EID Parry (India) Limited

UNFCCC Ref No: 1139

Project title: Bagasse based Cogeneration Project at Pudukkottai Tamil Nadu, India

Clean Development Mechanism
Emission Reduction Monitoring Report

Monitoring period: 14.09.2007 to 30.09.2008
(Includes starting and ending days)
for
Initial and First Periodic Verification

A Murugappa Group Company

Version: 02.7
25 March 2011

Purpose of the report:

This monitoring report has been prepared for the purpose of independent verification of the Green House Gas (GHG) emission reductions achieved by EID Parry (India) Limited's Clean Development Mechanism (CDM) project titled "Bagasse based Cogeneration Project at Pudukkottai Tamil Nadu, India" during the period "14 September 2007 to 30 September 2008" (includes starting and ending days). This monitoring report is for the initial and first periodic verification.

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1. GENERAL ASPECTS OF THE PROJECT ACTIVITY

Brief description of the project activity:

This project activity involves implementation of a bagasse based cogeneration plant ("project activity") in one of the sugar plants of EID Parry located at Pudukkottai District, Tamil Nadu, India. The cogeneration plant has been implemented with the objective of increasing the efficiency of electricity generation by substituting the existing low efficiency cogeneration system with a high efficiency cogeneration system. As a result of the project activity, the net electricity generation on site has increased enabling the export of electricity to the regional grid[1]. The export of the incremental electricity generation displaces an equivalent amount of electricity that would otherwise have been generated in fossil fuel intensive grid connected power plants and thereby reduces equivalent amount of Green House Gases (GHGs) from these power plants. The project plant meets the entire steam requirements of the sugar plant and there are no other boilers in the project site, except the pre-project system which is kept idle.

Emission reduction from the project activity in the first monitoring period:

The total emission reduction achieved in the first monitoring period "14 September 2007 to 30 September 2008" by the project activity is 65,490 tCO_2.

Details of the installed technology and equipments:

Turbine Generator details:

Rated output capacity:	18 MW
Type:	Extraction condensing system

Boiler details:

Rated steam output capacity:	100 tonnes per hour
Rated pressure:	86 kg/cm^2
Rated temperature:	510±5 degree Celsius

Present status of the project activity:

Commissioned and connected to grid on: 28 March 2006

Continued operation period: Since 28 March 2006

[1] Electricity is exported to the Tamil Nadu Electricity Board (TNEB) which is part of the southern regional grid of India

Status of pre-project equipments:

The pre-project cogeneration system is kept idle at the project site. The system was not operated during this monitoring period (14.09.2007 to 30.09.2008). The technical specifications of the major equipments used in pre-project cogeneration system are as follows:

Boiler:

S.N	Parameter	Boiler 1	Boiler 2
1	Steam flow	51.5 TPH	29 TPH
2	Rated steam pressure	17 kg / cm^2	
3	Rated steam temperature	280^oC	

Turbine:

S.N	Parameter	Turbine 1	Turbine 2
1	Power output	2.0 MW	2.5 MW

Project Participants:

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
Switzerland	EMIT Securities Limited (Private Entity)	No

Location of the project activity:

Town : Kurumbur Village – Aranthangi Taluk

City : Pudukkottai district

Country : Tamil Nadu State, India

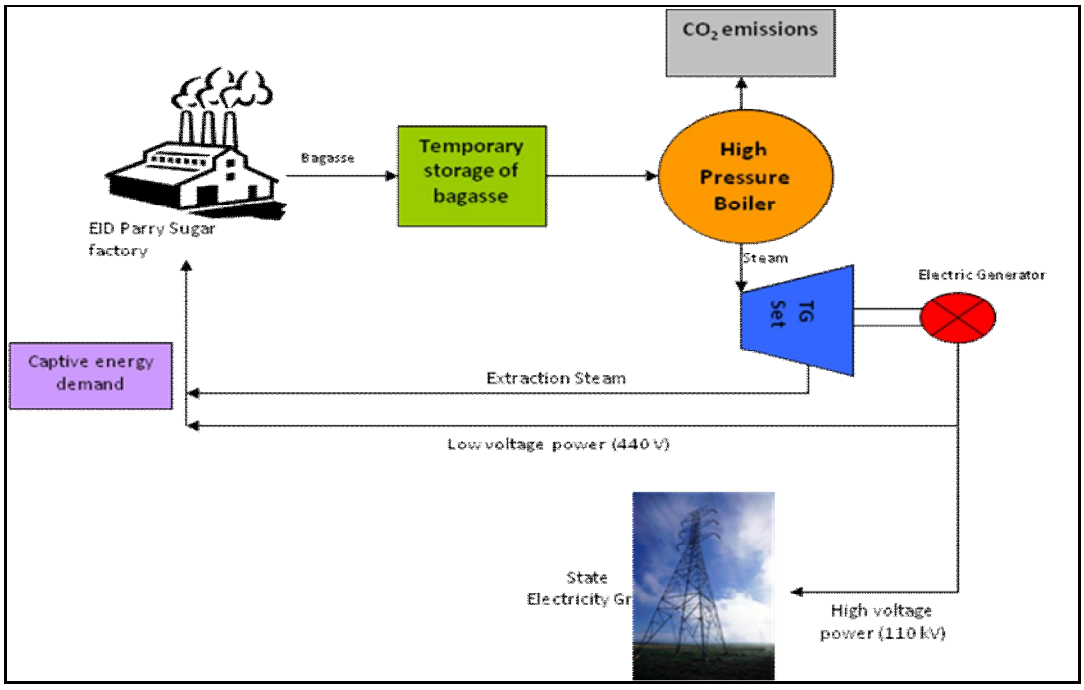
GPS coordinates : Latitude: 10.250556

Longitude: 78.086667

Technical description of the project activity:

EID Parry has installed a high pressure Steam-Rankine cycle in the project activity replacing the low pressure system which was exiting in the pre-project scenario. 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, highly efficient and 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 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.

Technical diagram:



Baseline and monitoring methodology applied to the project activity:

Title: The project activity applied the methodology ACM0006 version 04 (Consolidated baseline and monitoring methodology for grid-connected electricity generation from biomass residues), which is indicated in the registered PDD and validation report.

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

- AM0004: "Grid-connected Biomass 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, Version 06 ("Consolidated baseline methodology for grid-connected electricity generation from renewable sources") and the "Tool for the demonstration and assessment of additionality", Version 03 applicable at the time of registration of the project activity with UNFCCC.

Registration date and crediting period of the project activity:

UNFCCC Reference No:	1139[2]
Registration date:	14 September 2007.
Start date of crediting period:	14 September 2007
Crediting period:	14 September 2007 – 13 September 2017 (Fixed)

[2] https://cdm.unfccc.int/Projects/DB/SGS-UKL1179758404.75/view.html

Responsible person for completion of monitoring report:

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2. IMPLEMENTATION OF THE PROJECT ACTIVITY

Implementation status of the project activity:

Please refer to the present status of the project activity provided in section 1. The total downtime during this monitoring period is 1414 hours due to various planned and forced outages. The details of the same are provided in Annex 5.

Request for deviation applied to this monitoring period

A request for deviation regarding the monitoring of net quantity of electricity generated in the project plant for the first monitoring period (14 September 2007 – 30 September 2008) was sought[3] and has been accepted by CDM EB during its 50th EB meeting on 16/10/2009[4].

Revision of the monitoring plan:

During the initial and first periodic verification, it has been observed that the monitoring plan of the registered PDD is not in accordance with the approved monitoring methodology applied to the project activity i.e. ACM0006 Version 04. In order to fulfil with the monitoring requirement, a request for revision of the registered monitoring plan incorporating the approved monitoring procedure for net electricity generation and other appropriate revisions required as per adopted methodology were sought and have been approved by CDM EB on 29/06/2010[5].

[3]Deviation request submitted to EB:
http://cdm.unfccc.int/UserManagement/FileStorage/RRGIEHYBLNTP5377OE6BJ1JUL30HZM
[4]Deviation request accepted by EB:
http://cdm.unfccc.int/UserManagement/FileStorage/AM_CLAR_BMIBWXRD1JX8TR83TSHBMAL4V0U981
[5] Registered revised monitoring plan:
http://cdm.unfccc.int/UserManagement/FileStorage/ZW6XPBNHMLRO9QS0A5TFK872DIJYEV
Validation report of revised monitoring plan:
http://cdm.unfccc.int/UserManagement/FileStorage/G9KWZR7OP148BTUFLYDINSVJM32EQA

3. SUSTAINABLE DEVELOPMENT ASPECTS OF THE PROJECT ACTIVITY

Contribution to socio-economic well being:

The export of electricity to the grid by the project activity has helped to reduce power outages and thereby improving industrial output and quality of life resulting in socio-economic development of the region. The improved power situation encourages new small and medium industries in the region improving the rural employment scenario. These would indirectly contribute to reducing the population migration to cities.

Contribution to technological development:

The project activity has adopted an advanced high efficiency technology (steam pressure of 86 kg/cm^2). This has facilitated to establish the successful performance of this technology in the region thus encouraging other similar ventures in the region.

Contribution to environmental well-being:

The project activity reduces exploitation of natural resources (fossil fuels) for energy generation by supplementing the local electricity grid with a sizeable quantity of renewable[6] power. Further, the project reduces other negative environmental aspects of conventional power plants like emission of particulate matter and ash disposal. The project promotes the usage of renewable sources for power generation by successful demonstration of biomass based power generation.

[6] Power generated from renewable biomass residues (bagasse)

4. DESCRIPTION OF THE MONITORING SYSTEM

EID Parry has incorporated a special team for implementing the required monitoring procedures. The team comprises relevant personnel from various departments, who are assigned the task of monitoring and recording specific CDM parameters (The detailed list of parameters is presented in Annex 1) are relevant to their respective departments. The monitored values are 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 is investigated and appropriate action has been taken. The monitored values is recorded and stored in paper and electronically for verification. 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 monitoring parameters required to calculate emission reductions, project emissions and leakage.

Functions of the CDM Team:

- Monitor parameters for calculating emission reductions
- 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.

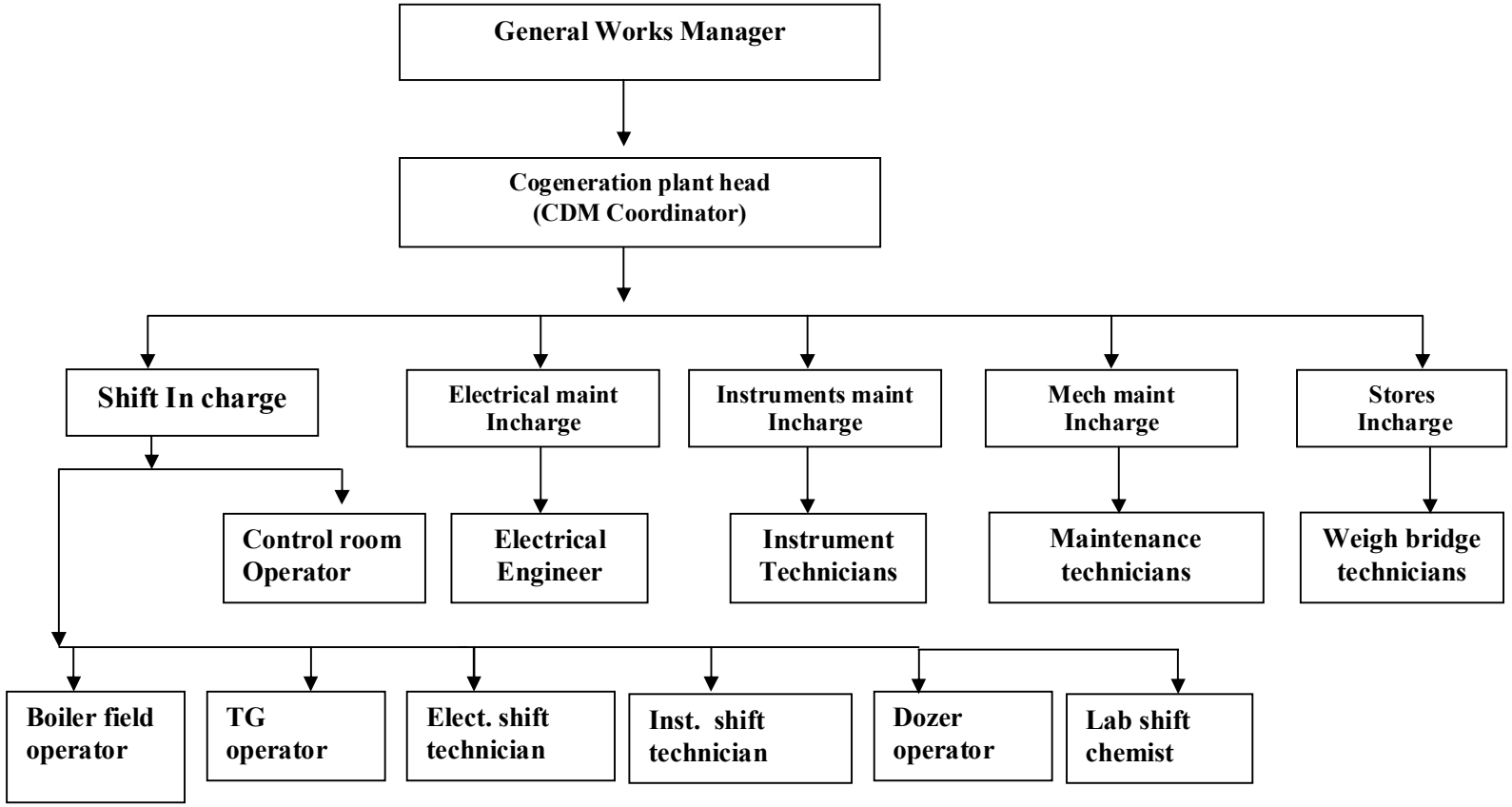
Plant Maintenance Procedure:

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

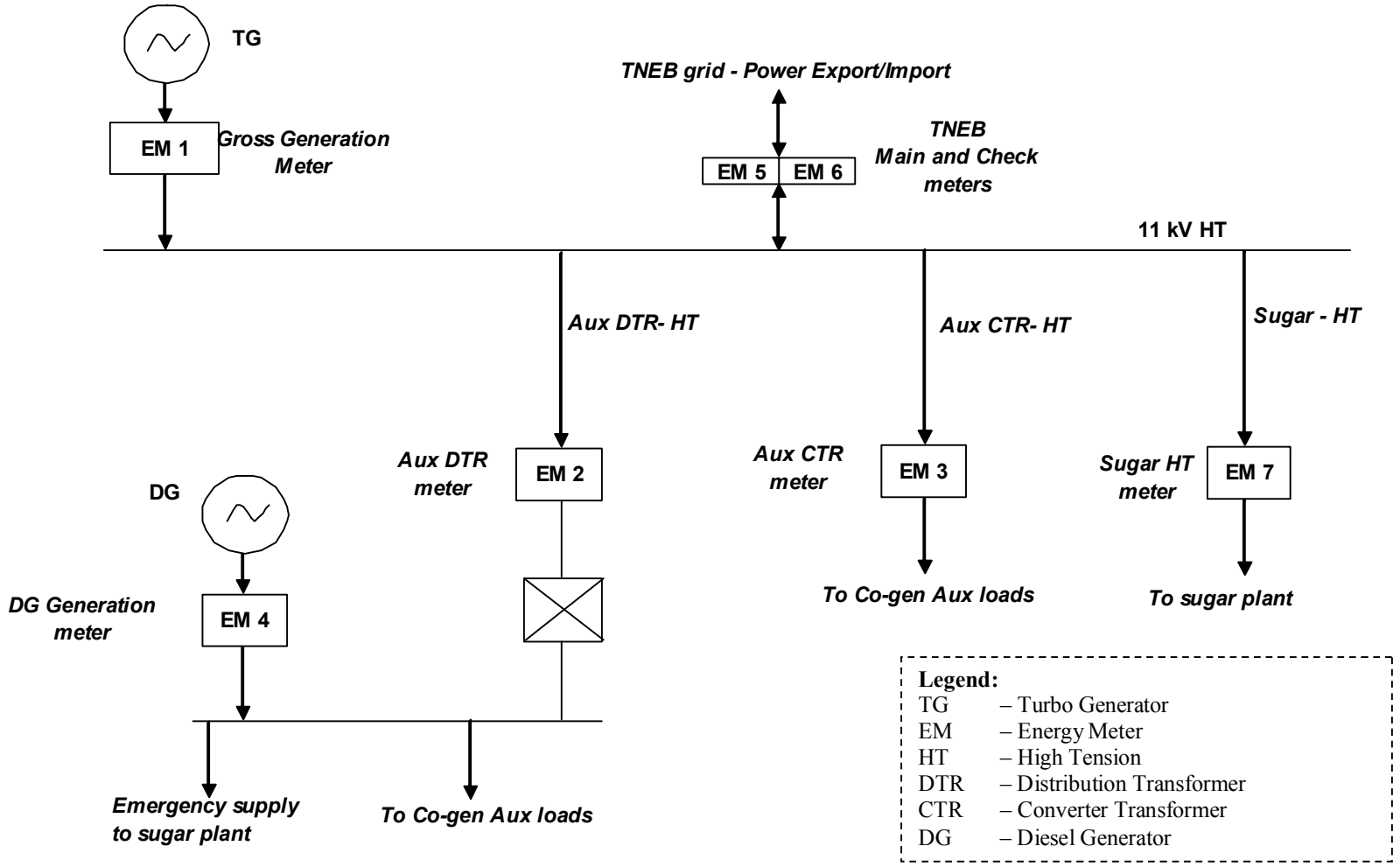
- Regular Maintenance procedures
- Maintenance and breakdown reports for analysis
- Stock critical spares
- Training on equipments and instruments

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.

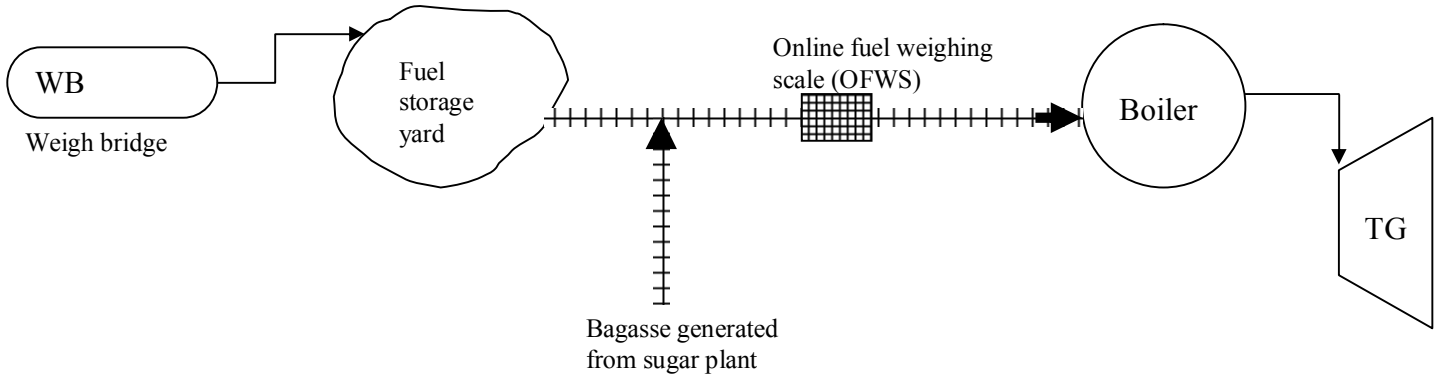
CDM TEAM


General Works Manager
Cogeneration plant head
(CDM Coordinator)
Shift In charge
Electrical maint
Incharge
Instruments maint
Incharge
Mech maint
Incharge
Stores
Incharge
Control room
Operator
Electrical
Engineer
Instrument
Technicians
Maintenance
technicians
Weigh bridge
technicians
Boiler field
operator
TG
operator
Elect. shift
technician
Inst. shift
technician
Dozer
operator
Lab shift
chemist

LINE DIAGRAM SHOWING ALL ELECTRICITY MONITORING POINTS



LINE DIAGRAM SHOWING ALL FUEL MONITORING POINTS



Details of Energy meters:

ID	Parameter	Equipment Name	Location	Serial No.	Make	Model No.	Accuracy class	CT / PT Range	Unit	Recording frequency
EM 1	Gross Generation	Gross Gen. Meter	HT Panel Room	ELI04157	Secure	ELITE	0.2	(1600/1A) / (110V/√3)	kWh	Continuous
EM 2	Aux. Consumption through DTR	Aux. DTR Meter	HT Panel Room	ELI04161	Secure	ELITE	0.2	(150/1A) / (110V/√3)	kWh	Continuous
EM 3	Aux. Consumption through CTR	Aux. CTR Meter	HT Panel Room	ELI04167	Secure	ELITE	0.2	(150/1A) / 110V/√3	kWh	Continuous
EM 4	Aux. Consumption through DG	DG Gen. Meter	Cogen MCC	5298399	L&T	ER 300 N	0.5	(2500/5A) / (415/√3 - 110√3)	kWh	Continuous
EM 5	Energy Export/Import	TNEB Main Meter	TNEB Yard	5462951	L&T	ER 300 P	0.2	(125/1A) / (110V/√3 – 110kV/√3)	kWh	Continuous
EM 6	Energy Export/Import	TNEB Check Meter	TNEB Yard	6489252	L&T	ER 300 P	0.2	(125/1A) / (110V/√3 – 110kV/√3)	kWh	Continuous
EM 7	Sugar plant consumption	Sugar HT Meter	HT Panel Room	ELI04148	Secure	ELITE	0.2	(400/1A) / (110V/√3)	kWh	Continuous
		Spare meter		ELI04147	Secure	ELITE	0.2	(150/1A) / (110V/√3)	kWh	Continuous

Net electricity generation ($EG_{project\ plant}$)[7] is the deduction of auxiliary consumption from gross generation calculated as follows
$EG_{project\ plant}$ = Gross Electricity Generation (EM 1 reading) – Auxiliary consumption (EM 2 + EM 3 + EM 4 readings)
Net electricity generation is crossed checked with the electricity exported and sold to TNEB which is monitored by EM 5

ID	Required Calibration frequency as per supplier	Actual Calibration frequency	Calibration date	Previous calibration
EM 1	Annual	Annual	04.11.2008	12.11.2007 & 01.01.2007
EM 2	Annual	Annual	05.11.2008	15.11.2007 & 01.01.2007
EM 3	Annual	Annual	03.11.2008	12.11.2007 & 01.01.2007
EM 4	Annual	Annual	11.12.2008	05.03.2008 & 13.08.2007
EM 5	Annual	Annual	07.05.2008 & 18/06/2009	09.08.2007
EM 6	Annual	Annual	07.05.2008 & 18/06/2009	09.08.2007
EM 7	Annual	Annual	03.11.2008	12.11.2007 & 01.01.2007
Spare[8]	Annual	Annual	18.12.2008	01.01.2007

[7] A request for deviation regarding the monitoring of net quantity of electricity generated in the project plant for the first monitoring period (14 September 2007 – 30 September 2008) was sought and has been accepted by CDM EB during its 50th EB meeting on 16/10/2009. A request for revision of the registered monitoring plan incorporating the approved monitoring procedure for net quantity of electricity generated in the project plant was sought and has been approved by CDM EB on 29/06/2010.

[8] Spare meter was not used during this monitoring period since the primary meters were operating without any problems.

Details of fuel monitoring equipments:

ID	Parameter	Equipment Name	Location	Serial No.	Make	Model No.	Accuracy class	Range	Unit	Recording frequency
WB	Truck loads of fuel purchased	Weigh bridge	Factory entrance	EB 99W121	Avery	L225	0.025	0 to 40000 kg	kg	Continuous
OFWS	Fuel consumption in boiler	Online fuel weighing system	Fuel conveyor to boiler	316/00	IPA	BCW32L9	0.5	0 to 45 tonnes per hour	Tonnes	Continuous
FWF	Feed water flow	Feed water flow transmitter	Boiler	232166	Rosemount	1151	0.25%	0 - 5000 mmWC	mmWC	Continuous
FWT	Feed water temperature	Feed water temperature transmitter	Boiler	2PT6402	Pyroelectronic	Smart	0.25%	0 - 600 ^{o}C	^{o}C	Continuous
FWP	Feed water pressure	Feed water pressure transmitter	Boiler	232546	Rosemount	1151	0.25%	0 - 150 kg/cm^2	kg/cm^2	Continuous
SF	Steam flow	Steam flow transmitter	Boiler	232167	Rosemount	1151	0.25%	0 - 5000 mmWC	mmWC	Continuous
ST	Steam temperature	Steam temperature transmitter	Boiler	232085	Rosemount	1151	0.25%	0 - 800 ^{o}C	^{o}C	Continuous
SP	Steam pressure	Steam pressure transmitter	Boiler	232123	Rosemount	1151	0.25%	0 - 160 kg/cm^2	kg/cm^2	Continuous

ID	Required Calibration frequency	Actual Calibration frequency	Calibration date	Previous calibration
WB	Annual	Annual	04.01.2008 & 21.01.2009	03.03.2007
OFWS	Annual	Six months	19.12.2008	25.06.2008, 27.12.2007, 28.06.2007
FWF	Annual	Six months	14.09.2007, 12.03.2008 & 09.12.2008	14.03.2007
FWT	Annual	Six months	23.09.2007, 23.03.2008, 23.09.2008 & 23.09.2009	23.03.2007
FWP	Annual	Six months	24.03.2008, 24.09.2008 & 24.09.2009	04.09.2007
SF	Annual	Six months	09.05.2008 & 09.11.2008	13.03.2007 & 13.09.2007
ST	Annual	Six months	09.03.2008 & 09.11.2008	11.03.2007 & 11.09.2007
SP	Annual	Six months	13.03.2008, 13.09.2008 & 09.11.2009	11.03.2007 & 11.09.2007

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MEASURES TO ENSURE DATA ACCURACY / UNCERTAINTY LEVELS:

Mass and energy balance:

The electricity parameters monitored are cross-checked by doing an annual energy balance as elaborated in Annex 2. The fuel consumption data is cross-checked by an annual mass balance considering purchased quantities and stock exchanges as elaborated in Annex 2.

Thermal Firing Capacity:

The thermal capacity is maintained same as that of the pre-project after project implementation.
Fuel firing capacity in the pre-project plant:
Boiler-1 : 16 TPH
Boiler-2 : 29 TPH
Fuel firing capacity in the project *plant:*
Project Boiler : 45 TPH

Calibration:

All the energy meters and other monitoring equipments have been calibrated as per approved monitoring plan to ensure that the accuracy levels are maintained within their specified levels. Copy of calibration reports have been submitted to the DOE.

CDM monthly review meeting:

The team meets once a month to review the CDM performance of the plant. Any particular concerns are discussed and appropriate action is taken.

CDM Internal audit:
The CDM data recorded is internally audited once every quarter. The audit team consists of three members – two technical persons and one accountant. Copy of internal audit reports are submitted to the DOE.

Training:
The personnel involved in the data monitoring have been provided with periodic trainings. This helps to eliminate any manual recording or calculation errors. Proof of training provided is submitted to the DOE.

Data uncertainty:
The uncertainty of the monitored data depends on the following parameters:
*Meter uncertainty***,** which is equivalent to the accuracy level of the meter. All the meters have been calibrated at least annually which ensures that the uncertainty levels are within the accuracy level.
Operator uncertainty – This is not applicable since none of the monitoring equipments need a manual operator.

All of the above has contributed to ensuring the accuracy of the recorded data.

Emergency preparedness procedure for the monitoring system is presented in Annex 6.

5. MONITORED DATA AND PARAMETERS

5.1 Gross Energy Generation in the project plant:

Data / Parameter:	**$EG_{Gross, project\ plant,y}$**
Data unit:	MWh
Description:	Gross quantity of electricity generated in the project plant
Source of data to be used:	Based on on-site measurements recorded in EID Parry's energy meter log books
Value of data	129797.2
Description of measurement methods and procedures applied:	This data has been measured continuously in gross energy meter. The Technician (Electrical) records the gross generation data on a daily basis in log books. Reporting and archiving: The Engineer (Electrical) reviews and approves the log books on a daily basis and records the data in computer. On a monthly basis, a compilation of all the energy parameters recorded for the month is prepared by the Engineer and submitted to the Cogen head. The Cogen head verifies the monthly energy report and archive it. Monitoring frequency: Continuously
QA/QC procedures applied	An annual energy balance has been done by the Cogen head to cross-check the recorded generation data with receipts from electricity exported and sold to TNEB. Refer "Energy balance" in Annex 2. **Calibration:** Gross energy meter has been calibrated annually as follows: Serial No. | Accuracy class | Calibration date | Prev. Calibrations | Result ELI 04157 | 0.2% | 04.11.2008 | 12.11.2007 01.01.2007 | Error % within limits Calibration is performed once in a year by a third party agency and is traceable to national standards.
Any comment:	A request for deviation regarding the monitoring of net quantity of electricity generated in the project plant for the first monitoring period (14 September 2007 – 30 September 2008) was sought and has been accepted by CDM EB during its 50th EB meeting on 16/10/2009[4]. A request for revision of the registered monitoring plan incorporating the approved monitoring procedure for net quantity of electricity generated in the project plant was sought and has been approved by CDM EB on 29/06/2010[5].

5.2 Auxiliary energy consumption in the project plant:

Data / Parameter:	**$EG_{Aux, project\ plant,y}$**
Data unit:	MWh
Description:	Auxiliary electricity consumption in the project plant
Source of data to be used:	Based on on-site measurements recorded in EID Parry's energy meter log books
Value of data	14360.116
Description of measurement methods and procedures applied:	This data has been measured continuously in three auxiliary energy meters. The Technician (Electrical) records the auxiliary consumption data on a daily basis in log books. The auxiliary equipments are supplied through two transformers (called DTR and CTR) during normal operation. During emergency, the equipments are also supplied from the DG set. The energy supply through all the three sources is monitored through three energy meters, which is summed up to calculate the total auxiliary consumption. $EG_{Aux} = EG_{Aux, DTR} + EG_{Aux, CTR} + EG_{DG}$ Reporting and archiving: The Engineer (Electrical) reviews and approves the log books on a daily basis and record the data in computer. On a monthly basis, a compilation of all the energy parameters recorded for the month is prepared by the Engineer and submitted to the Cogen head. The Cogen head verifies the monthly energy report and archives it. Monitoring frequency: Continuously
QA/QC procedures applied	An annual energy balance has been done by the Cogen head to cross-check the recorded data with receipts from electricity exported and sold to TNEB. Refer "Energy balance" in Annex 2. **Calibration:** The three auxiliary energy meters have been calibrated annually as follows:

Source	Serial No.	Accuracy class	Calibration date	Prev. Calibration	Result
Aux. DTR	ELI04161	0.2%	05.11.2008	15.11.2007 01.01.2007	Error % within limits
Aux. CTR	ELI04167	0.2%	03.11.2008	12.11.2007 01.01.2007	Error % within limits
Aux. DG	5298399	0.5%	11.12.2008	05.03.2008 13.08.2007	Error % within limits

	Calibration is performed once in a year by a third party agency and is traceable to national standards.
Any comment:	It may be noted that during emergencies, DG set electricity is fed to the sugar plant. This quantity of electricity is also measured in the "DG generation meter" and is accounted as auxiliary consumption of the project activity. This is conservative. (Refer EM4 in electricity metering diagram above). A request for deviation regarding the monitoring of net quantity of electricity generated in the project plant for the first monitoring period (14 September 2007 – 30 September 2008) was sought and has been accepted by CDM EB during its 50th EB meeting on 16/10/2009[4]. A request for revision of the registered monitoring plan incorporating the approved monitoring procedure for net quantity of electricity generated in the project plant was sought and has been approved by CDM EB on 29/06/2010[5].

5.3 Net energy generation in the project plant:

Data / Parameter:	**$EG_{project\ plant,y}$**
Data unit:	MWh
Description:	Net quantity of electricity generated in the project plant
Source of data to be used:	Based on on-site measurements recorded in EID Parry's energy meter log books
Value of data	115437.084
Description of measurement methods and procedures applied:	Calculated by deducting the auxiliary consumption from the gross electricity generation. $EG_{project\ plant} = EG_{gross} - EG_{Aux}$. The Technician (Electrical) records the net generation data on a daily basis in log books. Reporting and archiving: The Engineer (Electrical) reviews and approves the log books on a daily basis and record the data in computer. On a monthly basis, a compilation of all the energy parameters recorded for the month is prepared by the Engineer and submitted to the Cogen head. The Cogen head verifies the monthly energy report and archives it. Monitoring frequency: Continuously
QA/QC procedures applied	An annual energy balance has been done by the Cogen head to cross-check the recorded generation data with receipts from electricity exported and sold to TNEB. Refer "Energy balance" in Annex 2.
Any comment:	A request for deviation regarding the monitoring of net quantity of electricity

	generated in the project plant for the first monitoring period (14 September 2007 – 30 September 2008) was sought and has been accepted by CDM EB during its 50th EB meeting on 16/10/2009[4]. A request for revision of the registered monitoring plan incorporating the approved monitoring procedure for net quantity of electricity generated in the project plant was sought and has been approved by CDM EB on 29/06/2010[5].

5.4 Net quantity of Electricity supplied to the grid by the project:

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 energy meter log books.
Value of data	92135
Description of measurement methods and procedures applied:	This data has been measured continuously in TNEB energy meters. There are two energy meters connected in parallel to monitor this data. One is the main meter and another is the check meter, which is used to cross-check the main meter. The Technician (Electrical) records the energy meter reading on a daily basis in log books. On a monthly basis, the data is also recorded in the "Joint Meter Reading" (JMR) log book in the presence of both TNEB and EID Parry personnel. Reporting and archiving: The Engineer (Electrical) reviews and approves the log books on a daily basis and record the data in computer. On a monthly basis, a compilation of all the energy parameters recorded for the month is prepared by the Engineer and submitted to the Cogen head. The Cogen head verifies the monthly energy report and archives it. Monitoring frequency: Continuously
QA/QC procedures applied	The metered electricity export to the grid is cross-checked with monthly TNEB electricity purchase invoices which are found to be consistent. An annual energy balance has been done by the Cogen head to cross-check the recorded data with receipts from electricity exported and sold to TNEB. Refer "Energy balance" in Annex 2. **Calibration:**

	Energy meters have been calibrated annually as follows: <table><tr><td>Serial No.</td><td>Accuracy class</td><td>Calibration date</td><td>Prev. Calibration</td><td>Result</td></tr><tr><td>5462951</td><td>0.2</td><td>07.05.2008</td><td>09.08.2007</td><td>Error % within limits</td></tr><tr><td>6489252</td><td>0.2</td><td>07.05.2008</td><td>09.08.2007</td><td>Error % within limits</td></tr></table> Calibration is performed once in a year by the Metering Relay Test Services (MRTS) wing of the TNEB. The same is recorded by them in the "Joint Meter Reading" (JMR) log book.
Any comment:	This parameter is not required to be monitored as per the adopted methodology ACM0006 Version 04. Please refer to the revised monitoring plan approved by CDM EB and the validation report of revised monitoring plan[5]. However, the monitoring parameter "EG_y" has been included as part of this monitoring report as a cross-checking measure to the parameter "$EG_{project\ plant,y}$" to improve completeness of information.

5.5 On-site electricity consumption (Energy imported from the grid):

Data / Parameter:	**$EC_{PJ,y}$**
Data unit:	MWh
Description:	On-site electricity consumption attributable to the project activity during the year y.
Source of data to be used:	Energy meter measurements recorded in EID Parry energy meter log books.
Value of data	544
Description of measurement methods and procedures applied:	This data has been measured continuously in TNEB energy meters. There are two energy meters connected in parallel to monitor this data. One is the main meter and another is the check meter, which is used to cross-check the main meter. The Technician (Electrical) records the energy meter reading on a daily basis in log books. On a monthly basis, the data is also recorded in the "Joint Meter Reading" (JMR) log book in the presence of both TNEB and EID Parry personnel. Reporting and archiving: The Engineer (Electrical) reviews and approves the log books on a daily basis and record the data in computer. On a monthly basis, a compilation of all the energy parameters recorded for the month is prepared by the Engineer and submitted to the Cogen head. The Cogen head verifies the monthly energy report

<table>
<tr><td></td><td>and archives it.

Monitoring frequency: Continuously</td></tr>
<tr><td>QA/QC procedures applied</td><td>The metered electricity import from the grid is cross-checked with monthly TNEB electricity purchase invoices which are found to be consistent.
An annual energy balance has been done by the Cogen head to cross-check the recorded data with receipts from electricity exported and sold to TNEB. Refer "Energy balance" in Annex 2.

Calibration:
Energy meters have been calibrated annually as follows:
<table>
<tr><td>Serial No.</td><td>Accuracy class</td><td>Calibration date</td><td>Prev. Calibration</td><td>Result</td></tr>
<tr><td>5462951</td><td>0.2</td><td>07.05.2008 & 18/06/2009</td><td>09.08.2007</td><td>Error % within limits</td></tr>
<tr><td>6489252</td><td>0.2</td><td>07.05.2008 & 18/06/2009</td><td>09.08.2007</td><td>Error % within limits</td></tr>
</table>
Calibration is performed once in a year by the Metering Relay Test Services (MRTS) wing of the TNEB. The same is recorded by them in the "Joint Meter Reading" (JMR) log book.</td></tr>
<tr><td>Any comment:</td><td>This parameter is not included as part of the registered monitoring plan. A request for revision of the registered monitoring plan incorporating "monitoring of the parameter $EC_{PJ,y}$" which is required as per adopted methodology ACM0006 Version 04 was sought and has been approved by CDM EB on 29/06/2010[5].</td></tr>
</table>

5.6 Biomass residue combustion in the project plant:

Data / Parameter:	**$BF_{k,y}$**
Data unit:	Tonnes of dry matter
Description:	Quantity of biomass residues type k combusted in the project plant
Source of data to be used:	EID Parry fuel log books
Value of data	$BF_{ownbagasse,y}$: 116978.6 $BF_{purchasedbagasse,y}$: 7833.5 $BF_{groundnutshell,y}$: 4462.1 $BF_{canetrashy}$: 54.5
Description of measurement methods	Fuel consumption is measured continuously in on-line weighing scale installed in

<table>
<tr><td>and procedures to be applied:</td><td>the fuel conveyors. This data is recorded on a daily basis by Engineer (Mechanical) in fuel log books.
Reporting and archiving:
Data recorded by Engineer is reviewed and input to the computer by the Shift-in-charge. On a monthly basis, a compilation of all the Energy-CDM parameters recorded for the month would be prepared by the Shift-in-charge and submitted to the Cogen head. The Cogen head would verify the monthly energy-CDM report and archive it.

This gives the wet fuel quantity. The dry fuel quantity is calculated by adjusting for the moisture content as follows:

Dry fuel = Wet fuel * (100- moisture %)

Monitoring frequency: Continuously</td></tr>
<tr><td>QA/QC procedures applied</td><td>The measured values are cross-checked with an annual fuel balance based on monthly/annual manufacturing reports, purchase receipts and stock exchanges and are found to be consistent.

"Fuel combusted = Fuel generated in-house + Fuel purchased + Opening stock - Closing stock in fuel yard"

Refer Annex 2 for annual fuel balance.
Calibration:
Online weighing scale has been calibrated every six months as follows:
<table>
<tr><td>Serial No.</td><td>Accuracy class</td><td>Calibration date</td><td>Prev. Calibration</td><td>Result</td></tr>
<tr><td>316/00</td><td>0.5</td><td>19.12.2008</td><td>25.06.2008
27.12.2007
28.06.2007</td><td>Error % within limits</td></tr>
</table></td></tr>
<tr><td>Any comment:</td><td>In the parameter $BF_{k,y}$ listed in the PDD as per the registered monitoring plan, the source of data and measurement methods was not clearly described as per the methodology ACM0006 version 04.
A request for revision of the registered monitoring plan incorporating detailed source and measurement methods for monitoring of the parameter "$BF_{k,y}$" along with QA and QC procedures was sought and has been approved by CDM EB on 29/06/2010[5].</td></tr>
</table>

5.7 Moisture content of biomass residues:

Data / Parameter:	**Moisture content of biomass residues**
Data unit:	% water content
Description:	Moisture content of biomass residue type k
Source of data to be used:	EID Parry log books and monthly manufacturing reports
Value of data	

Moisture (%)		
Month	$Moisture_{ownbagasse,y}$	$Moisture_{purchasedbagasse,y}$
Sep-07	53.91	52.00
Oct-07	53.96	50.84
Nov-07	--	50.60
Dec-07	54.01	50.67
Jan-08	52.32	50.35
Feb-08	50.27	50.29
Mar-08	50.39	50.28
Apr-08	50.55	50.51
May-08	50.70	50.58
Jun-08	50.85	50.91
Jul-08	50.90	50.80
Aug-08	51.03	--
Sep-08	51.69	--

Moisture (%)		
Month	$Moisture_{groundnutshell,y}$	$Moisture_{canetrashy}$
Sep-07	--	--
Oct-07	--	--
Nov-07	--	--
Dec-07	--	--
Jan-08	--	--
Feb-08	--	--
Mar-08	--	--
Apr-08	13.82	30.90
May-08	13.75	--
Jun-08	13.90	--
Jul-08	13.74	--
Aug-08	13.66	31.05
Sep-08	14.27	30.94

Description of measurement methods and procedures to be applied:	The moisture content is measured on-site using the "weights method" described below and recorded in log books and electronic records. Weights method: The weight of fuel with moisture and without moisture (after drying in oven) is measured to arrive at the moisture content. This data is recorded on a daily basis by Engineer (Mechanical) in fuel log

	books. Reporting and archiving: Data recorded by Engineer is reviewed and input to the computer by the Shift-in-charge. On a monthly basis, a compilation of all the Energy-CDM parameters recorded for the month would be prepared by the Shift-in-charge and submitted to the Cogen head. Mean values are calculated monthly and recorded in monthly report. The Cogen head would verify the monthly energy-CDM report and archive it.
QA/QC procedures to be applied:	**Calibration:** Mass balance has been calibrated every six months as follows: Serial No. | Accuracy | Calibration date | Prev. Calibration | Result G4500312904 | 0.5 grams | 01.09.2008 | 03.03.2008 03.09.2007 | Error % within limits
Any comment:	This parameter is not included as part of the registered monitoring plan. A request for revision of the registered monitoring plan incorporating monitoring of the parameter "moisture content of biomass residues" which is required as per adopted methodology ACM0006 Version 04 was sought and has been approved by CDM EB on 29/06/2010[5].

5.8 Fossil fuel consumption (co-fired) in the project plant:

Data / Parameter:	**$FF_{project\ plant,\ i,y}$**
Data unit:	Tonnes
Description:	Quantity of fossil fuel type i combusted in the project plant during year y
Source of data to be used:	Onsite measurement recorded in EID Parry fuel log books
Value of data	$FF_{projectplant,coal,y}$: 1051 $FF_{projectplant,lignite,y}$: 10214
Description of measurement methods and procedures to be applied:	Fuel consumption is measured continuously in on-line weighing scale installed in the fuel conveyors. This data is recorded on a daily basis by Engineer (Mechanical) in fuel log books. Reporting and archiving: Data recorded by Engineer is reviewed and input to the computer by the Shift-in-charge. On a monthly basis, a compilation of all the Energy-CDM parameters recorded for the month would be prepared by the Shift-in-charge and submitted

	to the Cogen head. The Cogen head would verify the monthly energy-CDM report and archive it. Monitoring frequency: Continuously
QA/QC procedures applied	The measured values are cross-checked with an annual fuel balance based on purchased quantities and stock exchanges and are found to be consistent. "Fuel combusted = Fuel purchased + Opening stock - Closing stock in fuel yard" Refer Annex 2 for annual fuel balance. **Calibration:** Online weighing scale has been calibrated every six months as follows:
Any comment:	In the parameter $FF_{project\ plant,\ i,y}$ listed in the PDD as per the registered monitoring plan, the source of data and measurement methods was not clearly described as per the methodology ACM0006 version 04. A request for revision of the registered monitoring plan incorporating detailed source and measurement methods for monitoring of the parameter "$FF_{project\ plant,\ i,y}$" along with QA and QC procedures was sought and has been approved by CDM EB on 29/06/2010[5].

Serial No.	Accuracy class	Calibration date	Prev. Calibration	Result
316/00	0.5	19.12.2008	25.06.2008 27.12.2007 28.06.2007	Error % within limits

5.9 Fossil fuel consumption (on-site) due to the project activity:

Data / Parameter:	**$FF_{project\ site,\ i,y}$**
Data unit:	Tonnes
Description:	Quantity of fossil fuel type i combusted at the project site for other purposes that are attributable to the project activity during the year y.
Source of data to be used:	On-site measurements recorded in EID Parry log books
Value of data	$FF_{projectsite,diesel,y}$: 32633
Description of measurement methods and procedures to be applied:	The quantity of fossil fuel (diesel) consumed in the DG sets is measured using the volume meter (dip-stick) method. This consists of monitoring the depth of fuel level in the DG set fuel tank before and after the DG operation, using a fixed standard steel Ruler. The differential fuel level (depth) is multiplied with the tank's cross-sectional area to arrive at the volume of fuel consumed. The

	measured volume of fuel is recorded in log books on a daily basis by the Engineer (Mechanical). Reporting and archiving: Data recorded by Engineer is reviewed and input to the computer by the Shift-in-charge. On a monthly basis, a compilation of all the Energy-CDM parameters recorded for the month would be prepared by the Shift-in-charge and submitted to the Cogen head. The Cogen head would verify the monthly energy-CDM report and archive it. Monitoring frequency: Continuously
QA/QC procedures applied	The measured values are cross-checked with an annual fuel balance based on purchased quantities and stock exchanges and are found to be consistent. "Fuel consumed = Fuel purchased + Opening stock - Closing stock" Refer Annex 2 for annual fuel balance.
Any comment:	This parameter is not included as part of the registered monitoring plan. A request for revision of the registered monitoring plan incorporating monitoring of the parameter "$FF_{project\ site,\ i,y}$" which is required as per adopted methodology ACM0006 Version 04 was sought and has been approved by CDM EB on 29/06/2010[5].

5.10 Net Calorific Value of biomass residue type k:

Data / Parameter:	**NCV_k**
Data unit:	GJ/tonne of dry biomass residue
Description:	Net calorific value of biomass residue type k
Source of data to be used:	Analysis report of third party laboratory.
Value of data	$NCV_{ownbagasse}$: 3692, 3608, 3690, 3675 $NCV_{plantbagasse}$: 3678, 3661, 3653 $NCV_{groundnutshell}$: 3809, 3826 $NCV_{canetrash}$: 3594
Description of measurement methods and procedures to be applied:	Determined by a certified agency. Every six months, the lab technician collects and sends three samples to the third party laboratory. The analysis reports are reviewed and archived by the Cogen head. Monitoring frequency: Third party analysis once in six months taking three

	samples per analysis
QA/QC procedures applied	NCV determined based on third party analysis report is consistent with default values given in Table 1.2 of volume 2: Energy of the 2006 IPCC guidelines for national greenhouse gas inventories and with measurement data from previous years.
Any comment:	In the parameter NCV_k listed in the PDD as per the registered monitoring plan, the data unit and measurement methods was not clearly described as per the methodology ACM0006 version 04. A request for revision of the registered monitoring plan incorporating detailed source and measurement methods for monitoring of the parameter "NCV_k" along with QA and QC procedures was sought and has been approved by CDM EB on 29/06/2010[5].

5.11 Net Calorific Value of fossil fuel type i:

Data / Parameter:	**NCV_i**
Data unit:	GJ/tonne
Description:	Calorific value of fossil fuel type i
Source of data to be used:	Analysis report of third party laboratory.
Value of data	NCV_{coal} : 6152 $NCV_{lignite}$: 2462, 2412
Description of measurement methods and procedures to be applied:	Determined by a third party laboratory. Every six months, the lab technician collects and sends three samples to the third party laboratory. The analysis reports are reviewed and archived by the Cogen head. Monitoring frequency: Third party analysis once in six months taking three samples per analysis
QA/QC procedures applied	NCV determined based on third party analysis report is consistent with default values given in Table 1.2 of volume 2: Energy of the 2006 IPCC guidelines for national greenhouse gas inventories.
Any comment:	In the parameter NCV_i listed in the PDD as per the registered monitoring plan, the data unit and measurement methods was not clearly described as per the methodology ACM0006 version 04. A request for revision of the registered monitoring plan incorporating detailed

	source and measurement methods for monitoring of the parameter "NCV_i" along with QA and QC procedures was sought and has been approved by CDM EB on 29/06/2010[5].

Please refer to monthly-wise data of all the monitored parameters presented above in Annex 3.

5.12 Average return trip distance between biomass supply sites and project site:

Data / Parameter:	**AVDy**
Data unit:	Kilometres (Kms)
Description:	Average round trip distance (from and to) between biomass fuel supply sites and the project site
Source of data to be used:	Records of EID Parry on the origin of the biomass residues and distance provided by truck operators.
Value of data	124.56
Description of measurement methods and procedures to be applied:	Origin of the biomass residues for each truck trip is recorded in the stores department. The truck operator will provide the distance traveled by the trucks between the fuel supply sites and the project activity. Data provided by truck operator is reviewed and archived by the Cogen head. Monitoring frequency: Continuously
QA/QC procedures applied	Consistency of distance provided by truck operators have been verified by the project promoters using their own vehicles. Refer trip sheets of own vehicles.
Any comment:	Since biomass has been sourced from seven different sites, the mean value of the round trip distance is adopted for calculation as per the methodology. Refer table 3.1 below In the parameter AVD_y, listed in the PDD as per the registered monitoring plan, the source of data and measurement methods was not clearly described as per the methodology ACM0006 version 04. A request for revision of the registered monitoring plan incorporating detailed source and measurement methods for monitoring of the parameter "AVD_y" along with QA and QC procedures was sought and has been approved by CDM EB on 29/06/2010[5].

5.13 Number of truck trips for the transportation of biomass:

Data / Parameter:	**TL_y**
Data unit:	Tonnes

<table>
<tr><td>Description:</td><td>Average truck load of the trucks used for transportation of biomass</td></tr>
<tr><td>Source of data to be used:</td><td>EID Parry biomass purchase records.
Measured in EID Parry's weigh bridge</td></tr>
<tr><td>Value of data</td><td>10.60</td></tr>
<tr><td>Description of measurement methods and procedures to be applied:</td><td>The quantity of biomass transported by each truck from each source is measured in the weigh bridge and recorded. The stores department operator at the weigh bridge records each and every truck load before biomass is unloaded. All details including the vehicle number, weight of biomass and source of biomass are recorded by the operator in EID Parry's records.

The average truck load (average carrying capacity of trucks) is determined by averaging the weights of each truck carrying biomass to the project plant as follows:

TLy = (Total quantity of biomass transported in each truck in a period) / (No. of truck loads)

Frequency of monitoring: Continuously, aggregated annually</td></tr>
<tr><td>QA/QC procedures applied</td><td>Weigh bridge used in monitoring of truck loads has been calibrated annually
<table>
<tr><td>Serial No.</td><td>Accuracy class</td><td>Calibration date</td><td>Prev. Calibration</td><td>Result</td></tr>
<tr><td>EB 99W121</td><td>0.025</td><td>04.01.2008 & 21.01.2009</td><td>03.03.2007</td><td>Error % within limits</td></tr>
</table></td></tr>
<tr><td>Any comment:</td><td>Refer table 3.1 below</td></tr>
</table>

During the period 14.09.2007 to 30.09.2008, EID Parry has purchased biomass residues from seven sources. The name of the sources, return trip distance (AVDy), quantity of biomass residues purchased ($BF_{k,y}$) and numbers of truck trips to the project site are provided below:

Table 3.1

S.No	Source	Return trip distance (kms)	Biomass purchased from outside (Tonnes) $BF_{k,y}$	No. of truck trips used	Share (%)
1	Kothari Sugars and Chemicals, Kattur	224	211	18	1.9
2	EID Parry, Pettavaithalai	206	1927	147	17.5

3	Arignar Anna Sugar Mill, Kurungulam	158	2759	222	25.0
4	Chengalrayan Co-operative sugar mills, Periyasevalai	472	322	21	2.9
5	Kallakurichi Co-operative sugar mills, Kallakurichi	518	516	36	4.7
6	Sri Dhandayudhapani Traders, Alangudi	54	5201	569	47.2
7	SGM, Vallatharakottai	32	84	27	0.8
8	Total biomass purchased ($BF_{k,y}$)		**11020**		
9	Total no. of truck trips			**1040**	
10	Weighted average return trip distance (AVDy)	**124.56**			
11	Weighted average truck load (TLy)	**10.60**			

5.14 Emission Factor of trucks:

Data / Parameter:	**$EF_{km, CO2}$**
Data unit:	tCO_2/km
Description:	Average CO_2 emission factor for transportation of biomass with trucks
Source of data to be used:	EID Parry truck fuel economy measurement records. Conduct sample measurements of the fuel type, fuel consumption and distance traveled for all truck types. Calculate CO_2 emissions from fuel consumption by multiplying with appropriate density values, appropriate net calorific values and CO_2 emission factors. For density, default values from Bureau of Energy Efficiency (BEE, reliable national default values) will be applied. For NCV, default values from Central Electricity Authority of India (CEA, reliable national default values) will be applied. For CO_2 emission factors, IPCC default values will be applied.
Value of data	0.000886
Description of measurement methods	Sample measurements are conducted to determine the fuel efficiency (kms/litre

<table>
<tr><td>and procedures to be applied:</td><td>fuel) of the trucks by monitoring the fuel type, fuel consumption and distance travelled for all truck types.
From the fuel efficiency, fuel consumption per kilometre distance travelled (litre fuel/km) is calculated and multiplied with density of fuel (kg/litre) to arrive at fuel consumed per kilometre distance travelled (Tonne fuel/km).
The tonne of fuel consumed per km distance travelled is multiplied with the net calorific value of diesel (based on Central Electricity Authority data) and its CO_2 emission factor (IPCC default values) to arrive at CO_2 emission factor for transportation of biomass with trucks (tCO_2/km).
$= \frac{GJ}{Tonne of\ fuel} \ X \ \frac{tCO_2}{TJ} \ X \frac{Tonne\ of\ fuel}{km} \ X \ \frac{1\ TJ}{1000\ GJ} = \frac{tCO_2}{km}$
Monitoring frequency: Annually</td></tr>
<tr><td>QA/QC procedures applied</td><td>Value arrived is consistent with national/international default values.
The data on fuel efficiency based on actual measurements and sourced from nationally and internationally available database along with the results on average CO_2 emission factor of the trucks are given below:

<table>
<tr><td>Source</td><td>Fuel efficiency (km/litre)</td><td>Remarks</td><td>Average CO2 emission factor of the trucks (EFkm,CO2), tCO2/km</td></tr>
<tr><td>Based on actual measurement</td><td>3.058</td><td>Records for actual measurement on fuel efficiency have been already submitted to DOE.</td><td>0.000885672</td></tr>
<tr><td>Nationally available database</td><td>4.5</td><td>Sourced from World Bank report on "Road Transport Service Efficiency Study". Please refer to page No. 66 of the report[9].</td><td>0.000601864</td></tr>
<tr><td>Internationally</td><td>5</td><td>IPCC default value. Please</td><td>0.000777</td></tr>
</table>
</td></tr>
</table>

9 http://siteresources.worldbank.org/INTSARREGTOPTRANSPORT/PublicationsandReports/20747263/Final_version03NOV2005.pdf

	available database		refer to page no. 21 of Volume 2 Chapter 3 "Mobile Combustion" in Table 3.2.2 under footnote a. Allowing for 5 km/litre fuel efficiency results in an emission factor of 0.000546 tCO2/km. For developing nation, the value of 5 km/litre cannot be directly applied and IPCC recommends allowing for uncertainty assessment. In such a case, the estimated emission factor for European Diesel Heavy – Duty Vehicles has been considered for cross-checking measure and it would be appropriate. The IPCC default value of emission factor for European Diesel Heavy – Duty vehicles is 770 g/km (0.00077tCO$_2$/km – IPCC EF ID No. 19259)[10].	

From the above table, it can be noted that the results of average CO_2 emission factor of the trucks based on actual measurement is **"conservative"** and it "**does** not vary significantly from the IPCC default value".

Any comment:	Refer calculation Table 3.2 below. In the parameter $EF_{km, CO2}$, listed in the PDD as per the registered monitoring plan, the source of data and measurement methods was not clearly described as per the methodology ACM0006 version 04. A request for revision of the registered monitoring plan incorporating detailed source and measurement methods for monitoring of the parameter "$EF_{km, CO2}$" was sought and has been approved by CDM EB on 29/06/2010[5].

Table 3.2

Calculation of Average CO_2 emission factor for transportation of biomass with trucks ($EF_{km,CO2}$)

[10] http://www.ipcc-nggip.iges.or.jp/EFDB/find_ef.php (A screenshot of the page from IPCC is being submitted to DOE separately)

Parameter	Units	Value	Remarks
Fuel efficiency	kms/litre diesel (A)	3.058	Based on sample measurements
Fuel consumption per kilometer distance travelled	litres fuel/kms	0.3270	Calculated value (1/A)
Density for fuel	kg/litre (B)	0.85	Default value from Bureau of Energy Efficiency
Fuel consumption per kilometer distance travelled	Tonnes fuel/kms (C)	0.000278	Calculated value (A*B/1000)
NCV of diesel taken from Central Electricity Authority	kcal/kg	10270	Default value from Central Electricity Authority
	GJ/Tonne (D)	43.00049	Calculated value
CO_2 emission factor for diesel	TCO_2/TJ (E)	74.1	Default value from IPCC guidelines
Average CO_2 emission factor of the trucks ($EF_{km,CO2}$)	**tCO_2/km**	0.000886	Calculated value (C*D*E/1000)

5.15 Emission Factor of fossil fuel type i:

Data / Parameter:	**$EF_{CO2,FF,i}$**
Data unit:	tCO_2/TJ
Description:	CO_2 emission factor for fossil fuel type i
Source of data to be used:	In case of lignite, CO_2 emission factor would be based on India's National Communication to the UNFCCC In case of coal and diesel oil, default values as per latest IPCC guidelines
Value of data	Value adopted: Lignite: 106.1 Coal: 96.1 Diesel: 74.1
Description of measurement methods and procedures to be applied:	Lignite: From India's National Communication to the UNFCCC Coal: From IPCC guidelines Diesel: From IPCC guidelines Monitoring frequency: Appropriateness and conservativeness of the default value from latest IPCC guidelines and India's National Communication to the UNFCCC is reviewed annually and the most conservative value is adopted in the project activity.
QA/QC procedures	QA/QC procedure is not applied as default value from IPCC guidelines and

applied	India's National Communication to the UNFCCC is adopted
Any comment:	Conservative CO_2 emission factors data between the India's first National Communication to UNFCCC and IPCC default has been adopted for Lignite, coal and diesel oil used in the project activity. The parameter $COEF_{CO2,i}$ adopted in the registered monitoring plan is now revised as $EF_{CO2,FF,i}$ which is as per adopted methodology in the revised monitoring plan. A request for revision of the registered monitoring plan incorporating detailed source and measurement methods for monitoring of the parameter "$EF_{CO2,FF,i}$" along with QA & QC procedure was sought and has been approved by CDM EB on 29/06/2010[5].

5.16 Net quantity of heat generated from firing biomass in the project plant

Data / Parameter:	$Q_{project\ plant,y}$
Data unit:	GJ
Description:	Net quantity of heat generated from firing biomass in the project plant
Source of data to be used:	On-site measurements recorded in EID Parry log books
Value of data	1643505.09
Description of measurement methods and procedures to be applied:	Net heat generation is determined as the difference of the enthalpy of the steam generated by the project cogeneration plant minus the enthalpy of the feed-water and any condensate return. The respective enthalpies are determined based on the mass (or volume) flows, the temperatures and, in case of superheated steam, the pressure. Steam tables or an appropriate thermodynamic equation is used to calculate the enthalpy as a function of temperature and pressure. The fraction of heat generated from firing biomass residues is determined by dividing the quantity of biomass residues fired by the total quantity of all fuels fired, both expressed in energy quantities. The mass flow of the steam, feed water and condensate are monitored continuously using online flow meters. The temperature and pressure of steam, feed water and condensate are monitored continuously using gauges. Their enthalpies are adopted from steam tables. The net heat generation is calculated as "Enthalpy of steam – Enthalpy of feed water - Enthalpy of condensate" Monitoring frequency: continuously
QA/QC procedures applied	The consistency of heat generation is cross-checked with fuel consumption. Refer Annex 7 and CER spreadsheet for detailed calculation.

Calibration:

The monitoring equipments for steam flow, steam temperature, steam pressure, feed water flow, feed water temperature and feed water pressure have been calibrated every six months as follows:

ID	Serial No.	Accuracy class	Calibration date	Prev. Calibration	Result
FWF	232166	0.25 %	14.09.2007, 12.03.2008 & 09.12.2008	14.03.2007	Error % within limits
FWT	2PT6402	0.25 %	23.09.2007, 23.03.2008, 23.09.2008 & 23.09.2009	23.03.2007	Error % within limits
FWP	232546	0.25 %	24.03.2008, 24.09.2008 & 24.09.2009	04.09.2007	Error % within limits
SF	232167	0.25 %	09.05.2008 & 09.11.2008	13.03.2007 & 13.09.2007	Error % within limits
ST	232085	0.25 %	09.03.2008 & 09.11.2008	11.03.2007 & 11.09.2007	Error % within limits
SP	232123	0.25 %	13.03.2008, 13.09.2008 & 09.11.2009	11.03.2007 & 11.09.2007	Error % within limits

Any comment:

This parameter is not included as part of the registered monitoring plan. A request for revision of the registered monitoring plan incorporating monitoring of the parameter "$Q_{project\ plant,y}$" which is required as per adopted methodology ACM0006 Version 04 was sought and has been approved by CDM EB on 29/06/2010[5].

The boiler makeup water and condensate returns are collected in the feed water tank and taken to the boiler. The respective flow, temperature and pressure are also being monitored continuously in the project activity through individual monitoring equipments. In addition, the feed water flow, temperature and pressure are being monitored continuously at the point before entry into the boiler. On account of this, it is to be noted that the enthalpy of the feed water to the boiler takes into account the enthalpy of the condensate returned to the boiler.

Please refer to data and parameters determined at registration and not monitored during the monitoring period, including defaults values and factors presented in Annex 4.

6. BASELINE / PROJECT / LEAKAGE / EMISSION REDUCTIONS CALCULATION /TABLE

6.1 PROJECT EMISSIONS:

As per ACM0006, project emissions are calculated using the below formula:

$$PE_y = PET_y + PEFF_y + PE_{EC,y} + GWP_{CH4} \cdot PE_{Biomass,CH4,y}$$

Where:

PET_y	CO_2 emissions during the year *y* due to transportation of the biomass residues to the project plant (tCO_2/yr)
$PEFF_y$	CO_2 emissions during the year *y* due to fossil fuels co-fired by the generation facility or other fossil fuel consumption at the project site that is attributable to the project activity (tCO_2/yr)
$PE_{EC,y}$	CO_2 emissions during the year *y* due to electricity consumption at the project site that is attributable to the project activity (tCO_2/yr)
GWP_{CH4}	Global Warming Potential for methane valid for the relevant commitment period
$PE_{Biomass,CH4,y}$	CH_4 emissions from the combustion of biomass residues during the year *y* (tCH_4/yr). *In line with guidelines in ACM0006, this is excluded for simplification, both in the calculation of project emissions and baseline emissions.*

6.1.1 CO2 emissions from biomass transportation to the project plant:

$$PET_y = \frac{\sum_k BF_{k,y}}{TL_y} \times AVD_y \times EF_{km,CO2}$$

Where:

TLy	is the average truck load of the trucks used for transporting biomass from outside in year y,
AVDy	is the average return trip distance between the biomass fuel supply sites and the site of the project plant in kilometers (km), and
$EF_{km,CO2}$	is the average CO_2 emission factor for the trucks measured in tCO_2/km
$BF_{k,y}$	is the quantity of biomass residue type k transported during the year y

6.1.2 CO2 emissions from on-site fossil fuel combustion:

$$PEFF_{y} = \sum_{i} (FF_{projectplant,i,y} + FF_{projectsite,i,y}) xNCV_{i} xEF_{co_2,FF,i}$$

where,

$PEFF_y$	is the project emission from fossil fuel co-firing during the year y in tons of CO_2,
$FF_{projectplanti,y}$	Quantity of fossil fuel type i combusted in the biomass residue fired power plant during the year y.
$FF_{projectsite,i,y}$	Quantity of fossil fuel type i combusted at the project site for other purposes that are attributable to the project activity during the year y. Fossil fuel combustion in standby DG sets during start-up or maintenance activities would only be part of this parameter. Only that fossil fuel consumption attributable to the energy efficiency improvement would be included in this parameter.
$EF_{CO2,FF,i}$	is the CO_2 emission factor of the fossil fuel type 'i' in tCO_2/GJ
NCV_i	is the calorific value of the fossil fuel in GJ per mass unit.

6.1.3 CO2 emissions from electricity consumption in the project activity:

$$PE_{EC,y} = EC_{PJ,y} \times EF_{grid,y}$$

$PE_{EC,y}$	Emissions from electricity consumption in the project activity in tCO_2
$EC_{PJ,y}$	Electricity consumption in the project activity in MWh
$EF_{grid,y}$	Electricity Emission factor in tCO_2/MWh

4.2 Emission reductions due to displacement of electricity:

$$\boldsymbol{ER_{electricity,y} = EG_y \,.\, EF_{electricity,y}}$$

Where:

$ER_{electricity,y}$	Emission reductions due to displacement of electricity during the year *y* (tCO_2/yr)
EG_y	Net quantity of increased electricity generation as a result of the project activity (incremental to baseline generation) during the year *y* (MWh)
$EF_{electricity,y}$	CO_2 emission factor for the electricity displaced due to the project activity during the year *y* (tCO_2/MWh)

6.2.1 Incremental Electricity Generation:

$$EG_y = EG_{projectplant,y} \times \left(1 - \frac{\in_{el,preproject}}{\in_{el,project\ plant,y}}\right)$$

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 calculated as below:

6.2.2 Efficiency of electricity generation in the project plant:

$\varepsilon_{el,project\ plant,y}$ -is average net energy efficiency of electricity generation in the project plant, expressed in MWhel/MWhbiomass calculated as below:

$$\varepsilon_{el,projectplant} = \frac{EG_{projectplant,y}}{\sum_k NCV_k.BF_{k.y} + \sum_i NCV_i.FF_{projectplant,i,y}}$$

Where,

NCV_k is the net calorific value of biomass residue type k

$BF_{k,y}$ is the quantity of biomass residue type k combusted in the project plant in year y

NCV_i is the net calorific value of fossil fuel type i

$FF_{project\ plant,i,y}$ is the quantity of fossil fuel type i combusted in the project plant during year y

6.2.3 Electricity baseline emission factor:

The baseline emission factor has been calculated ex-ante as per formula and guidelines of the methodology ACM0006. The baseline emission factor has been determined to be 0.85 tCO_2/MWh[11]. This figure has been validated and will not change.

6.3 Emission reductions due to displacement of heat:

The project activity has catered to the complete steam requirements of the sugar plant and no other source of steam/heat was used.

Since the efficiency of heat generation in the project activity is same as that of the pre-project scenario, there is no increase or decrease of emission reductions due to the displacement of heat. This is as per ACM0006. $ER_{heat} = 0$.

6.4 Leakage:

The project activity falls under scenario 14 of ACM0006 and therefore does not require addressing leakage. There is no leakage of emission reductions. Ly = 0.

6.5 Emission reductions:

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

Where:

ER_y	Emissions reductions of the project activity during the year y (tCO_2/yr)
$ER_{electricity,y}$	Emission reductions due to displacement of electricity during the year y (tCO_2/yr)
$ER_{heat,y}$	Emission reductions due to displacement of heat during the year y (tCO_2/yr). This parameter is equal to zero since efficiency of heat generation in the project scenario is higher than the baseline scenario. $ER_{heat,y} = 0$.
$BE_{biomass}$	Baseline emissions due to biomass decay. This parameter is excluded from the project boundary and therefore is equal to zero. $BE_{biomass} = 0$.
PE_y	Project emissions during the year y (tCO_2/yr)
L_y	Leakage emissions during the year y (tCO_2/yr). For scenario 14 of ACM0006, leakage need not be separately estimated and therefore Ly = 0.

Since $ER_{heat,y} = 0$, $BE_{biomass,y}$ and $L_y = 0$ for this project activity, the above equation reduces to:

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

[11] Reference: Central Electrical Authority (CEA) CDM – Baseline CO_2 emission database version 1.0 dated 04/10/2006

CALCULATIONS AND RESULTS

Table T6.1: Project Emissions

Notation	Parameter	Unit	Total
PET_y	Emissions from biomass transportation	tCO_2	115
$PEFF_y$	Emissions from on-site fossil fuel use	tCO_2	13798
$PE_{EC,y}$	Emissions from electricity consumption	tCO_2	463
$\boldsymbol{PE_y}$	Total project emissions	tCO_2	14376

Table T6.1.1: Emissions due to biomass transportation

S.No.	Notation	Parameter	Unit	Total
1	$BF_{k,y}$	Quantity of biomass transported from outside	Tonnes	11020
2	TL_y	Average truck load of trucks used	Tonnes	10.60
3	AVD	Average return trip distance between the biomass fuel supply sites and the project plant	kms	124.56
4	$EF_{km,CO2}$	Average CO_2 emission factor of the trucks	tCO_2/km	0.000886
5	PET_y ((1/2)*3*4)	CO_2 emissions from biomass transportation	tCO_2	115

Table T6.1.2: Emissions due to combustion of fossil fuels in the project activity

S.No	Notation	Parameter	Unit	Total	Comments
1	$FF_{project\ plant,lignite}$	Quantity of lignite co-fired	T	10214	
2	$FF_{project\ plant,coal}$	Quantity of coal co-fired	T	1051	
3	$FF_{project\ plant,diesel}$	Quantity of diesel co-fired	T	0	
4	$FF_{project\ site,lignite}$	Quantity of lignite use on-site due to project activity	T	0	
5	$FF_{project\ site,coal}$	Quantity of coal use on-site due to project activity	T	0	
6	Intentionally blank				
7	$FF_{project\ site,diesel}$	Quantity of diesel use on-site due to project activity	T	28	
8	$NCV_{lignite}$	Calorific Value of lignite	kCal/kg	2462 and 2412	Monitored every six months
9	$NCV_{lignite}$	Calorific Value of lignite	TJ/T	0.010	Arrived from above value using conversion factor

10	NCV_{Coal}	Calorific Value of coal	kCal/kg	6152	
11	NCV_{Coal}	Calorific Value of coal	TJ/T	0.0258	
12	NCV_{diesel}	Calorific Value of diesel	kCal/kg	10,270	
13	NCV_{diesel}	Calorific Value of diesel	TJ/T	0.0430	Arrived from above value using conversion factor
14	$EF_{CO2,lignite}$	CO_2 emission factor of Lignite	tCO_2/TJ	106.10	
15	$EF_{CO2,coal}$	CO_2 emission factor of Coal	tCO_2/TJ	96.10	
16	$EF_{CO2,diesel}$	CO_2 emission factor of Diesel	tCO_2/TJ	74.10	
17	$PEFF_{lignite}$ (1+4)*9*14	Total CO_2 emissions from lignite combustion	tCO_2	11107	
18	$PEFF_{coal}$ (2+5)*11*15	Total CO_2 emissions from coal combustion	tCO_2	2602	
19	$PEFF_{diesel}$ (3+6)*13*16	Total CO_2 emissions from diesel combustion	tCO_2	88	
20	**PEFFy (17+18+19)**	**Total CO_2 emissions from fossil fuel combustion on-site due to the project activity**	**tCO_2**	**13798**	

Table T6.1.3: Emissions due to electricity consumption in the project activity:

S.No	Notation	Parameter	Unit	Value
1	$EC_{PJ,y}$	Quantity of electricity consumption	MWh	544
2	EF_{grid}	Electricity emission factor	tCO_2/MWh	0.85
3	$PE_{EC,y}$ (1*2)	Emissions from electricity consumption	tCO_2	463

Emission reductions due to displacement of electricity

Table T6.2: Efficiency of electricity generation in the project plant

The following table provides the heat equivalent of all fuels combusted, net electricity generation from all fuels and the overall efficiency of electricity generation.

Period	Total heat content of all fuels combusted $\sum BF_{k,y} \cdot NCV_{,k,y} + \sum FF_{project\ plant,k,y} \cdot NCV_{,k,y}$	Net electricity generation ($EG_{project\ plant,y}$)	Efficiency of electricity generation ($\varepsilon_{el,project\ plant,y}$)
	MWh	MWhe	(MWh electricity)/(MWh heat content)
	(1)	(2)	(3) = (2)/(1)
Sep-07	33600	6456	0.1921
Oct-07	53778	10839	0.2015
Nov-07	2511	343*	0.1366
Dec-07	23045	4371	0.1897
Jan-08	41099	8421	0.2049
Feb-08	55488	11184	0.2016
Mar-08	56229	10907	0.1940
Apr-08	56985	11581	0.2032
May-08	61183	12255	0.2003
Jun-08	56051	11368	0.2028
Jul-08	56013	11163	0.1993
Aug-08	46675	8891	0.1905
Sep-08	45151	7659	0.1696
Total	**587808**	**115437**	**0.1964**

** Improvements in plant and machinery are carried out in November 2007(off season) which has resulted in lower net electricity generation..*

Table T6.3: Incremental Electricity Generation

S.No	Notation	Parameter	Unit	Total
1	$EG_{project\ plant}$	Net Electricity Generation from the project plant	MWhe	115437
2	$\varepsilon_{el,\ project\ plant}$	Project plant efficiency	MWhe/ $MWh_{biomass}$	0.1964
3	$\varepsilon_{el,\ pre\text{-}project}$	Pre-project efficiency	MWhe/ $MWh_{biomass}$	0.036535
4	EG (1* (*1.0* - (3/2)))	Incremental Electricity generation from the project activity	MWh	93961

Table T6.4: Emission reductions due to displacement of electricity

S.No	Notation	Parameter	Unit	Value
1	EG_y	Incremental Energy generation from the project activity	MWhe/yr	93961
2	$EF_{electricity}$	Baseline emission factor for grid	tCO_2/MWh	0.85
3	$ER_{electricity,y}$ (1*2)	Emission reduction due to displacement of electricity	tCO_2/yr	79866

Table T6.5: Calculation of Emission Reductions

$ER_{heat,y}$	$ER_{electricity,y}$	$BE_{biomass,y}$	PE_y	L_y	ER_y
tCO_2	tCO_2	tCO_2	tCO_2	tCO_2	tCO_2
0	79866	0	14376	0	65490

The net emission reductions by the project activity during the monitoring period

= 65490 tCO_2e

7. COMPARISON OF ACTUAL EMISSION REDUCTIONS WITH ESTIMATES IN THE CDM-PDD

Item	Values applied in ex-ante calculation of the registered CDM-PDD	Actual values reached during the monitoring period
Emission reductions (tCO_2e)	86,623	65,490

The difference in emission reduction (ER) between the achieved value and the estimated ER considered in the registered PDD during the first monitoring period is due to higher project emissions leading to reduced ER resulting from combustion of fossil fuel in the project plant, combustion of fossil fuel at the project site for other purpose attributable to the project activity and from electricity consumption, the details of which is given as follows:

Item	Values considered in registered CDM-PDD	Actual values reached during the monitoring period
Project Emissions (PE_y, tCO_2e)	PE_{FFy} 0 PE_{Ty} 264.30 $PE_{EC,y}$ 0	PE_{FFy} 13798 PE_{Ty} 115 $PE_{EC,y}$ 463
	PE_y 264.30	PE_y 14376

The summary of the comparison of the actual emission reductions with estimated value considered in the CDM-PDD is presented below:

Item	Unit	Values considered in registered CDM-PDD	Actual values reached during the monitoring period
Net Electricity Generation from the Project plant	MWhe	131900	115437
Incremental Energy generation from the project activity	MWhe	102221	93961
Baseline Emissions (BE_y)	tCO_2e	86887.46	79866[12]
Project Emissions (PE_y,)	tCO_2e	264.30	14376
Emission Reductions (ER_y)	tCO_2e	86,623	65,490

[12] The total downtime of 1386.18 hours (57.76 days) due to various planned and forced outages during this monitoring period has resulted in reduced net electricity generation and baseline emissions. Please refer to calculation of incremental electricity generation and baseline emissions presented in section 6.

8. ABBREVIATIONS

CC	Climate Change
CDM	Clean Development Mechanism
CEA	Central Electricity Authority
CER	Certified Emission Reductions
CO_2	Carbon di-oxide
EID Parry	EID Parry (India) Limited
GHG	Greenhouse Gas
GWh	Giga Watt hour
IPCC	Inter-governmental Panel for Climate Change
KP	Kyoto Protocol
Km	Kilo meters
KV	Kilo Volt
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
MT	Metric Ton
MW	Mega Watt
Nox	Nitrogen Oxides
p.a	Per annum
PLF	Plant Load Factor
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

TJ	Trillion Joules
TNEB	Tamilnadu Electricity Board
TNPCB	Tamilnadu Pollution Control Board
TPH	Tones Per Hour
UNFCCC	United Nations Framework Convention on Climate Change

Annex 1: 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 [This data represents the parameter "$\mathbf{EG_{Gross,\ project\ plant,y}}$"]	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 [This data represents the parameter "**EGy**". Please refer to "any comment" provided for the parameter "EGy" under section 5.4]	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 [This parameter is not required to be monitored as per the adopted methodology ACM0006 Version 04. Please refer to the revised monitoring plan approved by CDM EB and the validation report of revised monitoring plan. However, this parameter is being monitored to perform annual energy balance and to improve the completeness of information. It is also to be noted that this parameter is not required to calculate emission reduction. Hence the detailed monitoring method has not been included in section B.7.1 and	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

the pertaining monitoring details of this parameter has been included in Annex 4 of the revised monitoring plan to improve the completeness of information.]											
Auxiliary electricity for Cogen plants [This data represents the parameter "$EG_{Aux, project plant,y}$".]	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 [This parameter is not required to be monitored as per the adopted methodology ACM0006 Version 04. Please refer to the revised monitoring plan approved by CDM EB and the validation report of revised monitoring plan. However, this parameter is being monitored to perform annual fuel balance and to improve completeness of information**.** It is also to be noted that this parameter is not required to calculate emission reduction. Hence the detailed monitoring method has not been included in section B.7.1 and the pertaining monitoring details of this parameter has been included in Annex 4 of the revised monitoring plan to improve the completeness of information]	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 [This data represents the parameter "$BF_{k,y}$".]	Tonnes	On-line fuel weighing system	Monthly	Recorded in Log book	Fuel conveyor to boiler	Internal calibration method	Six months	Boiler operator	Mech maint incharge	Cogen plant head	General works Manager
Quantity of Biomass/Bagasse Purchased from outside [This data is being monitored w.r.t (or under) the parameter "$BF_{k,y}$" to perform annual fuel balance for cross checking measure and "TL_y" for quantifying truck load. Please refer to "any comment" specified under the parameter "$BF_{k,y}$" which takes care of this point. This parameter is not required to be monitored as per the adopted methodology ACM0006 Version 04. Please refer to the revised monitoring plan approved by CDM EB and the validation report of revised monitoring plan. However, this parameter is being monitored to improve the completeness of information. The detailed monitoring method has not been included in section B.7.1 and the pertaining monitoring details of this parameter has been included in Annex 4 of the revised monitoring plan approved by CDM EB]	Tonnes	Weigh Bridge	Monthly	Recorded in the Log book in stores	Factory entrance	Reputed external agency	Yearly	Stores incharge	NA	Cogen plant head	General works Manager

Quantity of Coal purchased This data is being monitored w.r.t the parameter "$FF_{project\ plant,i,y}$" to perform annual fuel balance for cross-checking measure. This parameter is not required to be monitored as per the adopted methodology ACM0006 Version 04. Please refer to the revised monitoring plan approved by CDM EB and the validation report of revised monitoring plan. However, this parameter is being monitored to improve the completeness of information. The detailed monitoring method has not been included in section B.7.1 and the pertaining monitoring details of this parameter has been included in Annex 4 of the revised monitoring plan approved by CDM EB.	Tonnes	Weigh Bridge	Monthly	Recorded in the Log book in stores	Factory entrance	Reputed external agency	Yearly	Stores incharge	NA	Cogen plant head	General works Manager
Calorific value of bagasse [This data represents the parameter "$\mathbf{NCV_k}$]	Kcal/kg	Calorimeter	Half yearly	Measured in external lab	NA	Reputed external agency	Six months	Lab incharge	NA	Cogen plant head	General works Manager
Calorific Value of Biomass [This data represents the parameter "$\mathbf{NCV_k}$]	Kcal/kg	Calorimeter	Half yearly	Measured in external lab	NA	Reputed external agency	Six months	Lab incharge	NA	Cogen plant head	General works Manager
Calorific Value of Coal [This data represents the parameter "$\mathbf{NCV_i}$]	Kcal/kg	Calorimeter	Half yearly	Measured in external lab	NA	Reputed external agency	Six months	Lab incharge	NA	Cogen plant head	General works Manager

Annex 2: Energy and Fuel balance

Energy Balance:

The energy balance is done as follows:

Gross electricity generation – Auxiliary consumption + Import + DG Generation - Sugar plant consumption – Electricity exported = Line loss

Monitored & measured parameters

Gross Electricity Generation	Auxiliary consumption of the Cogen plant				Net Electricity Generation[13]
	Aux. DTR[14]	Aux. CTR	DG[5] generation (includes DG supply to cogen aux and emergency supply to sugar plant)	Total Auxiliary consumption	
kWh	kWh	kWh	kWh	kWh	kWh
129797200	4662000	9595420	102696	14360116	115437084

DG set supply to Cogen plant	Emergency supply to sugar plant from DG set	Emergency supply to sugar plant through Aux DTR feeder	Sugar plant Electricity Consumption - through normal feeder	Electricity Exported	Electricity Imported from TNEB	Energy balance	Line losses
kWh	kWh	kWh	kWh	kWh	kWh	kWh	%
39919	62777	211621	23265499	92135000	544000	894902	0.7

The line loss of 0.7 % is within the allowable level as prescribed by the Bureau of Energy Efficiency as indicated below:

[13] A Request for deviation regarding the monitoring of net quantity of electricity generated in the project plant for the first monitoring period (14 September 2007 – 30 September 2008) has been sought and accepted by CDM EB during its 50th EB meeting on 16/10/2009

[14] It may be noted that during emergencies, power supply is provided to the sugar plant through the "Aux DTR" feeder and from the DG sets. This quantity of electricity is also accounted as auxiliary consumption of the project activity. This is conservative.

Type of equipment	Allowable loss %
Circuit breakers	0.015
Load breakers	0.025
Switch gear	0.02
Cable loss	1.0
Total	**1.1**

Refer: Bureau of Energy Efficiency, Book 3, Chapter 1, Page 18: www.bee-india.nic.in/GuideBooks/3Ch1.pdf

Fuel Mass Balance:

A fuel mass balance is performed as follows:

The measured fuel consumption is cross-checked with the calculated fuel consumption figure using the below formula:

Fuel consumption = Opening stock + Fuel purchased + Fuel generated in-house - Closing stock

Type of fuel	Fuel generated in-house	Opening stock	Fuel purchased	Closing stock	Fuel consumption (calculated)	Fuel consumption (Measured)
	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes
Own bagasse	242515	0	0	745	241770	240919
Purchased bagasse	0	10155	5748	0	15903	15903
Groundnut shell	0	0	5201	24	5177	5177
Cane trash	0	0	83	4	79	79
Coal	0	0	1051	0	1051	1051
Lignite	0	0	10212	0	10214	10214
Total	242515	10155	22295	773	274194	273343

Annex 3: Monitored data

Monitored data for electricity parameters

Period	Gross Electricity Generation	Auxiliary Consumption				Net Electricity Generation	Electricity Imported for on-site use
		DTR	CTR	DG	Total		
	MWh	MWh	MWh	MWh	MWh	MWh	MWh
14 Sep-07 till 30 Sep-07	7201.9	220.0	524.6	1.4	745.9	6456.0	2.0
Oct-07	12147.8	411.7	890.4	7.2	1309.3	10838.5	27.0
Nov-07	626.4	197.0	68.1	18.2	283.4	343.0	193.0
Dec-07	5113.4	278.3	435.5	28.6	742.4	4371.0	136.0
Jan-08	9502.7	345.1	728.4	8.7	1082.1	8420.6	97.0
Feb-08	12439.6	383.8	871.8	0.0	1255.7	11183.9	0.0
Mar-08	12167.3	411.0	843.8	5.7	1260.4	10906.9	38.0
Apr-08	12885.6	412.9	889.0	2.4	1304.3	11581.3	6.0
May-08	13645.8	425.6	962.0	3.0	1390.6	12255.2	5.0
Jun-08	12710.8	406.6	935.7	0.9	1343.2	11367.6	1.0
Jul-08	12472.9	404.7	896.8	8.8	1310.2	11162.7	11.0
Aug-08	10087.3	389.2	791.8	15.3	1196.3	8891.0	21.0
Sep-08	8795.7	376.1	757.6	2.5	1136.2	7659.5	7.0
Total	129797.2	4662.0	9595.4	102.7	14360.1	115437.1	544.0

Fuel consumption and NCV parameters monitored

Parameters	Unit	Sep-07	Oct-07	Nov-07	Dec-07	Jan-08	Feb-08	Mar-08	Apr-08	May-08	Jun-08	Jul-08	Aug-08	Sep-08
Own bagasse (wet)	Tonnes	16200.0	19432.0	0.0	6041.0	16928.0	22364.0	21287.0	21951.0	25308.0	25242.0	24717.0	20581.0	20868.0
Moisture content	%	53.91	53.96	0.00	54.01	52.32	50.27	50.39	50.55	50.70	50.85	50.90	51.03	51.69
Own bagasse (dry)	Tonnes	7466.6	8946.5	0.0	2778.3	8071.3	11121.6	10560.5	10854.8	12476.8	12406.4	12136.0	10078.5	10081.3
NCV	Mcal/T	3692.0	3692.0	3692.0	3692.0	3608.0	3608.0	3608.0	3608.0	3690.0	3690.0	3690.0	3675.0	3675.0
Heat equivalent	MWh	32054.2	38407.5	0.0	11927.1	33861.8	46659.1	44304.9	45539.5	53534.4	53232.3	52072.1	43068.1	43080.1
Purchased bagasse (wet)	Tonnes	753.0	6912.0	1114.0	3552.0	210.0	1549.0	476.0	785.0	328.0	161.0	63.0	753.0	6912.0
Moisture content	%	52.00	50.84	50.60	50.67	50.35	50.29	50.28	50.51	50.58	50.91	50.80	0.00	0.00
Purchased bagasse (dry)	Tonnes	361.4	3397.9	550.3	1752.2	104.3	770.0	236.7	388.5	162.1	79.0	31.0	0.0	0.0
NCV	Mcal/T	3678.0	3678.0	3678.0	3678.0	3661.0	3661.0	3661.0	3653.0	3653.0	3653.0	3653.0	3678.0	3678.0
Heat equivalent	MWh	1545.8	14532.1	2353.6	7493.7	443.9	3277.9	1007.5	1650.2	688.5	335.7	131.7	0.0	0.0
Groundnut shell (wet)	Tonnes								349.0	1725.0	651.0	997.0	915.0	540.0
Moisture content	%								13.82	13.75	13.90	13.74	13.66	14.27
Groundnut shell (dry)	Tonnes								300.8	1487.8	560.5	860.0	790.0	462.9
NCV	Mcal/T								3809.0	3809.0	3809.0	3809.0	3826.0	3826.0
Heat equivalent	MWh								1332.1	6589.6	2482.5	3809.1	3514.6	2059.6
Cane trash	Tonnes								43.0				32.0	4.0

(wet)														
Moisture content	%								30.90				31.05	30.94
Cane trash (dry)	Tonnes								29.7				22.1	2.8
NCV	Mcal/T								3594.0				3594.0	3594.0
Heat equivalent	MWh								124.2				92.2	11.5
Coal	Tonnes							965.0	86.0					
NCV	Mcal/T							6152.0	6152.0					
Heat equivalent	MWh							6903.1	615.2					
Lignite	Tonnes		293.0	55.0	1266.0	2373.0	1939.0	1402.0	2754.0	132.0				
NCV	Mcal/T		2462.0	2462.0	2462.0	2462.0	2462.0	2462.0	2412.0	2412.0				
Heat equivalent	MWh		838.8	157.5	3624.3	6793.4	5551.0	4013.6	7724.0	370.2				
Heat equivalent of all fuels combusted in the project activity	MWh	33600.0	53778.4	2511.0	23045.1	41099.1	55487.9	56229.1	56985.3	61182.7	56050.6	56012.8	46674.9	45151.2
Fossil Fuel consumption on-site attributable to the project activity														
Diesel consumption in standby DG sets	litres	300.00	2450.00	7310.00	8725.00	2640.00	0.00	1445.00	700.00	825.00	300.00	2480.00	4650.00	808.00
Density of diesel	kg/l	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Diesel consumption in standby DG sets	Tonnes	0.26	2.08	6.21	7.42	2.24	0.00	1.23	0.60	0.70	0.26	2.11	3.95	0.69

Summary of Fuel consumption and NCV parameters monitored

Parameters	Unit	Total
Own bagasse (wet) consumption	Tonnes	240919.0
Own bagasse (dry) consumption	Tonnes	116978.6
Heat equivalent	MWh	497741.1
Purchased bagasse (wet) consumption	Tonnes	15903.0
Purchased bagasse (dry) consumption	Tonnes	7833.5
Heat equivalent	MWh	33460.5
Groundnut shell (wet) consumption	Tonnes	5177.0
Groundnut shell (dry) consumption	Tonnes	4462.1
Heat equivalent	MWh	19787.5
Cane trash (wet) consumption	Tonnes	79.0
Cane trash (dry) consumption	Tonnes	54.5
Heat equivalent	MWh	227.9
Coal consumption	Tonnes	1051.0
Heat equivalent	MWh	7518.3
Lignite consumption	Tonnes	10214.0
Heat equivalent	MWh	29072.8
Heat equivalent of all fuels combusted in the project activity	MWh	587808.1
Fossil Fuel consumption on-site attributable to the project activity		
Diesel consumption in standby DG sets	litres	32633.00
Density of diesel	kg/l	0.85
Diesel consumption in standby DG sets	Tonnes	27.74

Annex 4: Data and parameters determined at registration and not monitored during the monitoring period, including default values and factors

Electricity generation in pre-project scenario:

Data / Parameter:	**$EG_{pre\text{-}project,y}$**
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
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	This data is used for calculation of pre-project energy efficiency (ε_{el}, pre-project).
Additional comment:	---

Quantity of biomass input to the 4.5 MW low pressure cogeneration plant prior to the project activity:

Data / Parameter:	**$BF_{pre\text{-}project,y}$**
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
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	This data is used for calculation of pre-project energy efficiency (ε_{el}, pre-project).
Additional comment:	---

Baseline emission factor of the southern regional grid:

Data / Parameter:	**$EF_{electricity}$**
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
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	This data is used for calculation of baseline emission calculation.
Additional comment:	--

Annex 5: Planned and forced outage records during the monitoring period

Sl. No:	Date & Time		Duration	Reason for failure
	From	To	hr:mm:ss	
1	9/15/07 17:54	9/15/07 21:10	3:16:00	BC1 to BC2 & BC6 to BC2 Chute Jamming
2	10/21/07 17:17	10/21/07 20:52	3:35:00	Turbine trip - bearing temp probe malfunction
3	10/28/07 14:09	10/30/07 11:35	45:26:00	Travelling grate problem
4	10/31/07 0:30	10/31/07 0:50	0:20:00	Turbine tripped due to I/O card link failure
5	10/31/07 4:30	10/31/07 4:44	0:14:00	Turbine tripped - Main steam temp Low
6	11/2/07 3:00	11/2/07 10:30	7:30:00	Turbine tripped - Main steam pressure & temp Low
7	11/2/07 21:10	11/3/07 2:47	5:37:00	Turbine tripped - Main steam temp Low
8	11/3/07 14:45	12/14/07 15:13	984:28:00	Plant shut down - off-season
9	12/15/07 4:00	12/15/07 4:45	0:45:00	BC-5 Conveyor Jamming
10	12/15/07 6:00	12/15/07 6:10	0:10:00	Turbine tripped - Main steam temp Low
11	12/15/07 12:08	12/15/07 13:17	1:09:00	Turbine tripped - Main steam temp Low
12	12/18/07 5:45	12/18/07 6:22	0:37:00	BC-6 Chute Jamming
13	12/18/07 11:42	12/19/07 23:05	35:23:00	Plant stopped - Heavy rain
14	12/20/07 3:15	12/20/07 3:45	0:30:00	Turbine tripped - Main steam temp Low
15	12/20/07 16:22	12/20/07 17:14	0:52:00	Turbine tripped - Main steam temp Low
16	12/22/07 3:15	12/23/07 6:37	27:22:00	Plant shut down for maintenance - Cleaning day
17	12/23/07 11:06	12/23/07 11:18	0:12:00	Turbine tripped - lube oil pressure low during island mode
18	12/30/07 16:00	12/30/07 16:16	0:16:00	Turbine tripped - Main steam temp Low
19	1/6/08 10:30	1/6/08 10:42	0:12:00	Generator undervoltage Trip
20	1/12/08 15:06	1/12/08 15:41	0:35:00	Turbine tripped - lube oil pressure low during island mode
21	1/15/08 2:00	1/19/08 19:06	113:06:00	Plant stopped - Pongal Shut down
22	1/20/08 6:00	1/21/08 13:30	31:30:00	Want of Fuel - Crushing stopped
23	1/22/08 14:54	1/23/08 0:10	9:16:00	Want of Fuel - Crushing stopped
24	1/24/08 7:50	1/24/08 21:50	14:00:00	Want of Fuel - Crushing stopped
25	4/6/08 1:27	4/6/08 1:57	0:30:00	EB supply failed
26	4/13/08 11:57	4/13/08 12:03	0:06:00	EB supply failed

27	4/17/08 6:14	4/17/08 6:24	0:10:00	EB supply failed
28	4/17/08 9:28	4/17/08 9:44	0:16:00	EB supply failed
29	4/21/08 12:42	4/21/08 19:57	7:15:00	Plant stopped - slat conveyor & PMG coupling bush checking
30	4/24/08 2:55	4/24/08 3:05	0:10:00	EB supply failed
31	4/24/08 5:32	4/24/08 5:44	0:12:00	EB supply failed
32	4/30/08 12:41	4/30/08 12:52	0:11:00	EB supply failed
33	4/30/08 12:41	4/30/08 12:52	0:11:00	EB supply failed
34	4/30/08 12:41	4/30/08 14:04	1:23:00	EB supply failed
35	5/7/08 0:09	5/7/08 1:04	0:55:00	EB supply failed
36	5/12/08 11:32	5/12/08 11:36	0:04:00	EB supply failed
37	5/17/08 9:22	5/17/08 9:28	0:06:00	EB supply failed
38	5/20/08 5:39	5/20/08 5:49	0:10:00	EB supply failed
39	5/22/08 1:03	5/22/08 1:26	0:23:00	EB supply failed
40	5/25/08 7:00	5/25/08 12:25	5:25:00	EB supply failed
41	5/26/08 1:05	5/26/08 1:40	0:35:00	EB supply failed
42	5/26/08 1:53	5/26/08 2:08	0:15:00	EB supply failed
43	5/30/08 12:17	5/30/08 12:39	0:22:00	EB supply failed
44	6/18/08 4:10	6/18/08 6:15	2:05:00	EB supply failed
45	6/21/08 8:59	6/21/08 16:08	7:09:00	EB supply failed
46	6/22/08 9:52	6/22/08 10:02	0:10:00	EB supply failed
47	7/10/08 10:01	7/10/08 10:06	0:05:00	EB supply failed
48	7/14/08 5:18	7/14/08 5:23	0:05:00	EB supply failed
49	7/16/08 9:44	7/17/08 3:48	18:04:00	Plant shut down for maintenance - Cleaning day
50	7/18/08 11:50	7/18/08 11:59	0:09:00	EB supply failed
51	7/19/08 9:23	7/19/08 10:41	1:18:00	EB supply failed
52	7/19/08 11:46	7/19/08 13:37	1:51:00	Generator trip on under frequency during island mode
53	7/19/08 11:46	7/19/08 12:54	1:08:00	EB supply failed
54	7/25/08 7:14	7/25/08 7:38	0:24:00	Turbine tripped - lube oil pressure low during island mode
55	8/1/08 5:46	8/1/08 7:46	2:00:00	Generator trip on over frequency during island mode
56	8/1/08 16:00	8/1/08 16:35	0:35:00	Turbine tripped on vacuum low
57	8/1/08 20:30	8/3/08 5:58	33:28:00	Plant shut down for maintenance - Cleaning day

58	8/17/08 23:04	8/17/08 23:43	0:39:00	Turbine tripped - gear box rear thrust bearing temperature probe malfunction (TE_3400K)
59	9/4/08 5:55	9/4/08 6:39	0:44:00	EB supply failed
60	9/13/08 00:07	9/13/08 00:24	0:17:00	Turbine tripped - Main steam temp Low
61	9/19/08 12:54	9/19/08 23:54	11:00:00	Want of Fuel - Crushing stopped
		Total	**1386:11:00**	

Annex 6: Emergency preparedness and trouble-shooting procedures

EMERGENCY PREPAREDNESS PROCEDURES

Procedure to address emissions associated with emergencies:

Emissions are possible in the case of fuel yard fire. In such a scenario, the quantity of fuel burnt in the fire would also be considered as combusted in the project activity and included in calculating emission reductions.

Fire in the fuel yard

Biomass fuel stored over a longer period can catch fire due to spontaneous combustion.

Following precautions shall be taken for prevention as well as emergency handling:

- Fuel shall be stored in different heaps with good amount of space in between to maintain adequate ventilation
- Temperature of the fuel heap shall be periodically monitored and fuel from the higher temperature zone shall be exhausted on priority
- In the extreme dry months of May and June, some water sprinkling shall be periodically done
- As far as possible First in First Out system shall be adopted for fuel feeding.
- Entire fuel storage and feeding yard shall be declared as 'no smoking zone' and compliance ensured.
- Fire hydrant shall be laid around the fuel yard and hydrant pressure maintained and regularly monitored.

Fire Procedures:

- Fire extinguishers are provided in all areas and refilled before their expiry dates
- Safety training programs are arranged by factory manager once in six months to various department persons including securities from state government fire service department persons
- Hydrant is provided in fuel handling area and fuel storage godowns
- In case of any major fire, department persons will phone to personnel dept/security dept, who will inform the fire service department.

Emergency handling of the equipments:

Critical emergencies associated with operation of thermal power plants are:

- Low and high drum water levels
- Furnace explosions
- Fire in the fuel yard

Low water level

Should the water level drop out of the drum sight glass, all firing must be stopped immediately. Further action shall be taken in the following sequence:

- Output of steam supply to be cut drastically by off loading the power output. Only essential steam required for maintaining turbine safety like steam for the gland and ejector shall be maintained.
- In case low water has been caused by failure of pressure parts, feed water supply to be regulated only to avoid overheating of tubes due to dryness particularly for boiler with large amount of refractory. As soon as the fuel bed has bee dumped and refractory somewhat cooled, feed water supply is to be closed.
- In case of feed water pump de-priming due to loss of NSSH, steam supply to the de-aerator to be regulated to reduce the temperature and more DM water pumped to raise level in the feed water tank.

High water level

High water level can cause priming and carry over causing water to flow into the turbine and damage to the same. Emergency steps shall include opening of all blow down valves of boiler and steam drains of turbines. In case of very high carry over detected by sharp drop of steam temperature turbine shall be tripped and put on barring gear.

Furnace explosions

Safety hazard from furnace explosion is usually faced in case of liquid and gaseous fuel and pulverised coal. This happens mostly during initial firing. The failure of burner ignition system can cause accumulation of explosive mixture of unburnt fuel and air. When this mixture gets ignited subsequently, explosion can occur.

Procedure to handle casualties:

1. In all departments first-aid box with necessary medicines are maintained
2. Inside the company campus a common first aid department is maintained in general shifts
3. Company has arranged for 24 hours operating hospital with well equipped equipments and doctors
4. Two vehicles are in ready condition for taking injured to the hospital
5. After first aid is given, patient is admitted to ESI within 12 hours.

TROUBLE SHOOTING PROCEDURES:

Any error or discrepancy in the recorded data is identified by the Engineer during the daily review of the log books. Following are the procedures to be followed incase of such errors:

Type of problem	Possible causes	Corrective action
No display in meter	1. Wiring problem 2. Meter fault	Meter wirings are checked and rectified. If problem persists, meter is dismantled and sent to service centers and calibration
Display available, but no measurement. Reading is static	1. Fault or failure in current or potential transformers 2. Wiring problem 3. Meter fault	Meter wirings and fuse are checked and rectified. CT/PTs are checked. If problem persists, meter is dismantled and sent to service centers and calibration.
Readings are beyond the permissible error levels	1. Wiring problem 2. Meter fault	Meter wirings are checked and rectified. If problem persists, meter is dismantled and sent to service centers and calibration

Annex 7: Ney quantity of heat generated from firing biomass residues:

Generation	Supply					
Net heat output i.e. generated	Total heat input i.e. supplied		Total heat input from firing biomass		Fraction of heat generated from firing biomass residues	Net quantity of heat generated from "firing biomass residues"
GJ	MWh	GJ	MWh	GJ	GJ	GJ
103101.9	33600.0	120960.0	33600.0	120960.0	1.00	103101.9
161475.0	53778.4	193602.3	52939.6	190582.6	0.98	158956.4
7126.5	2511.0	9039.7	2353.6	8472.8	0.94	6679.6
66368.1	23045.1	82962.5	19420.8	69915.0	0.84	55930.4
128533.6	41099.1	147956.6	34305.6	123500.3	0.83	107287.8
168565.8	55487.9	199756.5	49937.0	179773.1	0.90	151702.6
165859.9	56229.1	202424.9	45312.4	163124.6	0.81	133658.6
171533.4	56985.3	205146.9	48646.0	175125.8	0.85	146431.2
177831.5	61182.7	220257.9	60812.5	218925.1	0.99	176755.4
165654.2	56050.6	201782.0	56050.6	201782.0	1.00	165654.2
167656.9	56012.8	201646.2	56012.8	201646.2	1.00	167656.9
138442.3	46674.9	168029.7	46674.9	168029.7	1.00	138442.3
131247.7	45151.2	162544.3	45151.2	162544.3	1.00	131247.7
					$Q_{project\ plant,y}$	1643509.09