure system. Steam-Rankine cycle is one of the commercial methods available for power generation in the MWs scale. The process involves circulation of working fluid (steam) around the cycle by creating high pressure steam in the boiler which drives an expander (TG) to generate power. When an alternator is connected to the TG's shaft, electricity is generated. EID Parry's new project plant and the low pressure system used earlier are both based on this cycle. The project activity constitutes a boiler of capacity 100TPH with outlet parameters of 86 kg/cm^2 & 510$\pm$5^{0}C using biomass as fuel, an 18 MW extraction cum condensing turbo-generator and auxiliary equipments. The high-pressure configuration of the system is technologically advanced, modern and highly efficient. EID Parry is among the few sugar mills in the country in proposing this configuration. Moreover, the project has adopted an air-cooled steam condenser against conventional practice of water cooled condensers. This would conserve huge volumes of water required for evaporative cooling, which is replaced by circulation of atmospheric air.

The accessories and auxiliary systems for the 18 MW cogeneration scheme include:

1) Pneumatically controlled bagasse handling system
2) Air cooled condenser
3) Firing system with re-injection system to save unburnt fuel
4) Feed water system fitted with conductivity meter to ensure quality of feed water
5) All electric motors and fans fitted with Variable Frequency Drives
6) De-aerator and Reverse Osmosis systems for feed water supply
7) Electrostatic precipitator to keep stack emissions under permissible levels
8) Effluent treatment plant, Ash handling system to take care of waste water and ash respectively
9) Distributed Control System (DCS)
10) Fire Protection System

11) Air conditioning and ventilation system for control room, panel room and TG building
12) Compressed air system for instruments and control systems
13) Electrical systems & lightning protection system, for its successful operation
14) Switchyard and power evacuation facilities of suitable standards

The power generated would meet the captive electricity requirements of the sugar factory and extraction steam would meet the process steam requirements. The surplus electricity is exported to the TNEB grid.

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 tCO_2e
2007-08	86,623
2008-09	86,623
2009-10	86,623
2010-11	86,623
2011-12	86,623
2012-13	86,623
2013-14	86,623
2014-15	86,623
2015-16	86,623
2016-17	86,623
Total estimated reductions (Tonnes of CO_2e)	**866,230**
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	86,623

A.4.5. Public funding of the project activity:

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There is no public funding for the project activity.

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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Title: Consolidated baseline and monitoring methodology for grid-connected electricity generation from biomass residues (ACM0006) Version 04

Reference: This consolidated baseline and monitoring methodology (ACM0006) is based on elements from the following methodologies:

- AM0004: "Grid-connected Biomasss Power-Generation that avoids uncontrolled burning of biomass which is based on the A.T Biopower Rice Husk Power Project in Thailand."
- AM0015: "Bagasse-based cogeneration connected to an electricity grid based on the proposal submitted by Vale do Rosario Bagasse Cogeneration, Brazil."
- NM0050: " Ratchasima SPP Expansion Project in Thailand."
- NM0081: "Trupan biomass cogeneration project in Chile."
- NM0098: "Nobrecel fossil to biomass fuel switch project in Brazil"

This methodology also refers to the ACM0002 ("Consolidated baseline methodology for grid-connected electricity generation from renewable sources") and the latest version of the *"Tool for the demonstration and assessment of additionality"*.

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

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Among the methodologies approved by UNFCCC for biomass based CDM project activities, ACM0006 has been chosen as most suitable to this project activity. The project activity meets the applicability conditions of ACM0006, as demonstrated below:

Conditions of ACM0006	Applicability to project activity
Applicable to grid connected and biomass residue fired electricity generation project activities	Bagasse fired in the project activity is a biomass residue. The project activity is connected to the TNEB grid to which it exports surplus electricity
Project activity may include the installation of a new biomass power generation plant at a site where currently no power generation occurs	Not relevant to the project activity
May be based on the operation of a power generation unit located in an agro-industrial plant generating the biomass residues	Based on the efficiency improvement of a power generation unit located in a sugar plant
Biomass residues are defined as *biomass* that is a by-product, residue or waste stream from agriculture, forestry and related industries. This shall not include municipal waste or other wastes that contain fossilized and/or non-biodegradable material.	Bagasse used in the project activity is a residue from agriculture related industry (sugar plant)
No other biomass types than *biomass residues*, as defined above, are used in the project plant and these biomass residues are the predominant fuel used in the project plant (some fossil fuels may be co-fired).	Bagasse will be used as the predominant fuel, however, some amount of coal may be co-fired during drought or other emergency situations
For projects that use biomass residues from a production process (e.g. production of sugar or wood panel boards), the implementation of the project shall not result in an increase of the processing capacity of raw input (e.g. sugar, rice, logs, etc.) or in other substantial changes (e.g. product change) in this process.	The project activity uses the residue (bagasse) from sugar manufacturing. The production process is independent of the project activity and shall not result in increase of the sugar plant crushing capacity.
The biomass used by the project facility should not be stored for more than one year.	Bagasse is not stored on the site for more than one year.
No significant energy quantities, except from transportation of the biomass, are required to prepare	The preparation of bagasse doesn't involve significant energy consumption. Some quantity of

the biomass residues for fuel combustion	energy may be used for biomass transportation from outside during unavailability of bagasse.
The methodology is only applicable for the 17 combinations of project activities and baseline scenarios identified in the methodology.	Project activity fits in scenario 14.

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

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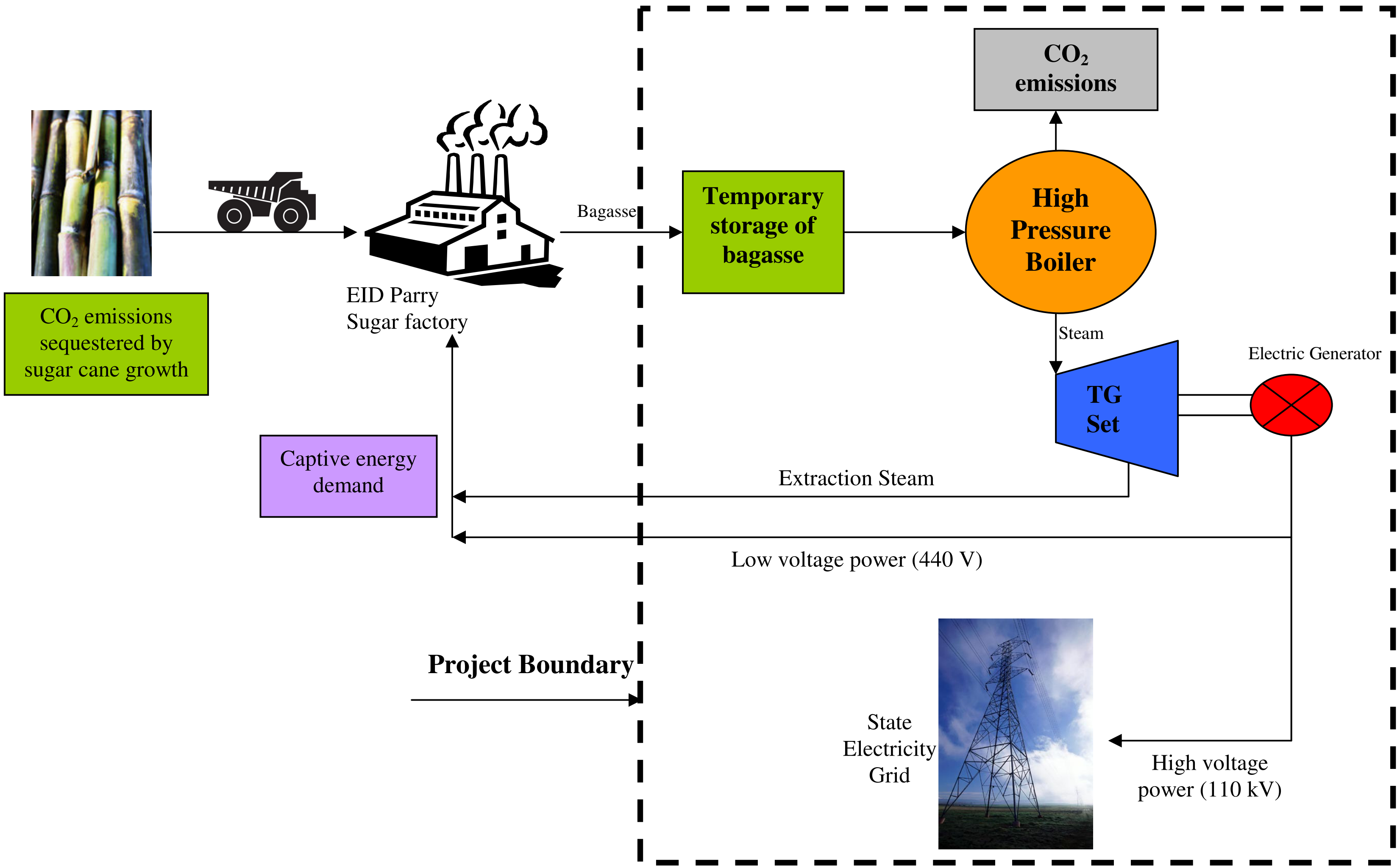
Figure B.3: Project Boundary



The project participants have included in the project boundary, GHG emissions sources from the project activity and emission sources in the baseline, as prescribed by the methodology ACM0006. The project boundary includes the following emission sources:

	Source	**Gas**		**Justification/Explanation**
Baseline Scenario	Grid Electricity Generation	CO_2	Included	Main Emission source.
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.
	Heat Generation in Onsite boilers	CO_2	Excluded	Heat generation is using biomass as fuel.
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.
	Decay or uncontrolled burning of surplus biomass	CO_2	Excluded	No surplus biomass
		CH_4	Excluded	No surplus biomass
		N_2O	Excluded	No surplus biomass
Project Scenario	Onsite fossil fuel combustion due to the project activity	CO_2	Included	Important emission source.
		CH_4	Excluded	Excluded for simplification. This quantity is very small.
		N_2O	Excluded	Excluded for simplification. This quantity is very small.
	Offsite transportation of	CO_2	Included	An important emission source.

	biomass	CH_4	Excluded	Excluded for simplification. This quantity is very small.
		N_2O	Excluded	Excluded for simplification. This quantity is very small.
	Combustion of biomass for electricity and/or heat generation	CO_2	Excluded	It is assumed that CO_2 emissions from surplus biomass residues do not lead to changes of carbon pools in the LULUCF sector.
		CH_4	Excluded	This emission source must be included only if CH4 emissions from uncontrolled burning or decay of biomass in the baseline scenario are included.
		N_2O	Excluded	Excluded for simplification. This quantity is very small.
	Biomass storage	CO_2	Excluded	It is assumed that CO_2 emissions from surplus biomass residues do not lead to changes of carbon pools in the LULUCF sector.
		CH_4	Excluded	Excluded for simplification. Since biomass is stored for not longer than one year, this emission source is assumed to be small.
		N_2O	Excluded	Excluded for simplification. This quantity is very small.

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

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As prescribed by ACM0006, project participants have determined the most plausible baseline scenario among all realistic and credible alternatives separately regarding:

- How power would be generated in the absence of the CDM project activity
- What would happen to the biomass in the absence of the project activity
- In case of cogeneration projects: how heat would be generated in the absence of the project activity

The following paragraphs illustrate the various potential alternatives, and the most plausible baseline scenario is determined using steps 3 (Barrier analysis) of the "tool for the assessment and demonstration of additionality" as prescribed by the methodology.

Power generation: How power would have been generated in the absence of the project activity?

Alternatives available for power generation:

1. *Option P5: Continuation of power generation at the existing power plant fired with the same type of biomass as 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*
2. *Option P1: Implementation of the project activity not undertaken as a CDM project activity*
3. *Option P4: Power generation in existing and/or new grid connected power plants*

Identification of most likely baseline power generation scenario using barrier analysis:

In Option P5 scenario, the project proponent would use a lower efficient cogeneration plant compared to the project activity, which would result in consumption of the entire bagasse to generate steam and power for in-house utilization or captive consumption only. Though this alternative does not entail surplus power generation and export to an electricity grid, it is in compliance with all applicable legal and regulatory requirements and could be the baseline.

In India, all the sugar mills have their own cogeneration units, most of them operating with low-pressure boiler configuration of below 45 kg/cm^2 (Maximum are in the range of 21 kg/cm^2 to 45 kg/cm^2) to cater to the in house steam and power requirements. This scenario (present situation of sugar mills) is considered as "Business As Usual" case for the Indian sugar industry, where in, bagasse is used at lower efficiency levels to meet the internal power requirements of sugar mills.

Prior to the 18 MW cogeneration plant, the sugar mill was equipped with two boilers, a 51.5 TPH and 29 TPH with parameters 17 kg/cm^2 and 280^0 Centigrade and two turbines of capacities 2.0MW and 2.5MW were existent to meet the energy requirements of the sugar mill and would have continued operating till the end of the crediting period. Conventionally it is easier for sugar mills to opt for low efficiency cogeneration plant considering that they are less capital intensive. Cogeneration plants with outlet boiler pressure of lower pressure produce less power (as compared to EID Parry's 86 kg/cm^2) and are less capital intensive. EID Parry had an option to continue operating its low pressure cogeneration system as against selected configuration of 86 kg/cm^2 outlet boiler pressure, which would incur a high capital outlay. Moreover, the other investment barrier to the project activity was the uncertainty of the financial

returns, which is sensitive to tariff change and climatic risks (cane availability). There are also no legal and regulatory requirements for continuation of the low pressure system. However, they have implemented "modern and energy efficient technology", which was available in the country at the time of implementation of the project activity. In cognizance of the investment barriers and other barriers, EID Parry opted for implementation of the high pressure system (Option P1) considering that the CDM incentive would improve the long term financial sustainability of the project activity.

The existing generation mix of the southern regional grid is dominated by fossil fuel power plants and future capacity additions planned are largely from fossil fuel based power plants. Therefore, in the BAU scenario, the grid is likely to remain as a GHG emission intensive power source.

Barriers	**Option**		
	P5	**P1**	**P4**
Investment	No	Yes	No
Technological	No	Yes	No
Common practice	No	Yes	No
Institutional	No	No	No

The most likely baseline power generation scenario would be a combination of Option P5 and Option P4.

Heat (steam) generation: How heat would be generated in the absence of the project activity?

Alternatives available for heat generation:

1. *Option H5: Continuation of heat generation in the existing low pressure cogeneration plant (old boiler) fired with the same type of biomass (i.e. bagasse and biomass) as in the project activity and implementation of the project activity not undertaken as a CDM project activity, at the end of the lifetime of the existing plant.*
2. *Option H1: Implementation of the project activity not undertaken as a CDM project activity.*

Identification of most likely baseline heat generation scenario using barrier analysis:

Since the project activity is a cogeneration activity, the alternatives for heat generation are similar and associated to the alternatives for power generation. Therefore, analysis of the power generation alternatives applies as well to heat generation.

In the pre-project scenario, the process heat requirement of the sugar factory has been met by steam from the exhaust of the backpressure turbines of the old low pressure cogeneration system. In the absence of

the project activity, the low pressure cogeneration system would have continued to operate without any problems till the end of the crediting period and the factory would have continued to meet its heat requirement from the system. There is no policy or regulation enforcing the replacement of the low pressure system with the capital intensive high pressure system. EID Parry could have continued heat generation in the low pressure system.

Barriers	**Option**	
	H5	**H1**
Investment	No	Yes
Technological	No	Yes
Common practice	No	Yes
Institutional	No	No

The most likely baseline heat generation scenario would be Option H5.

Biomass: What would happen to the biomass in the absence of the project activity?

Alternatives available for biomass:

1. *Option B4: The biomass would have been used for heat and/ or electricity generation at the project site*
2. *Option B1: Left to decay without utilizing it for energy purposes or Option B3: Sold off and used for power generation at other sites:*

Identification of most likely baseline biomass scenario using barrier analysis:

In the absence of the project activity bagasse would have been used to generate heat and power (required for captive consumption only) at the project site by the old boiler and turbine configuration. Refer to description of this under “alternatives for power generation” above.

Prior to the implementation of the project activity, the bagasse generated in-house was used in the low pressure cogeneration system. Since the efficiency of low pressure system is very low, the entire bagasse generated would be used to meet only the captive energy requirements with no surplus bagasse. This would have continued to be the scenario in the absence of the CDM project activity. Therefore, the options B1 and B3 are not the likely alternatives in the absence of the project activity.

Barriers	**Option**	
	B4	**B1, B3**
Investment	No	Yes
Technological	No	Yes
Common practice	No	Yes
Institutional	No	No

The most likely baseline biomass scenario would be Option B4.

Most plausible baseline scenario for the project activity:

The above analysis shows that the most likely baseline scenario is a combination of:

- Option P4 and P5: Continuation of power generation at the existing power plant (old boiler with lower efficiency) fired with the same type of biomass as the project activity and partly in existing and/or new grid connected power plants.
- Option H5: Continuation of steam generation from bagasse
- Option B4: Use of biomass to generate heat and power at the project site

Baseline scenario 14 of ACM0006 is the applicable baseline scenario for the project activity.

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): >>

In order to demonstrate that the CDM project activity reduces anthropogenic GHG emissions that would have occurred in the absence of the project activity, it is necessary to prove that:

- The implementation of the project activity is not the baseline scenario, (i.e., There would be no increase in efficiency of energy generation and EID Parry would not export power to the grid,).

ACM0006 prescribes the use of the "Tool for the demonstration and assessment of additionality" (Figure B5.1) for the above purpose, which is applied to the project activity as described further:

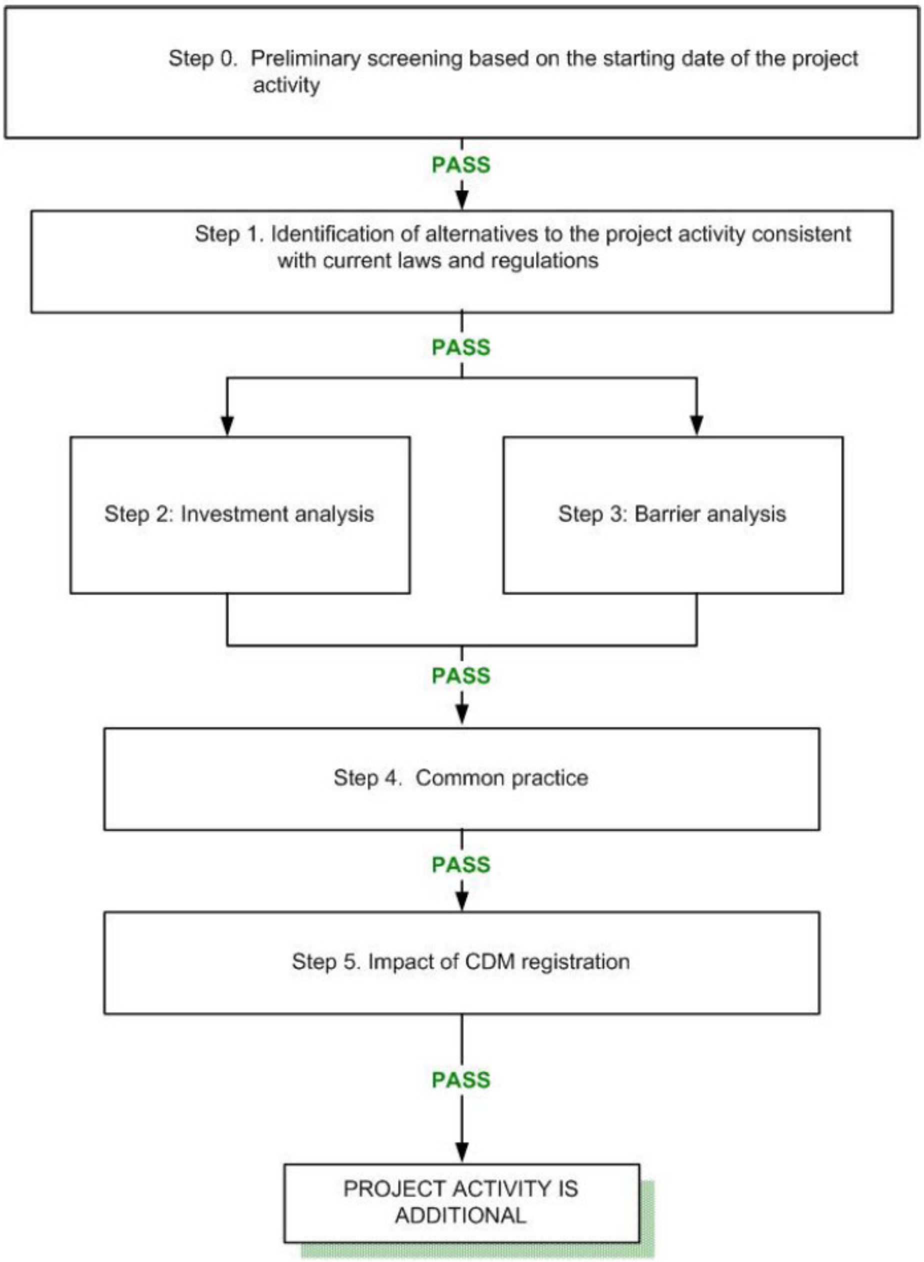

Fig B5.1 Flowchart for demonstrating additionality of the project

B.5.1 Step 0: Preliminary screening based on the starting date of the project activity

The project promoters do not wish to have the crediting period prior to the registration of the project activity. However, the consideration of CDM incentive prior to starting the project activity is described below:

During August 2004, EID Parry started exploring the surplus power generation potential at its Pudukkottai sugar plant by efficiency enhancement of the cogeneration system. Being aware of the GHG emission reduction potential and the prospective carbon credits of the project activity, EID Parry started corresponding with some prominent organisations involved in carbon trading. A proposal of the project activity including techno-economic parameters and preliminary estimates of carbon credits was submitted to EID Parry's Management for approval. The various aspects of the proposal were discussed in the Board of Director's Meeting held on 11.10.2004 during which EID Parry's management took a decision to go ahead with the project. EID Parry considered that the prospective CDM revenues could help offset the risks faced by the project activity and enable its long term sustainability.

B.5.2 Step 1 - Identification of alternatives to the project activity consistent with current laws and regulations

Project participants have determined the most plausible baseline scenario among all realistic and credible alternatives separately regarding:

- How power would be generated in the absence of the CDM project activity
- What would happen to the biomass in the absence of the project activity
- In case of cogeneration projects: how heat would be generated in the absence of the project activity

In sub-step 1a and 1b, EID Parry is required to identify realistic and credible alternative(s) that were available to EID Parry or similar project developers that provide output or services comparable with the project activity. These alternatives are required to be in compliance with all applicable legal and regulatory requirements.

- **Sub-step 1a. Define alternatives to the project activity**
  - EID Parry identified the different potential alternative(s) to project activity available to all other sugar-manufacturing units in India. The alternatives have been analysed using (step3: Barrier analysis of the "Tool for demonstration of Additionality") and the most plausible baseline scenario has been identified in Section B.4.

Summary on alternatives

Considering the alternatives explained in section B.4 above, it can be inferred that for the project activity, the most likely alternatives consistent with current laws and regulations are:

1. A combination of:
   - Option P4 and P5: Continuation of power generation at the existing power plant (old boiler with lower efficiency) fired with the same type of biomass as the project activity and partly in existing and/or new grid connected power plants.
   - Option H5: Continuation of steam generation from bagasse
   - Option B4: Use of biomass to generate heat and power at the project site

2. The implementation of the project activity not undertaken as a CDM project activity.

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

Both the above two alternatives are consistent with applicable laws and regulations:

- The applicable regulations do not restrict EID Parry to continue steam and power generation using the lower efficiency systems
- The applicable regulations do not restrict EID Parry to continue steam and power generation from bagasse or other biomass
- Though the Ministry of Non-Conventional Energy Sources (MNES) aims to achieve 10% of installed power generation capacity from renewable sources, there is no mandate on any private entity to enhance power generation capacity from renewable sources.

The next step for additionality justification as per the Fig B5.1 is either

- **Step 2 - Investment analysis (OR)**
- **Step 3 - Barrier analysis**

As EID Parry has faced barriers and risks during the implementation of the project activity, it is discussed in greater detail in order to further elaborate on the reasons due to which, the alternative two (Implementation of the project activity not undertaken as a CDM project activity) is not the baseline scenario. In view of overall project scenario, EID Parry proceeds to establish project additionality by conducting ‘Barrier Analysis’ as under.

B.5.3 Step 3: Barrier Analysis

It is required to demonstrate that the project activity faces barriers which:

- Prevent the implementation of this type of project activity; and
- Do not prevent the implementation of at least one of the alternatives

Sub-step 3a: Identification of barriers that would prevent the implementation of the project activity

During the year 2004, EID Parry explored the opportunity to improve the operational margins of its Pudukkottai sugar factory by diversifying into surplus power generation and its export to the grid. A detailed study was conducted on the feasibility of surplus energy generation by adopting high pressure cogeneration system to improve the cogeneration efficiency. Though the study projected an acceptable rate of return through energy sales to the grid, the huge investment requirements, technological uncertainties and vulnerability to climatic and tariff policy changes were major barriers for EID Parry in undertaking the project activity. The specific barriers faced by EID Parry in implementing the project activity are described below:

- **Technological Barrier**

The most plausible alternative to the project activity is to have continued with the low pressure cogeneration configuration operating with low efficiency. The project activity involved the replacement of the low pressure system with a high-pressure co-generation technology (86 kg/cm^2). The high pressure system had a very low market penetration and meant a major technological leap for EID Parry. The lack of success stories on the performance of high pressure technology and the lack of skilled manpower to operate such systems posed as major barriers to EID Parry and are described below:

- **Performance uncertainties:**

The design, construction and operation of a high pressure cogeneration system are significantly different from that of a low pressure system. At high operating pressures, boiler metallurgy (the ability to withstand thermal and mechanical stress) and water chemistry assume critical importance. The sustained performance and operational life of a cogeneration power plant depends on various factors like thermal stress pattern (cyclical loading), quality of water, steam parameters, cooling water parameters and proper operation and maintenance. A high pressure system is more sensitive to these factors than a low pressure system thus increasing the risk of performance loss and equipment damage. The high pressure (86

kg/cm^2) cogeneration technology is relatively new to the Indian sugar mills and is not established in the country/region. During conceptualisation of the project activity, the high pressure technology had very low penetration in the region (Only three sugar mills in India had adopted an 86 kg/cm^2 pressure cogeneration technology). This lack of successful high pressure systems raised performance uncertainties with respect to efficiencies of major equipment and trouble-free plant operation.

Any performance loss or frequent maintenance shutdowns would correspondingly reduce the power and steam output. EID Parry was wary that such a situation would not only impact the energy sale revenue but also affect the primary manufacturing process (The sugar plant depends on the cogeneration system for its power and steam requirements. In case the high pressure cogeneration system has to be shutdown, the sugar plant would also be shut down resulting in huge financial loss). Thus EID Parry was apprehensive of implementing a technology that not only risks the economic feasibility of the project activity but also that of the primary business.

- **Lack of trained manpower:**

As stated above, metallurgy and water chemistry are critical parameters in high pressure cogeneration systems. Minor deviations in the operating parameters could result in reduced equipment life, loss of performance and unscheduled maintenance shutdown. Therefore the Operation and Maintenance (O&M) of high pressure system is complicated and requires frequent monitoring and control of critical parameters which is possible only with a trained and experienced O&M team. The trained manpower capable of handling a high-pressure cogeneration system was not readily available to EID Parry. The low prevalence of high pressure systems in the region also meant a limited availability of skilled manpower to operate such systems. Though a preliminary training was provided to the O&M team by the equipment suppliers, EID Parry was apprehensive of this lack of experienced and trained manpower that could transform into unscheduled shutdowns, performance loss or degradation of equipment life.

It may be noted that EID Parry's apprehension about the performance uncertainty and lack of experienced and trained manpower was justified shortly after implementation of the project activity. A few months after implementation of the project activity, high silica content was noticed in the boiler feed water that had resulted in deposition of scales in the turbine blades necessitating shut down of the cogeneration plant. The reason was found to be failure of all the Reverse Osmosis (RO) membranes in the water treatment plant. All the RO membranes had to be replaced. The TG had to be transported to the supplier for removal of scales and necessary rectification work. Consequently, the project activity was

under shutdown for a period of around 60 days (20% of expected annual operating days) resulting in significant loss of revenue. The root cause for the above was identified as lack of experience of the operating personnel in the water treatment and high pressure steam system. Subsequently, a specialized training was given to the operating team in the above aspects and the importance of maintaining the above parameters within limits for trouble free operation of the plant.

- **Grid Interconnection**

The project activity involves export of power to the TNEB grid which necessitates interconnection and parallel operation of the power plant with the grid. Normally, such power plants are interconnected to the grid through a sub-station in a ring feeder system. EID Parry's project activity, being located in a remote area, had to connect to the grid in radial feeder. For interconnection through a radial feeder, EID Parry had to adopt the alternate option of grid interconnection through the Loop In – Loop Out (LILO) system instead of the conventional interconnection through a sub-station. Since the radial feeders are prone to more instabilities than a ring feeder system, the grid interconnection is more difficult to operate and poses a higher risk to the project activity than the conventional system. The project activity is more prone to be affected by the grid instabilities and therefore frequently switch to "islanding mode" operation. The risk of equipment damage is higher than that of the conventional system considering the frequency of such disturbances and switching to "islanding mode". The necessity to adopt such a higher risk grid interconnection system posed as a technical barrier to project promoters.

➢ **Institutional barrier:**

The main purpose of the project activity is to generate revenue from the sale of surplus electricity to the TNEB. For their earnings, the project depends on the payment from TNEB against the sale of electricity to the grid. This is the only source of revenue to recover the project investment and thus the economic feasibility of the project activity is vulnerable to TNEB's power purchase tariff and related policies.

The Power Purchase Agreement (PPA) between EID Parry and TNEB is designed such that the quantity of energy delivered and tariff payable are liable to revision. The provisions of the PPA allow TNEB to revise the power purchase tariff as per orders released by the Tamil Nadu Electricity Regulatory Commission (TNERC) from time to time. This posed a significant threat to the long term cash flow and feasibility of the project activity. Presently TNEB is under pressure to reduce[1] its power purchase cost

[1] http://tnerc.tn.nic.in/orders/MP%20263%20Nellikuppam%20krishnamurthy.pdf and http://tnerc.tn.nic.in/caselist.htm

from Independent Power Producers (IPPs) so that it can afford to lower power supply tariff to its consumers. Any downward revision of the purchase tariff will have serious negative impact on the project returns, as was the case with biomass power plants in the neighbouring state[2]. EID Parry had to take this risk and face this institutional barrier on which they have limited or no control. It may be noted that shortly after implementation of the project activity, TNERC has revised the purchase tariff for bagasse cogeneration plants:

- If in any financial year the plant load factor is above 55%, the energy exported in excess of it shall be paid at rates applicable to fossil fuel based generating stations
- Grid support and grid availability charges

- **Other barriers:**
  - **Climatic risks:**

The revenues from the project are mainly dependent on the quantity of power exported, generation cost and the tariff at which the TNEB purchases it. The quantum of power exported is directly dependent on the cane availability since bagasse is used as the primary fuel. The annual sugarcane availability fluctuates[3] (Refer Figure B 5.2 below) based on rainfall and regional climatic conditions and is highly unpredictable in nature. Further, disease and pests also pose risk to the sugar cane yield. In periods of drought, cane output may reduce as much as 50% below normal, leading to a corresponding deficiency in bagasse. This would demand EID Parry to either reduce the power available for export or purchase high cost outside biomass. Both of these options would result in lower returns for EID Parry since the former would reduce the energy sale revenues while the later would increase the generation cost. EID Parry was sceptical about the huge capital outlay considering that the primary product (sugar) is cyclical in nature and hence seasonal income flows.

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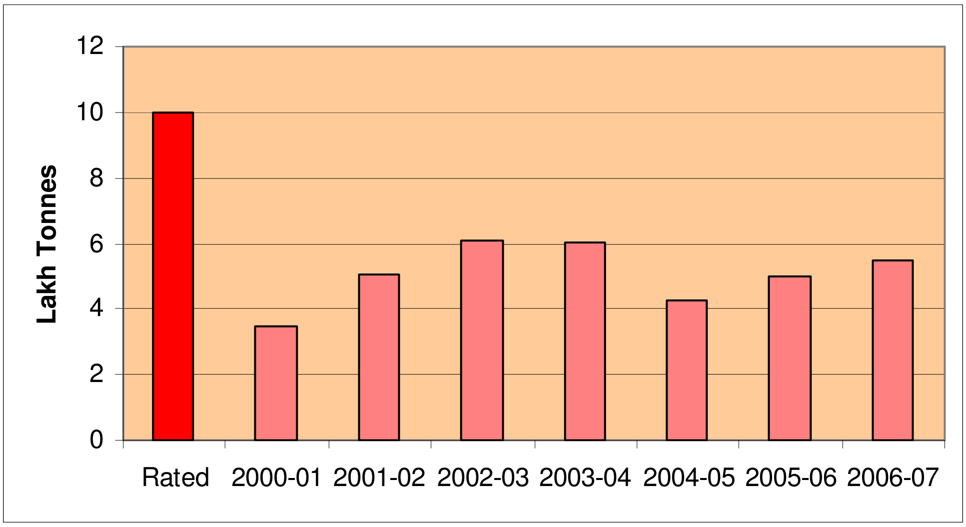
[2] The power tariff applicable for Non-Conventional Energy Source power projects as per MNES guidelines is Rs.2.25 per kWh with base year 94-95 with annual escalation of 5% for a period of 10 years. The tariff applicable for the year 2003-04 was Rs.3.48 per KWH. However, APERC revised the tariff effective from 1st April, 2004 to Rs.2.69/kWh. Moreover APERC limited the PLF of cogeneration projects to 55%. The energy exported in excess to 55% PLF will be paid at below cost tariff by APTRANSCO. The downward revision and the PLF limit imposed on biomass power plants by APTRANSCO, has affected their returns in a detrimental manner. It took a prolonged litigation by the biomass power promoters to bring a roll back of the tariff reductions in to effect.

[3] Year-wise graphs for production and yield of sugarcane in TamilNadu and India are given in Annex 5.

Figure B 5.2: Year-wise cane availability



- **Higher upfront cost:**

The investment required for implementation of a high pressure system was significantly increased due to the installation of an air-cooled condenser as against the conventional practice of water cooled condensers. The project activity is situated in a region where the availability of water is limited. The installation of an extraction cum condensing turbine requires plenty of cooling water for the condenser that is scarce in the region, posing as a significant barrier to the project. However, EID Parry, determined to facilitate the surplus power generation, surmounted the barrier by opting to install an air-cooled condenser in place of conventional water cooled condenser. Revenue from CDM is expected to compensate for the incremental capital investment (10% of total cost[4]) and operational cost entailed.

- **Organisational barrier:**

Traditionally the sugar-manufacturing sector belongs to agriculture sector with limited knowledge and exposure of complications associated with commercial production and sale of electricity. The bagasse based power projects is a steep diversification from the core rural economics to power sector economics, where the project proponents has to meet challenges of power policies, delivery/non-delivery of power and techno-commercial problems associated with electricity boards. EID Parry for long, been involved in business of sugar production and rural economics, had to transform (overcome barrier) and develop

[4] Please refer Annexure 5 “Break-up of Project Cost” for details

expertise to deal with the economics of electricity generation, distribution and dealing with power sector economics and bureaucracy.

Summary:

To summarise the above, EID Parry decided to invest in the energy efficiency project despite the huge capital outlay and apprehension about its returns which have significant technological, institutional and other uncertainties. EID Parry has overcome the above barriers and implemented the cogeneration energy efficiency project considering that the CDM funds would offset any financial losses from the project risks and hence the project activity may be considered additional.

- **Additionality test for Regulatory/Legal requirements**

There is no legal or regulatory binding on EID Parry imposed by national or regional laws to implement the project activity. The above tests and analysis suggest that the project activity is additional and the anthropogenic emissions of GHG by sources will be reduced below those that would have occurred in the absence of the registered CDM project activity.

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

The following demonstrates that the most likely alternative to the project activity (i.e. continuation of the existing low pressure system) doesn't face any of the barriers faced by the project activity:

Technological barrier: The existing system is a low pressure system that is well established and commonly prevalent in the country.

- ***Performance Uncertainties:*** The actual performance and life of low pressure cogeneration systems are well known in the country since most of the Indian sugar mills operate with such systems.
- ***Lack of trained manpower:*** EID Parry has several years of experience in operating low pressure cogeneration systems in its sugar plants. The existing O&M team are also well experienced in operating such systems. Moreover, since most sugar mills operate with low pressure systems, there is sufficient availability of manpower with experience in such systems.

Institutional barriers: The institutional barrier cited for the CDM project activity is not applicable to the existing system since there is no export of power involved in this scenario.

Other barriers:

- ***Climatic risks:*** The low pressure system is of back pressure type with the sole purpose of catering the power and steam demand of the sugar plant and therefore can be considered as a utility integrated with the sugar plant and did not involve any independent revenue contribution (e.g. through the export of power to grid.) and therefore the climatic risks would not result in any independent economic impact through the low pressure system.
- ***Higher upfront cost:*** The low pressure system would not involve any significant additional investment for its continued operation. Moreover, since the turbine is of back-pressure type and doesn't involve steam condensing, it does not involve water based or air based condenser cooling.
- ***Organisational barriers:*** The low pressure system does not involve export of power to the grid and therefore EID Parry would not be concerned with the power sector economics or the electricity policies.

The barriers associated with the CDM project activity do not exist for the baseline alternative (continuation of the low pressure system) and thus do not prevent its implementation.

B.5.4 Step 4: Common Practice Analysis

Sub-step (4a): Analyse other activities similar to the project activity

The common practice in the Indian sugar industry is the installation of a low pressure cogeneration unit to meet the plant's energy requirements with no surplus power generation. The table B5 below analyses the status of high pressure (86 kg/cm^2) cogeneration in the Indian sugar industry.

Table B5: Common Practice Analysis for EID Parry project activity

Total number of Sugar Mills in India	*429*
Sugar Mills with high pressure(86 kg/cm^2) cogeneration during conceptualisation of the project activity	*3*
Source: Ministry of Environment and Forests (MoEF)[5] and India Brand Equity Foundation (IBEF)[6]	

During conceptualisation of the project activity only three sugar mills in India, from a total of around 429 sugar mills, are operating with grid connected cogeneration unit of high pressure configuration of 86 kg/cm^2 (equivalent configuration as of the project activity). This shows a very low penetration of technology (less than 1%).

Sub-step (4b): Discuss any similar options that are occurring

Sub-step 4a demonstrates that the project activity is of very low penetration (less than 1%) in the country and therefore is not a common practice.

[5] http://mnes.nic.in/annualreport/2003_2004_English/ch5_pg8.htm

[6] http://www.ibef.org/download/FoodProcessing_sectoral.pdf

B.5.5 Step 5: Impact of CDM registration

EID Parry has implemented the project activity despite the various risks (described in step B.5.3) associated with the project activity; Technical problems related to the plant operation has already lead to untimely shut down of plant and resulted in significant loss of production (as discussed earlier in step B.5.3). Moreover, the bagasse availability for 2006-07, the first year of project operation is expected to be only 70% of the rated capacity. Also, there have been changes in SERC's policy on co-generation. The continuation of the above situation would negatively impact the long term feasibility of the co-generation plant and result in huge financial losses. The CDM registration will certainly improve the financial sustainability of the project activity by facilitating carbon revenues that would serve to overcome the project risks by offsetting part of the financial losses. Moreover, its financial viability would encourage Financial Institutions (FIs) to readily fund similar ventures by other promoters.

The successful operation of the project plant would demonstrate the viability of high efficiency grid connected power generation and encourage similar initiatives in other sugar industries in the country resulting in a significant quantum of anthropogenic greenhouse gas emissions reductions.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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The emission reductions are mainly from the incremental energy generation using the same quantity of biomass that would been combusted in the baseline scenario (low pressure cogeneration plant). The incremental energy is exported to the grid and displaces equivalent CO_2 emission from grid connected power plants.

Project Emissions:

With reference to ACM0006, it is required to account CO_2 emissions from the combustion of fossil fuels used by the project activity (during unavailability of bagasse / drought / any other unforeseen circumstances) and that used for transportation of biomass from other sites to the project activity. Such emissions are calculated by using the below equations:

Carbon dioxide emissions from transportation of biomass to the project site (*PETy*):

$$PET_y = \frac{\sum BF_{i,y}}{TL_y} \times AVD_y \times EF_{Km,CO_2}$$

Where:

BFi,y is the quantity of biomass type i, transported from other sites and used as fuel in the project plant during the year *y* in a volume or mass unit,

TLy is the average truck load of the trucks used measured in tons of biomass,

AVDy is the average return trip distance between the biomass fuel supply sites and the site of the project plant in kilometers (km), and

EF_{Km,CO_2} is the average CO_2 emission factor for the trucks measured in tCO_2/km

Carbon dioxide emissions from on-site consumption of fossil fuels (*PEFFy*):

$$PEFF_y = \sum FF_{projectplant,i,y} \; x \; COEF_{co_2,i}$$

where,

$PEFF_y$ is the project emission from fossil fuel co-firing during the year y in tons of CO_2,

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

$COEF_{CO2,i}$ *i*s the CO_2 emission factor of the fossil fuel type 'i' calculated as:

$COEF_{CO2,i}$ $= 96.1 \times 0.98 \times NCV_i$

Where, 96.1 is the IPCC default emission factor for coal in tCO_2/TJ, 0.98 is the oxidation factor and NCV_i is the calorific value of the fossil fuel.

Baseline Emissions:

ACM0006 refers to calculation of baseline emission factor using ACM0002 ("Consolidated baseline methodology for grid connected electricity generation from renewable energy sources") estimated as under:

Baseline emissions due to displacement of electricity

For the displacement of electricity, the baseline scenario is the electricity that would have been generated by the operation of grid-connected power plants and by the addition of new generation sources, in the absence of the project activity.

Calculation of electricity baseline emission factor

As the power generation capacity of the biomass power plant is more than 15 MW, $EF_{electricity,y}$ should be calculated as a combined margin (CM), following the guidance in the section "Baselines" in the "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (ACM0002).

STEP 1. Calculate the Operating Margin emission factor(s) ($EF_{OM,y}$) – Out of four methods mentioned in the ACM0002, Simple OM approach has been chosen for calculations since in the southern regional grid mix, the low-cost/must run resources constitute less than 50% of total grid generation. Simple OM factor is calculated as under.

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

where,

Fi ,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 from the grid

COEFi,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

GENj,y - Is the electricity (MWh) delivered to the grid by source *j*

The CO_2 emission coefficient *COEFi* is obtained as

$$COEF_i = NCV_{i,}\ x\ EF_{CO2} xOXIDi$$

For calculations, local values of *NCVi* and $EFCO_{2i}$ have been used and a 3-year average based on the most recent statistics available at the time of PDD submission has been used for grid power generation data.

STEP 2. Calculate the Build Margin emission factor ($EF_{BM,y}$) as the generation-weighted average emission factor (tCO_2/MWh) of a sample of power plants *m* of southern regional grid, as follows:

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

where,

Fi,m,y, *COEFi,m* and *GENm,y* - Are analogous to the variables described for the simple OM method above for plants *m*.

Considered calculations for the Build Margin emission factor $EF_{BM,y}$ are *ex ante* based on the most recent information available on plants already built for sample group *m* of southern regional grid at the time of PDD submission. The sample group *m* consists 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.

Further, power plant capacity additions registered as CDM project activities have been excluded from the sample group *m* of southern regional grid mix.

STEP 3. Calculate the electricity baseline emission factor *EFelectricity,y* as the weighted average of the Operating Margin emission factor (*EFOM,y*) and the Build Margin emission factor (*EFBM,y*):

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

Where, the weights w_{OM} and w_{BM}, by default, are 50% (i.e., $w_{OM} = w_{BM} = 0.5$)

Determination of EG_y:

Where scenario 14 applies, *EGy* is determined based on the net efficiency of electricity generation in the project plant prior to project implementation $\varepsilon_{el,pre\ project}$ and the net efficiency of electricity generation in the project plant after project implementation $\varepsilon_{el,project\ plant,y}$, as follows:

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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,
$\varepsilon_{el,pre\ project}$	- is the net efficiency of electricity generation in the project plant prior to project implementation, expressed in MWhel/MWhbiomass
$\varepsilon_{el,project\ plant,y}$	-is average net energy efficiency of electricity generation in the project plant, expressed in MWhel/MWhbiomass.

Leakage:

ACM0006 states "The main potential source of leakage for this project activity is an increase in emissions from fossil fuel combustion due to diversion of biomass from other uses to the project plant as a result of the project activity. Where the most likely baseline scenario is the use of the biomass for energy generation (scenarios 1, 4, 6, 8, 9, 11, 12, 13 and 14), the diversion of biomass to the project activity is already considered in the calculation of baseline reductions. In this case, leakage effects do not need to be addressed." The project activity falls under scenario 14 of ACM0006 and therefore does not require addressing leakage. There is no leakage of emission reductions.

Emission Reductions:

The emission reductions from the project activity are primarily the reduction in CO_2 emissions associated with grid power generation achieved through its substitution with biomass based power generation. The emission reduction *ERy* by the project activity during a given year *y* is the difference between the emission reductions from; the substitution of electricity generation with fossil fuels (*ERelectricity,y*), the emission reductions from the substitution of heat generation with fossil fuels (*ERheat,y*); and project emissions (*PEy*), emissions due to leakage (*Ly*), as follows:

Formula used for estimation of the total net emission reductions due to EID Parry's project activity during a given year *y* is as under.

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

where,

ER_y - Are the net emissions reductions of the project activity during the year y in tons of CO_2

$ER_{heat,y}$ - Are the emission reductions due to displacement of heat during the year y in tons of CO_2

$ER_{electricity,y}$ - Are the emission reductions due to 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

L_y - Are the leakage of emission reductions during the year y in tons of CO_2

In this case (Scenario 14), $ER_{heat,y}$ and L_y are zero.

The project proponents does not claim emission reductions for displacement of heat since heat generation prior to the project activity was also generated using bagasse as fuel. Emission reductions from avoidance of emissions due to natural decay or uncontrolled burning do not apply to scenario 14.

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

Data / Parameter:	**$EG_{pre-project,y}$**
Data unit:	MWh
Description:	Electricity generation in the 4.5 MW low pressure system (pre-project scenario)
Source of data used:	EID Parry
Value applied:	2003-04: 15988.36 2004-05: 11929.95 2005-06: 13571.47
Justification of the choice of data or description of	Measured and recorded by EID Parry using energy meters for the three pre-project years (2003-06)

measurement methods and procedures actually applied :	
Any comment:	This data is used for calculation of pre-project energy efficiency

Data / Parameter:	$\mathbf{BF_{pre\text{-}project,y}}$
Data unit:	Tonnes
Description:	Quantity of biomass input to the 4.5 MW low pressure cogeneration plant prior to the project activity
Source of data used:	EID Parry
Value applied:	2003-04: 181303.09 2004-05: 124929.11 2005-06: 146249.90
Justification of the choice of data or description of measurement methods and procedures actually applied :	Monthly and annual mass and energy balance in the sugar plant supported by RT 8C forms submitted to the Government of India
Any comment:	This data is used for calculation of pre-project energy efficiency

Data / Parameter:	$\mathbf{NCV_{BF,y}}$
Data unit:	Kcal/kg
Description:	Net Calorific value of fuel (biomass) used in the pre-project scenario
Source of data used:	EID Parry
Value applied:	2250
Justification of the choice of data or description of measurement methods and procedures actually applied :	The NCV is determined by a certified third party agency
Any comment:	This data is used for calculation of pre-project energy efficiency

Data / Parameter:	$\mathbf{EF_{electricity}}$
Data unit:	tCO_2/MWh
Description:	Combined margin baseline emission factor of the southern regional grid
Source of data used:	CEA/IPCC
Value applied:	0.85
Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculated as per guidelines provided in ACM0002
Any comment:	More details in Annexure 3

B.6.3 Ex-ante calculation of emission reductions:

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The following tables show the calculation of emission reductions using the formula mentioned in section B.6.1.

Project emissions:

Emissions due to combustion of fossil fuels in the project activity:					
S.No	**Notation**	**Parameter**	**Unit**	**Value**	**Comments**
1	FFproject $plant,_y$	Quantity of coal used	T/yr	0	Will be measured if used. Envisaged only during emergencies.
2	NCV	Calorific Value	TJ/T coal	0	Will be measured if used. Envisaged only during emergencies.
3	EF_{CO2}	CO2 emission factor	tCO_2/TJ	96.1	IPCC default value
4	OXID	Oxidation factor		0.98	IPCC default value
5	COEF (2*3*5)	CO2 emission factor	tCO_2/T coal	0	Methodology formula
6	$PEFF_y$ (1*5)	CO2 emissions from coal	tCO_2/yr	0	Methodology formula

Emissions due to combustion of fossil fuels for transportation of biomass:					
7	BF_y	Quantity of biomass bought and transported from outside for off-season operation	T	40,800	Estimate based on efficiency and calorific value for 50 days of off-season operation
8	TL_y	Average truck load of the trucks used	T	10	Average rated tonnage of trucks used
9	AVD_y	Average return trip distance between the biomass fuel supply sites and the project plant	kms	100	Conservative assumption. ACM0006 prescribes a minimum value of 20 kms.
10		Fuel consumption per 1000 kilometer	kg/000'kms	205	Actual data provided by truck operator
11		CO2 emission factor	kgCO2/kg fuel	3.16	IPCC default value
12	$EF_{km,CO2}$ (10*11)	Average CO2 emission factor of the trucks	kgCO2/km	0.6478	Methodology formula

13	PET_y ((7*9*12) / (8))	CO2 emissions from diesel	tCO2	264.30	Methodology formula
14	PE_y (6+13)	Total Project Emissions	tCO2	264.30	Methodology formula

Leakage:
As per ACM0006, for project activities under scenario 14, leakage is already considered in the baseline calculations and need not be separately addressed.

Baseline emissions:

Determination of EGy:					
S.No	**Notation**	**Parameter**	**Unit**	**Value**	**Comments**
1	EGpre-project,y	Generation from the pre-project 4.5 MW, 17 Kg/cm2 system in three pre-project years	MWhe	**2003-04:** 15988.36 **2004-05:** 11929.95 **2005-06:** 13571.47	Actual values recorded by EID Parry
2	EGproject plant,y	Generation from the 18 MW, 86 Kg/cm2 system	MWhe	131,900	Based on 250 days operation during the crushing season and 50 days during the off-season at acheivable load factor
3	BFpre-project,y	Fuel Consumption (Old 4.5 MW system)	T	**2003-04:** 181303.09 **2004-05:** 124929.11 **2005-06:** 146249.90	Actual values recorded by EID Parry
4	BFpre-project,y	Fuel Consumption in heat equivalent	MWh	**2003-04:** 473880.95 **2004-05:** 326533.47 **2005-06:** 382260.68	
5	BFproject plant,y	Fuel Consumption (New 18 MW system)	T	310,800	Based on manufacturer provided efficiency values
6	BFproject plant,y	Fuel Consumption in heat equivalent	MWh	812,353	
7	$\varepsilon_{el, pre-project}$ (1/4)	Pre-project efficiency	-	0.036535	Maximum efficiency achieved during the three pre-project years
8	$\varepsilon_{el, project plant,y}$	Project plant	-	0.1623	ACM0006 formula

	(2/6)	efficiency			
9	EGy (2* (1- (7/8)))	Incremental Energy generation from the project activity	MWh	102,221	ACM0006 formula

S.No	Notation	Parameter	Unit	Value
10	EG_y	Incremental Energy generation from the project activity	MWhe/yr	102,221
11	$EF_{electricity}$	Baseline emission factor for grid	tCO_2/MWh	0.85
12	BE_y (10*11)	Baseline emissions	tCO_2/yr	86,887

Emission reductions

S.No	Notation	Parameter	Unit	Value
1	BE_y	Baseline emissions	tCO_2/yr	86,887
2	PE_y	Project emissions	tCO_2/yr	264
3	L_y	Leakage	tCO_2/yr	0
3	ER_y (1-2-3)	Emission reductions	tCO_2/yr	86,623

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

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Sr. No.	Operating Years	Baseline Emission Factor (tonnes of CO_2 / MWh) EFy	Incremental electricity generation (MWh) EGy	Baseline Emissions (tonnes of CO_2) BEy	Project Emissions (tonnes of CO_2) PEy	Certified Emission Reductions - CERs (tonnes of CO_2)
1.	2007-08	0.85	102,221	86,887	264	86,623
2.	2008-09	0.85	102,221	86,887	264	86,623
3.	2009-10	0.85	102,221	86,887	264	86,623
4.	2010-11	0.85	102,221	86,887	264	86,623
5.	2011-12	0.85	102,221	86,887	264	86,623
6.	2012-13	0.85	102,221	86,887	264	86,623
7.	2013-14	0.85	102,221	86,887	264	86,623
8.	2014-15	0.85	102,221	86,887	264	86,623
9.	2015-16	0.85	102,221	86,887	264	86,623
10.	2016-17	0.85	102,221	86,887	264	86,623
	2007-2017		**1,022,210**	**868,870**	**2,640**	**866,230**

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

B.7.1 Data and parameters monitored:

Data / Parameter:	**AVD_y**
Data unit:	Kilometres (Kms)
Description:	Average return trip distance between biomass fuel supply sites and the project site
Source of data to be used:	Truck operator
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 truck operator will provide the distance travelled by the truck between the fuel supply site
QA/QC procedures to be applied:	Consistency of distance records provided by the truckers will be checked by comparing recorded distances with information from other sources
Any comment:	This data is used to calculate project emissions from biomass transportation

Data / Parameter:	**TL_y**
Data unit:	Tonnes
Description:	Average truck load of the trucks used for transportation of biomass
Source of data to be used:	EID Parry
Value of data applied for the purpose of calculating expected emission reductions in section B.5	10
Description of measurement methods and procedures to be applied:	Average carrying capacity of trucks
QA/QC procedures to be applied:	Weigh bridges used for measuring the truck loads will be calibrated periodically
Any comment:	This data is used to calculate project emissions from biomass transportation

Data / Parameter:	**$EF_{km, CO2}$**
Data unit:	t CO_2/km
Description:	Average CO_2 emission factor for transportation of biomass with trucks

Source of data to be used:	IPCC and Truck operator
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.6478
Description of measurement methods and procedures to be applied:	Data from the truck operators
QA/QC procedures to be applied:	Check consistency of measurements and local / national data with default values by the IPCC. If the values differ significantly from IPCC default values, possibly collect additional information or conduct measurements.
Any comment:	Local or national data will be used. Default values from the IPCC will be used alternatively and chosen in a conservative manner.

Data / Parameter:	$\mathbf{FF_{project\ plant\ i,y}}$
Data unit:	Tonnes
Description:	Onsite fossil fuel consumption of type ‘i’ for co-firing in the project plant
Source of data to be used:	EID Parry
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0
Description of measurement methods and procedures to be applied:	The quantity of fossil fuel is measured at the weigh bridge before their unloading into the project site.
QA/QC procedures to be applied:	The consistency of metered fuel consumption quantities will be checked with purchase receipts
Any comment:	

Data / Parameter:	$\mathbf{NCV_{i,FF}}$
Data unit:	Kcal/kg
Description:	Calorific value of fossil fuel
Source of data to be used:	EID Parry
Value of data applied for the purpose of calculating expected emission reductions in	0

section B.5	
Description of measurement methods and procedures to be applied:	The NCV is determined in calibrated calorimeters of a certified agency
QA/QC procedures to be applied:	Check consistency of measurements and local / national data with default values by the IPCC. If the values differ significantly from IPCC default values, possibly collect additional information or conduct measurements.
Any comment:	The value will be determined when fossil fuel is used

Data / Parameter:	**$COEF_{CO2, i}$**
Data unit:	tCO_2/t of fuel
Description:	CO_2 emission factor for fuel type i
Source of data to be used:	IPCC
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0
Description of measurement methods and procedures to be applied:	Calculated using formula provided in ACM0006. Refer B.6.1.
QA/QC procedures to be applied:	Check consistency of measurements and local / national data with default values by the IPCC. If the values differ significantly from IPCC default values, possibly collect additional information or conduct measurements.
Any comment:	Local values / IPCC Guidelines/Good Practice

Data / Parameter:	**EG_y**
Data unit:	MWh
Description:	Net quantity of Electricity supplied to the grid by the project
Source of data to be used:	EID Parry/TNEB
Value of data applied for the purpose of calculating expected emission reductions in section B.5	102,221
Description of measurement methods and procedures to be applied:	Calibrated energy meters of EID Parry and TNEB Frequency: Daily in EID Parry meters and monthly in TNEB meters
QA/QC procedures to be applied:	The consistency of metered net electricity generation will be cross-checked with receipts from sales (if available) and the quantity of biomass fired (e.g. check whether the electricity generation divided by the quantity of biomass fired results in a reasonable efficiency that is comparable to previous years)

Any comment:	Reference to ACM0002. Electricity supplied by the project activity to the grid. Double check by receipt of sales.

Data / Parameter:	**$EG_{project\ plant,y}$**
Data unit:	MWh
Description:	Net quantity of electricity generated in the project plant during the year y
Source of data to be used:	EID Parry
Value of data applied for the purpose of calculating expected emission reductions in section B.5	131,900
Description of measurement methods and procedures to be applied:	Calibrated energy meters of EID Parry Frequency: Daily in EID Parry meters
QA/QC procedures to be applied:	The consistency of metered net electricity generation will be cross-checked with receipts from sales (if available) and the quantity of biomass fired (e.g. check whether the electricity generation divided by the quantity of biomass fired results in a reasonable efficiency that is comparable to previous years)
Any comment:	

Data / Parameter:	**$BF_{i,y}$**
Data unit:	Tonnes
Description:	Quantity of biomass type *i* combusted in the project plant during year y
Source of data to be used:	EID Parry
Value of data applied for the purpose of calculating expected emission reductions in section B.5	310,800
Description of measurement methods and procedures to be applied:	Monthly and annual mass and energy balance in the sugar plant supported by RT 8C forms submitted to the Government of India
QA/QC procedures to be applied:	Any direct measurements with mass or volume meters at the plant site will be cross-checked with annual energy balance that is based on fuel generated in-house, purchased quantities and stock exchanges
Any comment:	

Data / Parameter:	**$NCV_{i,BF}$**
Data unit:	Kcal/kg
Description:	Net calorific value of biomass
Source of data to be used:	EID Parry

Value of data applied for the purpose of calculating expected emission reductions in section B.5	2250
Description of measurement methods and procedures to be applied:	The NCV is determined in calibrated calorimeters of a certified agency
QA/QC procedures to be applied:	Check consistency of measurements and local / national data with default values by the IPCC. If the values differ significantly from IPCC default values, possibly collect additional information or conduct measurements.
Any comment:	

Data / Parameter:	$\varepsilon_{el,project\ plant,y}$
Data unit:	MWh electricity per MWh heat input
Description:	Average net energy efficiency of electricity generation in the project plant
Source of data to be used:	EID Parry
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.1623
Description of measurement methods and procedures to be applied:	Calculated using formula provided in ACM0006 based on estimated electricity generation and fuel consumption
QA/QC procedures to be applied:	Check consistency with manufacturer's information or the efficiency of comparable plants.
Any comment:	

Data / Parameter:	ε_{boiler}
Data unit:	%
Description:	Average net energy efficiency of heat generation in the boiler that is operated next to the project plant
Source of data to be used:	EID Parry
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not Applicable. There is no boiler operated next to the project plant
Description of measurement methods and procedures to be	Not Applicable

applied:	
QA/QC procedures to be applied:	Check consistency with manufacturer's information or the efficiency of comparable plants.
Any comment:	

B.7.2 Description of the monitoring plan:

>>

EID Parry will incorporate a special team for implementing the monitoring procedures as described in sections B6.2 and B7.1. The team will comprise of relevant personnel from various departments, who will be assigned the task of monitoring and recording specific CDM parameters relevant to their department. The monitored values will be periodically cross-checked by the respective department heads and sent to the CDM team head for compilation and analysis. Any deviation of monitored values from estimated values will be investigated and appropriate action would be taken. The monitored values would be recorded and stored in paper and electronically for verification. Elaborate monitoring information is provided in Annexure 4.

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)

>>

02/07/2007

M/s. EID Parry India Limited

'DARE' House

234, NSC Bose Road

Chennai – 600 001

The entity is a project participant 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:

>>
20/12/2004

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

>>
20 to 25 years

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

>>
The project proponent wishes to adopt a fixed crediting period of ten years

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:

C.2.2.1. Starting date:

>>
05/09/2007 or Upon Registration with UNFCCC whichever is later

C.2.2.2. Length:

>>
10 years 0 months

SECTION D. Environmental impacts

>>

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

>>

An Environmental Impact Assessment has been undertaken to investigate, analyse and mitigate the effects caused by the project activity on the surrounding environment. The project proponent being environmentally concerned and in view of running the project activity as a sustainable one, has taken all care to follow the rules and regulations for conservation of environment as prescribed by the licensing authorities (TNPCB). The Environmental Impact Assessment takes into consideration, the impacts associated with the project activity in the following phases of the project implementation:

- Construction Phase
- Operation and Maintenance Phase

All issues concerned to environs of the project activity have been identified and their possible impacts have given due consideration in the Environmental Management Plan. Assessment of environmental impacts due to the project activity has been carried out and a separate report is available as Enclosure – I

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

>>

The following documents have been prepared by EID Parry in accordance with the requirements of the host party (Government of India):

- Environmental clearance in the form of "Consent to operate" from the Tamil Nadu Pollution Control Board (TNPCB).
- Environmental Impact Assessment and Environmental Management Plans have been prepared and submitted to the pollution control board.
- Consent for operation obtained from the Tamil Nadu (State) Pollution Control Board (TNPCB) under Section 21 of the Air (Prevention and Control of Pollution) Act, 1981 (Central Act 14 of 1981) as amended.
- Consent for operation obtained from TNPCB under Section 25/26 of the Water (Prevention and Control of Pollution) Act, 1974 (Central Act 6 of 1974) as amended.

These documents have been made available to the DOE during Validation.

SECTION E. Stakeholders' comments

>>

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

>>

EID Parry India Limited has commenced power export through the 18 MW biomass based cogeneration plant from their sugar factory premises starting March 2006. The major local stakeholders to the project activity are the local population comprising mainly of farmers, state pollution control board governing the region, off-taker of power and other parties involved in its construction, operation and supply of fuel. EID Parry decided to go ahead with the stakeholder consultation process via conducting a meeting (06.01.2006) and appraising the stakeholders about the project activity. The list of invited stakeholders includes:

- Elected body of representatives administering the local area (Village Panchayat)
- Non Governmental Organizations (NGO's) in the area
- Tamil Nadu Electricity Board (TNEB)
- Tamil Nadu Pollution Control Board (TNPCB)

The stakeholder consultation was conducted at EID Parry's premises. EID Parry's CDM consultants appraised the stakeholders about the project activity, technology used, fuel used and its likely benefits. Clarifications raised on the impacts were addressed and the written responses from stakeholders were collected. The whole process has been recorded on video and a report of the meeting is available with the project proponent, which will be made available to the DOE.

E.2. Summary of the comments received:

>>

Elected body of representatives administering the local area:

The panchayat is the representative body of the local population surrounding the project activity.

The following table shows the possible impacts the project activity could have on local population and measures undertaken by EID Parry:

Possible impacts	Preventive measures
Increase in air/Water/Noise pollution resulting in degradation of health and local ecology	Appropriate Flue gas treatment systems, effluent treatment systems and noise reduction systems have been incorporated to ensure outlet noise/emissions are below prescribed levels.
Improvement in direct employment as operating and maintenance staff for the project activity resulting in lesser labour migration from rural areas	Positive impact
Improvement in the local grid power quality	Positive impact
High water consumption for cooling requirements resulting in groundwater depletion	Air-cooled condenser has been installed in place of water cooled condenser to prevent water depletion

Thus, the project activity doesn't have any negative impacts on the local population. The panchayat has commended the preventive measures adopted and welcomed the implementation of the project activity in their locality.

Tamil Nadu Pollution Control Board (TNPCB)

The TNPCB prescribes certain standards of environmental compliance for the stack emissions, stack height and discharge of effluent from the cogeneration plant. These are elaborated in Section 21 of the Air (Prevention and Control of Pollution) Act 1981 and Section 25/26 of the Water (Prevention and Control of Pollution) Act 1974 (Central Act 6 of 1974). EID Parry has installed required treatment systems to comply with these norms. The TNPCB has verified these systems and issued consent for operating the plant.

Tamil Nadu Electricity Board (TNEB)

As a buyer of the power, the TNEB is a major stakeholder in the project activity. They hold the key to the commercial success of the project activity. TNEB has agreed to purchase power from the project activity under the Non-conventional sources category and signed Power Purchase Agreement (PPA) with EID Parry. An agreement has been signed between TNEB and EID Parry on 24th April 2005 for the parallel operation of the project activity with the grid and supply / purchase of surplus power from the CDM project activity. The potential threat for TNEB is the disturbance from parallel operation leading to physical and operational damage of the grid. However, EID Parry has installed the required isolation and safety equipment to prevent such disturbances. TNEB will draw power and therefore pay under the

Section 43 of the Electricity (Supply) Act, 1948. TNEB has commended the project as a renewable source of power that helps it to reduce the demand – supply gap in the state.

Project Consultants

The various activities of the project from concept to commissioning like the preparation of Detailed Project Report (DPR), preparation of basic and detailed engineering documents, preparation of tender documents, selection of vendors / suppliers, supervision of project implementation, Successful commissioning and trial runs involve the participation of project consultants and hence comments have been received from them.

Equipment suppliers

The equipment vendors and suppliers involved in the erection & commissioning of the project activity are aware of the potential risks involved in operating the project activity. They have provided their comments on impacts of the project activity.

The stakeholders have recognized the efforts taken by EID Parry towards environmentally and socio-economically sustainable operation of the project activity and have mentioned their appreciation for the project activity in the responses.

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

>>

All the stakeholders who attended the stakeholder meeting have provided positive response to the local and global effects of implementing the project activity. Since no negative comments were received, the project proponents are not required to take any corrective action. The promoters intend to operate the project activity in a sustainable and environmentally friendly way as possible so that there is no negative impact on the local stakeholders from the project activity during its lifetime. Further, the PDD will be made available in the validating DOE’s website for public comments, which will be addressed appropriately.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	EID Parry India Limited
Street/P.O.Box:	234, NSC Bose Road
Building:	DARE House
City:	Chennai
State/Region:	Tamil Nadu
Postfix/ZIP:	600 001
Country:	India
Telephone:	+91 44 25306789
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E-Mail:	radhakrishnankn@parry.murugappa.com
URL:	www.eidparry.com
Represented by:	
Title:	General Manager – Commercial
Salutation:	Mr
Last Name:	K.N.
Middle Name:	
First Name:	Radhakrishnan
Department:	
Mobile:	+91-98400-85880
Direct FAX:	
Direct tel:	+91 44 25340251
Personal E-Mail:	

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding available for the project activity.

Annex 3

BASELINE INFORMATION

The Central Electricity Authority (CEA) has published the baseline emission factors database for the various electricity grids in India. The emission factors have been calculated based on UNFCCC guidelines (ACM0002). For further details on the calculation methods and data used, please refer the following weblink:

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

In the CEA database, the simple operating margin, build margin and combined margin emission factors of the regional electricity grids have been provided separately for two cases; Including electricity imports and Excluding electricity imports from other regional grids. Since, emission factors excluding imports are lower, the same has been considered as a conservative approach. The combined margin emission factor for the southern regional grid (0.85 tCO_2/MWh) has been considered for this project activity.

Central Electricity Authority: CO2 Baseline Database

VERSION	**1.0**
DATE	**04 Oct 2006**

EMISSION FACTORS

Weighted Average Emission Rate (tCO2/MWh) (excl. Imports)

	2000-01	2001-02	2002-03	2003-04	2004-05
North	0.71	0.73	0.74	0.71	0.71
East	1.08	1.06	1.11	1.10	1.08
South	0.73	0.74	0.81	0.84	0.78
West	0.90	0.93	0.91	0.90	0.92
North-East	0.38	0.38	0.34	0.36	0.29
India	0.81	0.83	0.85	0.85	0.84

Simple Operating Margin (tCO2/MWh) (excl. Imports)

	2000-01	2001-02	2002-03	2003-04	2004-05
North	0.96	0.98	1.00	0.99	0.98
East	1.22	1.22	1.20	1.23	1.20

South	1.01	1.00	**0.99**	**1.00**	**1.00**
West	0.98	1.01	0.99	0.99	1.01
North-East	0.66	0.65	0.66	0.62	0.66
India	1.01	1.02	1.02	1.03	1.03

Build Margin (tCO2/MWh) (excl. Imports)

	2000-01	2001-02	2002-03	2003-04	2004-05
North					0.53
East					0.90
South					0.71
West					0.77
North-East					0.10
India					0.70

Combined Margin (tCO2/MWh) (excl. Imports)

	2000-01	2001-02	2002-03	2003-04	2004-05
North	0.75	0.76	0.77	0.76	0.75
East	1.06	1.06	1.05	1.07	1.05
South	0.86	0.85	0.85	0.86	0.85
West	0.88	0.89	0.88	0.88	0.89
North-East	0.38	0.38	0.38	0.36	0.38
India	0.85	0.86	0.86	0.86	0.86

Annex 4

MONITORING INFORMATION

EID Parry has employed the latest and state of the art monitoring system and equipment to measure, record and report the various key CDM parameters. Monitoring methods have been designed and implemented for all the parameters (in Sections B.6.2 and B.7.1) required to calculate emission reductions, project emissions and leakage.

Power generation and export: The quantity of energy generated and exported is the main parameter for calculating emission reductions. The gross energy generated, captive consumption and energy exported are monitored by energy meters and recorded both manually and by the DCS. These figures will be cross-checked with TNEB invoices that indicate the net energy supplied to the grid. Moreover, the quantity of steam generation is also monitored and recorded.

Bagasse and other fuels: The quantity of bagasse generated is monitored based on the cane crushed. Periodic sampling is done for testing and monitoring the calorific value. Annual bagasse balance will be done to verify the figures. Purchase of outside biomass and coal for co-firing during bagasse shortages will be measured at the weigh bridge during entry into the premises. The values will be cross checked with purchase invoices. The calorific values of purchased fuels will also be monitored in the laboratory.

Energy Efficiency: The total quantity and heat content of fuels fired will be consolidated on a periodic basis and correlated with the steam and energy generation in the same period to calculate the energy efficiency of the boiler, overall electrical efficiency and specific steam consumption.

Biomass Transportation: The vehicles used for transportation of outside biomass will be monitored and the details including vehicle registration number, quantity of biomass transported every trip, number of trips, odometer readings prior to and after the trip and fuel consumption of the truck will be recorded in log books and consolidated in electronic format. The average mileage will be calculated from correlating the total distance traveled in a period and the total fuel consumed.

All the instruments and equipments used for metering will be calibrated by an authorized third party on a periodic basis to ensure accuracy of measurements. EID Parry will follow its internally accepted standards and norms of in monitoring all the above parameters. The records will be available for scrutiny during Validation and Verification. The following section describes EID Parry's monitoring mechanism in more detail:

CDM Team:

The CDM team comprises of personnel from the Mechanical, Electrical, Instrumentation, Laboratory and Systems departments. The personnel in the team perform the dual functions of power plant O&M and compliance with CDM procedures. The organization structure of the CDM team is given in the below figure.

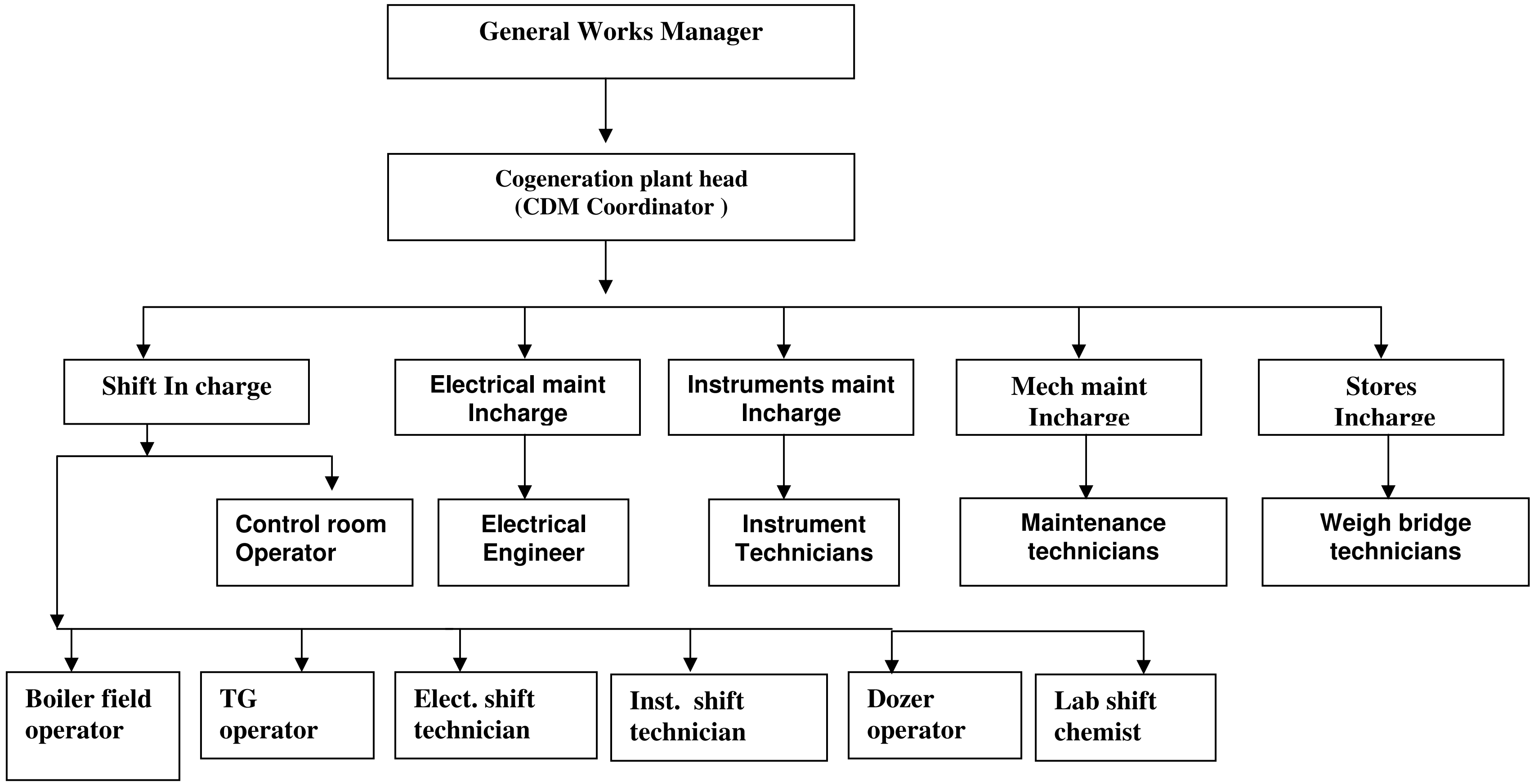


Figure: CDM Team

Functions of the CDM Team:

- Monitor parameters for calculating emission reductions generated by the project activity
- Maintain records of relevant data for verification of CERs.
- Ensure accuracy of data by proper maintenance and calibration of monitoring equipment.
- Operate the power plant in compliance with the CDM Project Design Document
- Take all preventive measures to ensure plant availability at all times.

Data Monitoring:

Monitoring methods of process parameters and equipments are as below:

- Online Monitoring
- Local / Field Monitoring

Online Monitoring

Online monitoring involves monitoring process parameters from a central control room or computer by data transfer through a wired network. These data are archived in a computer / digital media.

The system can be programmed to compile data and generate reports and provides flexibility for data usage. Generally, critical parameters like power produced, condition of steam & boiler parameters are continuously monitored by the DCS.

Local or Field Monitoring

The monitoring instruments used in the Field level monitoring generally consist of gauges and meters with a local display/output at the measuring point. Certain critical data are manually recorded in logbooks by technicians.

Equipments Used:

Operator stations of DCS, Digital and Analog Panel Indicators are used for online monitoring of process and equipments. Energy meters, flow meters, pressure gauges, temperature gauges, vacuum gauges and level gauges are used for local/field monitoring purpose. DCS acts as the “window” to the entire process. It is used to monitor, display, control, collect, store the process data and for generating reports.

Following is the detailed list of monitoring parameters.

Data description	Unit	Instrument used	Monitg. Freq.	Procedure for monitoring the parameter	Location of instmt	Calibration Method	Calib. Freq.	Responsibility of monitoring	Resp. of data approval	Resp. of reporting & archiving	QC of data (Internal audit)
Energy Generation from 18 MW TG	MWh	Energy Meter	Daily	Recorded in EMS and log book	HT panel room	Reputed external agency	Yearly	Shift engineer	Electrical maint incharge	Cogen plant head	General works Manager
Energy Exported	MWh	Energy Meter	Monthly	Recorded in log book	TNEB Switchyard	By meter relay test wing of TNEB	Yearly	Shift engineer	Electrical maint incharge	Cogen plant head	General works Manager
Captive Energy Consumption	MWh	Energy Meter	Daily	Recorded in EMS and log book	HT panel room	Reputed external agency	Yearly	Shift engineer	Electrical maint incharge	Cogen plant head	General works Manager
Auxiliary electricity for Cogen plants	MWh	Energy Meter	Daily	Recorded in EMS and log book	HT panel room	Reputed external agency	Yearly	Shift engineer	Electrical maint incharge	Cogen plant head	General works Manager
Quantity of Bagasse Generated	Tonnes	Cane Weigh bridge, Juice and Water flow meter	Daily	Calculated based on the mass balance of cane crushed and juice flow	NA	Reputed external agency	Yearly	Control lab	Production HOD	Cogen plant head	General works Manager
Bagasse Consumed in 18 MW Plant	Tonnes		Monthly	Calculated on mass balance and recorded in Log book	NA	NA	NA	Boiler operator	Mech maint incharge	Cogen plant head	General works Manager
Quantity of Biomass/Bagasse Purchased from outside	Tonnes	Weigh Bridge	Monthly	Recorded in the Log book in stores	NA	NA	NA	Stores incharge	NA	Cogen plant head	General works Manager

Quantity of Coal purchased	Tonnes	Weigh Bridge	Monthly	Recorded in the Log book in stores	NA	NA	NA	Stores incharge	NA	Cogen plant head	General works Manager
Calorific value of bagasse	Kcal/kg	Calorimeter	Half yearly	Measured in external lab	NA	NA	NA	Lab incharge	NA	Cogen plant head	General works Manager
Calorific Value of Biomass	Kcal/kg	Calorimeter	Half yearly	Measured in external lab	NA	NA	NA	Lab incharge	NA	Cogen plant head	General works Manager
Calorific Value of Coal	Kcal/kg	Calorimeter	Half yearly	Measured in external lab	NA	NA	NA	Lab incharge	NA	Cogen plant head	General works Manager

Frequency of Monitoring:

The monitoring frequency of a parameter depends on its significance to the process. Critical process parameters are generally monitored on a continuous basis. Apart from monitoring the process online in DCS, all critical process parameters of Boiler, Turbine and Equipments are monitored every hour and recorded. Other parameters are monitored in appropriate intervals.

Energy parameters:

All energy related parameters like steam generation, energy production, auxiliary consumption, captive consumption, electricity exported are monitored on a real-time basis in digital energy meters and logged in storage devices through the computer.

The DCS operator/ Shift in-charge prepares a daily report on the total steam generation, electricity generation and export, and forward the same to the cogeneration plant head.

Fuel parameters:

The quantity of bagasse generation shall be calculated daily by mass balance

ie., cane crush + water = Juice + bagasse

Quantity of fuel consumed (bagasse) is monitored on a monthly basis.

Data Recording:

Methods of recording project data:

Logbooks consisting of all critical parameters of Boiler and Turbine are prepared and maintained for recording the process data. Trained Operators / Technicians are assigned the responsibility of monitoring and recording the process parameters in logbooks. Energy related parameters (like kWh generated, exported etc) are continuously recorded by respective energy meters and are also captured by DCS and stored in the computer. Bagasse generation from mill, outside bagasse purchase and consumption of bagasse in the boiler is continuously recorded.

Data Archiving:

DCS is used to collect, store the process data and for generating reports. History of process data can be viewed in DCS as Trend display. It is decided that at any point of time, Process data Log books of the previous three years are stored. Hard copies of all CDM parameters shall be kept with cogen plant head.

Review Procedures & Frequency:

Mechanical, Electrical and instrument maintenance in charge would review the progress of the implementation of documented procedures and quality system records on a daily basis.

CALIBRATION FREQUENCY

Periodic calibration schedule which spreads over the year for all electrical and electronic instruments will be prepared and maintained. As per the schedule, calibration of instruments and equipments will be carried out once a year and recorded in calibration reports.

PLANT MAINTENANCE PROCEDURE:

Maintenance procedures are adopted as below to ensure trouble free running of the plant to get optimum level of output.

- Regular Maintenance procedures
- Maintenance and breakdown reports for analysis
- Stock critical spares
- Training on equipments and instruments

Preventive and Breakdown maintenance procedures are prepared and documented for various types of equipments like Boiler, turbine, air cooled condenser, material handling conveyors, Water treatment plant, High/ low capacity motors, HT/LT panels, HT/LT Transformers, Alternator, Exciter, Control panels in the respective departments and instrumentation.

Responsibilities under CDM:

CDM responsibilities of mechanical department:

- The team will verify availability of sufficient bagasse/biomass stock to meet the power plant's requirement
- The team will verify, compile and send a daily report of steam generated, energy generated, auxiliary consumption, captive consumption and energy exported to the cogeneration plant head
- The team shall co-ordinate with the laboratory team and inform them of incoming biomass to arrange for its weighing and sampling

CDM responsibilities of the Electrical department:

- The team will prepare a monthly power and fuel report and send it to the cogeneration plant head
- The team will ensure on a daily basis that all energy meters are functioning properly and that data is recorded.
- The team will cross-check the plant energy meter with that of the Electricity utility's meter on a monthly basis.
- The team will arrange for the calibration and certification of energy meters when there is a significant deviation from the utility meter or on a periodic basis.

CDM responsibilities of the Laboratory-in-charge:

- The team will collect samples of fuel and arrange for its analysis.
- The results of the same will be sent to the cogeneration plant head.

CDM responsibilities of the stores department:

- The team will monitor and measure the incoming fuel quantity and distance traveled by the truck used.
- A summary of the total quantity of fuel purchased is sent to the cogeneration plant head every month.

CDM responsibilities of the cogeneration plant head / CDM coordinator:

- The cogeneration plant head will ensure that all CDM related parameters are monitored.
- Receives report of CDM parameters from the mechanical, electrical, stores and lab-in-charge, compiles the same to calculate the CERs generated and reports it to the General Works Manager.
- Stores the reports for CDM Verification
- Reviews and guides the departments in terms of their functions related to CDM
- Prepares a monitoring report at the end of the year to be submitted to the verification agency.

CDM committee meeting:

The committee will meet once a month to review the CDM performance of the plant. The CERs generated are compared with the expected CERs and corrective actions are taken.

Training of Personnel:

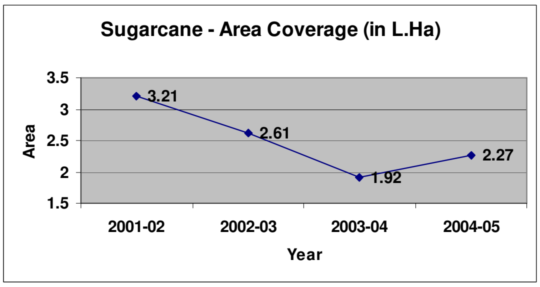
Various member of the CDM team will be trained time to time according to the departmental needs

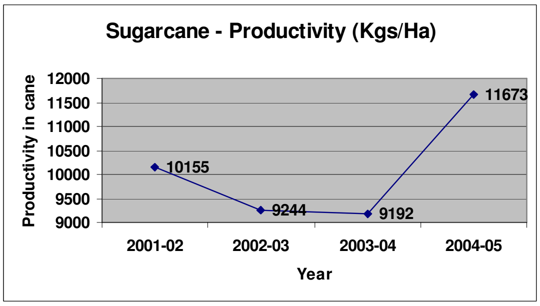
CDM Internal Audit:

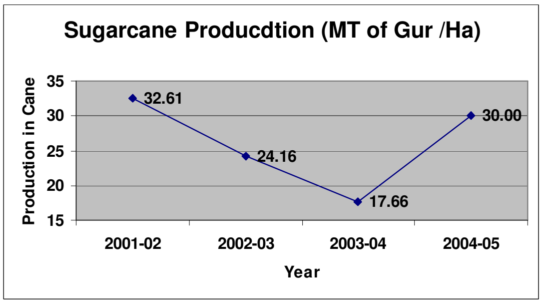
An internal audit (IA) team will be formulated and will conduct the audit once in a quarter. The IA team will constitute of one site Accountant, one Mechanical Engineer, one Electrical Engineer and one Process Engineer. The team will review the monitored data and verify them for correctness. The IA team will submit a report to the Head (Cogeneration plant) who will review it and forward it to the General Works Manager.

Annex 5

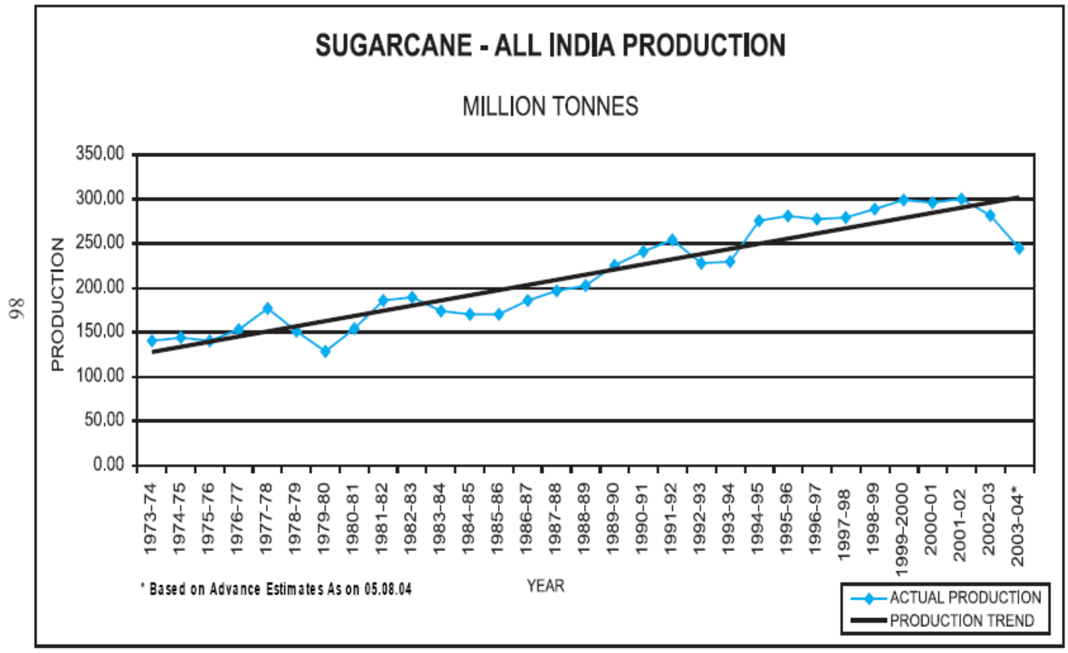
Sugarcane cultivation and production in Tamilnadu and India







For Tamilnadu, Source: www.agricoop.nic.in/RabiCampaing05_06/ RabiCamp05_06/Tamil%20Nadu.ppt



Source: Reports of "The Commission For Agricultural Costs and Prices During 1999-2000" – www.agricoop.nic.in

Break-up of the Project Cost

S.No	Particulars	Value (Rs.in lacs)
1	Civil	932
2	Boiler	2201
3	TG Set	1696
4	Air Cooled Condenser	715
5	Bagasse/Ash Handling System	420
6	Water Treatment Plant	140
7	DCS	192
8	Other Mechanical Equipments	369
9	Electrical Equipments	810
	Total Civil, Plant and Machinery	**7475**

Appendix A

Abbreviations

CC	Climate Change
CDM	Clean Development Mechanism
CEA	Central Electricity Authority
CER	Certified Emission Reductions
CMIE	Centre for Monitoring Indian Economy
CO	Carbon mono-oxide
CO_2	Carbon di-oxide
CPU	Central Power Units
DCS	Distributed Control System
DPR	Detailed Project Report
DM	De-Mineralised
EID Parry	EID Parry (India) Limited
EGEAS	Electric Generation Expansion Analysis System
EPS	Electric Power Survey
ESP	Electro Static Precipitator
EIA	Environmental Impact Assessment
FD	Forced Draft
FIs	Financial Institutions
FYP	Five Year Plan
GHG	Greenhouse Gas
GOI	Government of India
GWh	Gega Watt hour
HP	High Pressure
HV	High Voltage
ID	Induced Draft
IPCC	Intra-governmental Panel for Climate Change
IPP	Independent Power Producers
IREDA	Indian Renewable Energy Development Agency

ISPLAN	Integrated System Plan
KP	Kyoto Protocol
Km	Kilo meters
KV	Kilo Voltage
KW	Kilo Watt
KWh	Kilo Watt hour
NCES	Non-Conventional Energy Sources
LP	Low Pressure
1 Lakh	1,00,000
MkWh	Million Kilo Watt hour
MU	Million units
MNES	Ministry of Non-conventional Energy Sources
MoP	Ministry of Power
MoU	Memorandum of Understanding
MSW	Municipal Solid Waste
MT	Metric Ton
MW	Mega Watt
NCE	Non Conventional Energy
NEDA	Non conventional Energy Development Agency
Nox	Nitrogen Oxides
NTPC	National Thermal Power Corporation
p.a	Per annum
PLF	Plant Load Factor
PPA	Power Purchase Agreement
PIN	Project Idea Note
PRDS	Pressure regulating and de-superheating station
REP	Renewable Energy Projects
SA	Secondary Air
SEB	State Electricity Board
SO_2	Sulphur Di-oxide

SPM	Solid Particulate Matter
STG	Steam Turbine Generator
TCD	Tones of Crushing per Day
TDS	Total Dissolved Solids
TERI	Tata Energy Research Institute
TJ	Trillion Joules
TNEB	Tamilnadu Electricity Board
TNPCB	Tamilnadu Pollution Control Board
TPH	Tones Per Hour
UNFCCC	United Nations Framework Convention on Climate Change

Appendix B

Reference List

Sr.No	Particulars of the references
	Kyoto protocol / UNFCCC Related
1.	Kyoto Protocol to the United Nations Framework Convention on Climate Change
2.	Website of United Nations Framework Convention on Climate Change (UNFCCC), http://unfccc.int
3.	UNFCCC Decision 17/CP.7: Modalities and procedures for a clean development mechanism as defined in article 12 of the Kyoto Protocol.
	Project Related
4.	Detailed Project Report on 18 MW Non-Conventional renewable sources bagasse Cogeneration Power Plant at EID Parry, Pudukkottai
5.	Various project related information / documents / data received from EID Parry.
	Baseline Related
6.	CMIE published document of April 2002 on Energy, which includes the detailed data of Energy sector of India.
7.	Website of Center for Monitoring Indian Economy (CMIE) Pvt. Ltd., Mumbai, India – www.cmie.com
8.	Website of Central Electricity Authority (CEA), Ministry of Power, Govt. of India - www.cea.nic.in
9.	CEA published document "Fifteenth Electric Power Survey of India"
10.	CEA published Report on "Power on Demand by 2012, Perspective plan studies"
11.	CEA Report on, Fourth National Power plan 1997 – 2012.
12.	Website of Ministry of Power (MoP), Govt. of India www.powermin.nic.in
13.	Website of Ministry Non-Conventional Energy Sources (MNES), Govt. of India – www.mnes.nic.in

14.	Website of Indian Renewable Energy Development Agency (IREDA), www.ireda.nic.in
15.	Official website of Government of Tamilnadu http://www.tn.gov.in
16.	Infraline web site. http://www.infraline.org
17.	South India Sugar Manufacturer's Assosiation (SISMA)
18.	www.indianelectricity.com

Enclosure I

Summary of Environmental Impact Assessment

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

The impact of the project on the environment can occur at two stages:

3. Construction phase (short term)
4. Operational phase (long term)

Various impacts during the construction and operation phase on the environmental parameters have been studied and the impact of the project activity during each phase is described as under.

Impacts during construction phase

The impacts during construction phase of the 18 MW biomass based cogeneration plant are listed as given here:

Air quality impacts:

- Due to dust arising out of leveling, grading, earthworks, foundation works
- Due to vehicular emissions from transportation of raw materials such as cement, sand, gravel etc
- Due to particulate emissions from construction activities such as pre-casting, fabrication, welding etc

Noise level increase:

- From construction activities
- Noise generated by earthmovers, Materials handling and Impact based equipment

Land use and soil quality:

- Change in land use pattern
- Rehabilitation and resettlement are not involved

Water environment impacts

- From consumption of water for construction purposes

Impacts on Terrestrial ecology

- Removal of vegetation at the site

- Impact on Aquatic ecology
- There are no major water bodies in the immediate vicinity of the plant

Impacts on Demography and Socioeconomics

- Employment opportunities to local people

All the above points discussed represent a broad range of environmental impacts during the construction phase of the cogeneration plant. It should be noted that the impacts due to construction activities are mostly short-term and will cease to exist beyond the construction phase.

Impacts during operational phase

The impacts during operational phase of the cogeneration plant are as given here:

Air quality impacts:

Negligible quantities of oxides of sulphur are present in the flue gas discharged by the cogeneration plant. The temperature encountered during burning of bagasse is not enough to produce nitrous oxide emissions, whereas Suspended Particulate Matter (SPM) from fly ash in the flue gas is inevitable.

Noise level increase:

Noise emission arises from the operation of turbine, boiler, compressors, motors and associated equipments in the cogeneration plant.

Water quality impacts:

The effluents generated from the project activity will be treated in the effluent treatment plant to ensure that there is no environmental deterioration. Wastewater treatment plant has been provided for the adequate treatment of the cogeneration plant effluents. The wastewater is treated to make it usable for irrigation purposes.

Water required of the project plant is met by the water sources available at the project site. Hence impact on ground water will not be significant.

Ecological impacts:

No ecological impacts are envisaged as the wastewater from the cogeneration plant is treated appropriately before final disposal. Also as trees have been planted around the site of the project activity, it cools the atmosphere in the operational area and mitigates air pollution and noise level increase.

Land and soil impacts:

Construction of cogeneration plant and roads will change the natural characteristics of the surface. Addition of impervious surface could add to marginal increase in runoff, which in turn could lead to soil erosion in case that soil is improperly vegetated.

Impact on Topography and Climate

The major envisaged topographical changes would be due to the manmade civil structures, which are negligible. Impact on climatic conditions will not be significant.

Demographic and Socio-economic impacts:

The cogeneration plant has contributed to socio economic growth in the following ways;

- Generation of employment opportunities
- Reduces migration of local work force to other areas
-

Summary of Environmental Management Plan (EMP)

The EMP is prepared to basically mitigate the various impacts arising from construction and operational phases of the cogeneration power plant. Further, an EMP is required to ensure sustainable development in the area of the project cogeneration site. The project activity is likely to provide a new economic fillip for the region as a whole. The EMP aims at controlling pollution at source to the extent possible, followed by treatment measures before they are discharged.

<u>Construction phase</u>

Air quality

The following mitigative measures were followed during the construction phase

- Spraying of water at regular intervals to suppress dust emissions from construction activities
- Covering construction materials during transportation
- Proper maintenance and periodic emission check for transportation vehicles

- Use of personal protective equipment (PPE) like goggles and nose masks to reduce impact of dust emissions during construction activities

Noise environment

The noise levels are within acceptable limits. Community noise levels are not likely to be affected because of vegetation and attenuation due to physical barriers. Earmuffs are provided to workers to be used during construction activities.

<u>Operational phase</u>

Air environment

The following mitigation measures will be adopted to keep under control impacts on air environment:

- Regular monitoring of air quality
- Installing of Electro Static Precipitator to control particulate matter
- Development of a green belt

Noise environment

- Providing absorbing as well as noise damping materials in all aspects of project activity
- Acoustical sealing should be done for all openings
- Provision of ear plugs, work rotation, adequate training
- Incorporation of noise control measures at source
- Sound proofing/ glass paneling of critical operating stations
- Regular noise level monitoring at the plant and surrounding area
- Plantation of green belt which acts as a attenuator of noise

Land and soil environment

- Improvement of soil quality and plantation of suitable tolerant species in the study area.

Water environment

- The water requirement should be restricted and should be conserved by recycling treated wastewater to the maximum extent.

Ecological environment

- Development of a greenbelt at the site of the project activity

Socioeconomic Environment

- Training to cane growers and farmers in order to improve productivity