CDM
Monitoring Report

Of

"Methane Recovery and Power Generation in a Distillery plant"

By GMR Industries Ltd. (GIDL)

UNFCCC0505

Version 1.4

Monitoring Period:

From: 01/04/2007

To: 30/09/2007

(both days included)

GMR Industries Limited (sugar division)
Sankili, Regidi, Amadalavalasa Mandal,
Srikakulam District – 532440
Andhra Pradesh, India

CERs claimed in Second Monitoring Report

9550

Table of Contents:

1. Introduction

The purpose of monitoring report is to calculate and clearly demonstrate the GHG emission reduction quantity achieved by this project for periodic verification.

The monitoring report shall cover the activity from **01/04/2007 to 30/09/2007** as second monitoring period. First monitoring report covered the activity from 01/10/2006 to 31/03/2007 and was subject to EB review EB 35 Para 82g.

Starting date of project activity: 01/12/2003
Project Commissioning date: 01/06/2005
Project Registration Date: 29/09/2006

Starting date of crediting period (first 7 year crediting period): 01/10/2006

2. Reference

Title: Methane Recovery and Power Generation in a distillery plant.

Version: 1.2

Date of completion of the Monitoring Report: 10/05/2008

Approved Baseline Methodology:
The project has two components and they confirm to following small scale approved baseline methodologies.

a. Type IIIH: Methane recovery in wastewater treatment.
b. Type ID: Grid connected renewable electricity generation.

Approved Monitoring Methodology:
The project has two components and they confirm to following small scale approved monitoring methodologies.

a. Type IIIH: Comprises Methane recovery from spent wash treatment facilities.
b. Type ID: Comprises renewable energy generation units that displaces electricity based on fossil fuel fired generating stations.

Project Design Document:
Methane recovery and power generation in a distillery plant" by GMR Industries Ltd. (GIDL); UNFCCC reference number - 0505
Version: 1.3
Date: 04/09/2006

3. Description of Project Activity

a. General Description:

This project activity is based at the distillery unit of integrated sugar complex of GMR Industries Ltd. (GIDL - Sugar Division) at Sankili village, Srikakulam District in the State of Andhra Pradesh. The company belongs to GMR group. The distillery has implemented ISO-9001:2000: system.

The sugar division of the GMR Industries Ltd. (GIDL) owns a distillery with a capacity of 40 KLPD. The raw material to the distillery is molasses from the sugar plant. The major products from the distillery are Rectified Spirit (RS), Extra Neutral Alcohol (ENA) and Ethanol. The plant has modern Molecular Sieve Dehydration System. The plant is having zero pollution discharge.

The Spent-Wash generated from the distillery is high in Bio-chemical Oxygen Demand (BOD)/Chemical Oxygen Demand (COD) content. The approx. quantity of Spent-Wash generated from the process is ~400 m3 per day. The BOD level of the Spent-Wash is in the range 55000-60000 mg/l and the COD is in the range of 130000-150000 mg/l. As per the norms of State Pollution Control Board and Central pollution Control Board (CPCB) in India this high BOD/COD Spent-Wash can not be discharged without proper treatment. The limit of BOD of the Spent-Wash for disposal in surface water is 30 mg/l and for disposal on land is 100 mg/l.

In normal course distilleries in India adopt open lagoons treatment system for meeting the pollution control standards of BOD/COD of the Spent-Wash before its discharge. But in open lagoon system Methane, a potent GHG, is generated due to the anaerobic conditions which escape into atmosphere and there is no control or capturing involved. This project activity from GIDL entails treatment of this high BOD/COD Spent-Wash anaerobically in a closed digester and capturing the Methane generated in a controlled manner. The Methane captured is combusted in a boiler for steam generation and further to generate power through a turbo-generator. The project activity also includes combustion of other GHG natural biomass residue fuels such as rice-husk to supplement biogas fuel in the boiler. The capacity of the power generation plant is ~1.0 MW.

b. Technical Description of Project activity:

Location details:
The plant is located at the distillery unit of GIDL (Sugar Division) at village Sankili of Regidi Mandal of Srikakulam District in Andhra Pradesh, India. The plant site is about 142 km from the nearest airport of Visakhapatnam on National Highway NH-5. The geographic location in which the project activity is located is depicted in the map below:


INDIA
States and Union Territories
N
JAMMU & KASHMIR
Srinagar
HIMACHAL PRADESH
Shimla
Chandigarh
PUNJAB
UTTARANCHAL
Dehradun
DELHI
HARYANA
PAKISTAN
CHINA (TIBET)
ARUNACHAL PRADESH
Itanagar
NEPAL
SIKKIM
Gangtok
BHUTAN
RAJASTHAN
Jaipur
UTTAR PRADESH
Lucknow
Patna
BIHAR
ASSAM
Dispur
Shillong
NAGALAND
Kohima
Imphal
MANIPUR
MEGHALAYA
Agartala
TRIPURA
Aizawl
MIZORAM
MYANMAR
GUJARAT
Gandhinagar
Bhopal
MADHYA PRADESH
Ranchi
JHARKHAND
WEST BENGAL
Calcutta
CHHATTISGARH
Raipur
ORISSA
Bhubaneshwar
BANGLADESH
DIU
DAMAN
DADAR & NAGAR HAVELI
MAHARASHTRA
Mumbai (Bombay)
ANDHRA PRADESH
ARABIAN SEA
Panaji
GOA
BAY OF B
ANDHRA PRADES
KARNATAKA
Bangalore
Chennai (Madras)
PONDICHERRY (Puduchchery)
KARAIKAL (Pondicherry)
TAMILNADU
LAKSHADWEEP
MAHE (Pondicherry)
KERALA
Port Blair
ANDAMAN & NICOBAR ISLANDS
Thiruvananthapuram
Map not to Scale
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Districts of Andhra Pradesh
N
MAHARASHTRA
CHHATTISGARH
Srikakulam
Adilabad
Nizamabad
Karimnagar
Medak
Sangareddi
Warangal
HYDERABAD
Rangareddi
Khammam
East Godavari
West Godavari
Vizianagaram
Vishakhapatnam
Vishakhapattana
Nalgonda
Mahbubnagar
Krishna
Eluru
Yan
KARNATAKA
Guntur
Machilipatnam
Bay of Bengal
Kurnool
Prakasam
Ongole
Map not to Scale
Anantapur
Cuddapah
Nellore
State Capital
State Boundary
District Boundary
District Headquarter
Chittoor
TAMILNADU
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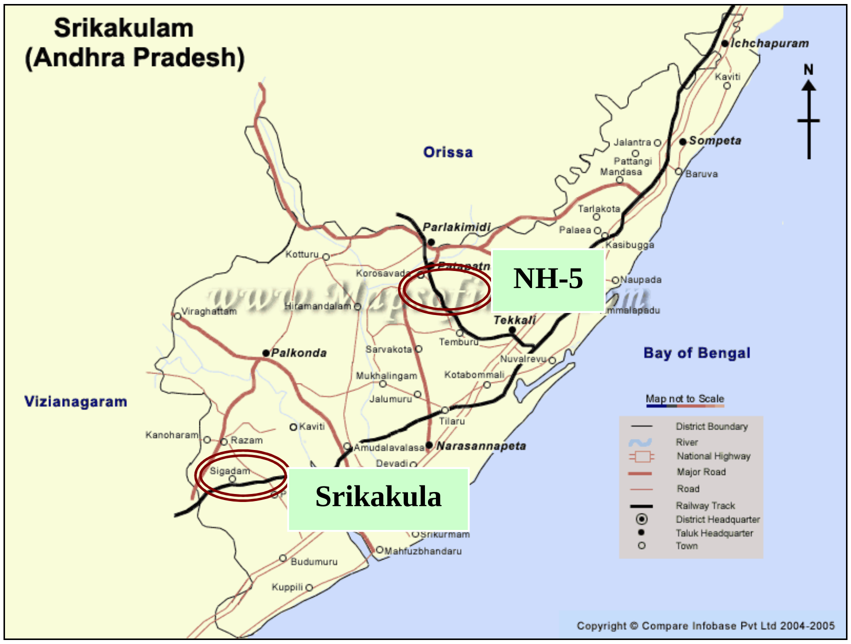

Technical Details:

Turbine Specification:

Steam turbine Model	PRSB 150
Inlet Steam pr.	43 ata
Inlet Steam Temp.	425 Deg C
Exhaust Steam Pr.	4 ata
Max. Steam flow	10.5 TPH
Turbine Rated Speed	8142 RPM
Rated Power	1000 kW
No of stages	05

Boiler Specification:

Make	Cheema Boilers ltd.
Capacity	10.5 TPH
Boiler Type	Power Pack-FBC
Superheated steam pr.	44 kg/cm2
Superheated steam temp.	430 +- 5 Deg C

ESP:

Make	Thermax Ltd.

Model	SC-9-16-16G-(3X1.25)-1.2P
Number of fields	3

4. Baseline Methodology

The project activity helps in GHG emission reduction in two ways-

1. Methane emission reduction through its controlled recovery in an anaerobic digestion plant
2. Reduction of emissions from fossil fuel based grid power by biogas and other biomass combustion in power generation plant

The project is a small scale CDM project activity and is based on Appendix B (Version No. 07 dated 28 November 2005) of the simplified modalities and procedures for small-scale CDM project activities. The project activity conforms to the following categories-

Category	Technology/ measure
TYPE IIIH: Methane Recovery in Wastewater Treatment Reference: version 1, Scope 13, 15; dated 03 March 2006	Comprises Methane recovery and combustion from waste water treatment facilities.
TYPE ID: Grid connected renewable electricity generation Reference: Version 8, Scope 1; dated 03 March 2006	Comprises renewable energy generation units that displaces electricity based on at least fossil fuel fired generating stations.

Estimation of Grid Emission factor has been done ex ante in PDD. The GEF calculation is done in Appendix -16.

5. Monitoring Methodology and Plan

The project is a small scale CDM project activity and is based on Appendix B (Version No. 07 dated 28 November 2005) of the simplified modalities and procedures for small-scale CDM project activities. The project activity conforms to the following categories-

Project Category	Criteria
TYPE IIIH : Methane Recovery in Wastewater Treatment	Comprises Methane recovery from Spent-Wash treatment facilities.
TYPE ID : Grid connected renewable electricity generation	Comprises renewable energy generation units that displaces electricity based on fossil fuel fired generating stations

6.1 The data being monitored as a part of project activity are as follows:

ID number	Data Source	Data variable	Data unit	Measured (m), calculated © or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	For how long is archived data to be kept?	Comment	Reference
1.1	Plant Data	Flow of Spent-Wash in digester	m^3	*m*	*Daily*	*100%*	*Paper*	*Credit period + 2 yrs*		Appendix -1
1.2	Lab test data	Chemical Oxygen Demand of untreated Spent-Wash into the digester	mg/l	*e*	*Daily*	*100%*	*Paper*	*Credit period + 2 yrs*	*Standard "Reflux method" is used for estimation of COD of spent wash following Central Pollution Control Board norms*	Appendix -2
1.3	Lab test data	Chemical Oxygen Demand of treated water from digester	mg/l	*e*	*Daily*	*100%*	*Paper*	*Credit period + 2 yrs*	*Standard "Reflux method" is used for estimation of COD of treated water following Central Pollution Control Board norms*	Appendix -3

1.4	Plant data	Biogas flow into boiler	m3	*m*	*Daily*	*100%*	*Paper*	*Credit period + 2 yrs*		Appendix -4
1.5	Lab test data	%CH4, Volumetric content of Methane in biogas	%	*m*	*Daily*	*100%*	*Paper*	*Credit period + 2 yrs*	*Methane concentration in biogas is measured using "Gas Chromatograph-Thermal Conductivity Detector"*	Appendix -5
1.6	Plant data	Pressure of biogas	mm. WC	*m*	*Daily*	*100%*	*Paper*	*Credit period + 2 yrs*		Appendix -6
1.7	Plant data	Temp. of biogas	Deg C	*m*	*Daily*	*100%*	*Paper*	*Credit period + 2 yrs*		
1.8	Plant data	Gross Electricity generated in the power plant	kWh	*m*	*Daily*	*100%*	*Paper*	*Credit period + 2 yrs*		Appendix -7
1.9	Plant data	Auxiliary Electricity Consumption	kWh	*m*	*Daily*	*100%*	*Paper*	*Credit period + 2 yrs*		Appendix -8
1.10	Plant data	Net electricity generation	kWh	*c*	*Daily*	*100%*	*Paper*	*Credit period + 2 yrs*		Appendix -9
1.11	Plant data	Quantity of fossil fuel i combusted in boiler	Tonnes	*m*	*Monthly*	*100%*	*Paper*	*Credit period + 2 yrs*		Appendix -10
1.12	Lab test data	Calorific value of fossil fuel i combusted	kcal/ kg	*e*	*Monthly*	*100%*	*Paper*	*Credit period + 2 yrs*		Appendix -11
1.13	Plant data	Power consumed in equipment in digester plant	kWh	*m*	*Daily*	*100%*	*Paper*	*Credit period + 2 yrs*		Appendix -12

1.14	Plant data	Quantity of digester solid residues generated	tonnes	*m*	*Monthly*	*100%*	*Paper*	*Credit period + 2 yrs*		Appendix -13
1.15	Plant data	Quantity of digester solid residue treated by composting	tonnes	*m*	*Monthly*	*100%*	*Paper*	*Credit period + 2 yrs*	*Total quantity generated of solid residues in digester goes to composting plant*	Appendix -14
1.16	Plant data/ IPCC default values	Coefficient of emission for fossil fuel i combusted in boiler	tCO2e/ tonne	*c*	*Monthly*	*100%*	*Paper*	*Credit period + 2 yrs*	*Refer Section E.1.1 for detail formula*	Appendix -15
1.17	Plant data	Quantity of biomass residues combusted in boiler for power and steam generation	Tonnes	*m*	*Monthly*	*100%*	*Paper*	*Credit period + 2 yrs*	*From transportation records / purchase invoice copies*	Appendix-17

5.2 QA/QC Procedures being undertaken for data monitoring

Data *(Indicate table and ID number e.g. 3.-1.; 3.2.)*	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
Table D.3 (ID numbers from 1.1, 1.4, 1.6, 1.7	Low	The data will be collected as part of normal plant level operations. QA/QC requirements consist of cross- checking these with other internal company report.
Table D.3 (ID numbers from 1.2, 1.3	Low	Data are estimated using standard "Reflux method" as per Central Pollution Control Board (CPCB), Government of India norms.
Table D.3 (ID number 1.5	Low	Data is measured using "Gas Chromatograph –Thermal Conductivity Detector" method.
Table D.3 (ID numbers from 1.8- 1.10, 1.11, 1.13	Low	Data is monitored as part of power plant operation and logs are maintained on daily basis; meters are calibrated as per predefined calibration program
Table D.3 (ID number 1.12	Low	Fuel calorific value is lab tested of each stock and a record is maintained to this effect
Table D.3 (ID numbers from 1.14- 1.15	Low	Total solid residues from digester are sent to composting plant. A record for residues generated and sent to compost plant is maintained
Table D.3 (ID numbers 1.16	Low	Data is calculated based on NCV and IPCC default values for emission factor and oxidation factor for fossil fuels

GIDL's is an ISO-9001:2000 certified plant and it has well defined monitoring, calibration and recording procedures. Calibration of instruments is carried out as per predefined calibration plan.

6. GHG Calculations

The GHG calculation for this project is divided in two parts, as per the applicability of methodology.

A. For Methane Avoidance / Spent wash Treatment Part

As per the methodology AMS IIIH, the emission reductions for the methane avoidance are calculated as

$ER_y = BE_y – (PE_y + L_y)$

BE_y = Baseline emissions for spent wash treatment part
PE_y = Project emissions for spent wash treatment part
L_y = Leakage for spent wash treatment part

a) Calculation of BE_y i.e. baseline emissions for methane avoidance

BE_y = (Biogas flow into boiler) * (% CH4, Volumetric content of Methane in biogas) * (Methane Density) * GWP_CH4 / 1000

Variable	Value	Reference
Biogas flow into boiler (m^3)	Tabulated in Appendix	Appendix - 4
% CH4, Volumetric content of Methane in biogas (%)	Tabulated in Appendix	Appendix – 5
Density of Methane	Tabulated in Appendix	Appendix – 6 [1]
Global Warming Potential of CH4	21	

BE $_y$ (spent wash treatment) for the six months:

BE_y (t CO2)	
Month	Value
April-2007	4480.7
May-2007	4836.98
June-2007	4218.5
July-2007[2]	881.2
August-2007	1612.2
September-2007	0.0
Total	**16029.6**

As per the formulae described in registered PDD the baseline estimations are also calculated as below:

$$ME_{y,ww,untreated} = Q_{y,ww} * COD_{y,ww,untreated} * B_{o,ww} * MCF_{ww,untreated}$$

$Q_{y, ww}$	Appendix - 1
$COD_{y, ww, untreated}$	Appendix - 2
$B_{o, ww}$	0.21 kg CH4/kg methane
$MCF_{ww, untreated}$	0.738 (as per registered PDD)

$$ME_{y, ww, treated} = Q_{y, ww} * COD_{y, ww, treated} * B_{o,ww} * MCF_{ww, treated}$$

$Q_{y, ww}$	Appendix - 1
$COD_{y, ww, treated}$	Appendix – 3
$B_{o, ww}$	0.21 kg CH4/kg methane
$MCF_{ww, treated}$	0.738 (as per registered PDD)

[1] 0.68 kg/m^3 density is for STP i.e. atmospheric pressure and ambient temperature of 15º C. Temperature and pressure values are monitored to find density at actual temperature and pressure

http://encyclopedia.airliquide.com/Encyclopedia.asp?GasID=41#GeneralData

[2] The distillery and boiler was stopped during the period of 11.07.07 to 03.08.07 due to rain

BE_y (t CO_2) (As per Meth)	
Month	Value
April-2007	3182.7
May-2007	3309.34
June-2007	2978.8
July-2007	623.9
August-2007	1162.0
September-2007	0.0
Total	**11256.8**

b) Calculate PE_y i.e. Project emissions for Methane Avoidance

Power Consumption in digester plant

PE_y (Digester Plant) = (Power Consumption in digester plant) * (GEF) / 1000

Variable	Value	Reference
Power Consumption in digester plant / equipment (KWh)	Tabulated in Appendix	Appendix – 12
GEF (t CO_2/MWh)	0.845	Appendix - 16

PE_y (spent wash treatment) for six months:

PE_y (tCO_2)	
Month	Value
April-2007	20.5
May-2007	22.1
June-2007	18.2
July-2007	7.9
August-2007	9.5
September-2007	0.0
Total	**78.2**

Project emissions for Dissolved Methane

$PE_{y, dissolved} = Q_{y, ww} * [CH4]_{y, ww, treated} * GWP\_CH4$

PE_y (tCO_2)	
Month	Value
April-2007	25.4
May-2007	26.2
June-2007	22.8
July-2007	6.4
August-2007	12.5
September-2007	0.0
Total	**93.2**

c) Calculate L_y i.e. Project Leakages

In this case the leakages are already taken into account, since methane avoidance is taken for only the methane going into boiler.

B. For Power Generation

This calculation is based on AMS ID

$ER_y = BE_y – (PE_y + L_y)$

a) BE_y (Power Generation) = (Gross Electricity Generated in Power Plant) * GEF /1000

Variable	Value	Reference
Gross Power generation in Power Plant (KWh)	Tabulated in Appendix	Appendix – 7
GEF (t CO2/MWh)	0.845	Appendix - 16

BE $_y$ (power generation) for the six months:

BE_y (t CO2)	
Month	**Value**
April-2007	411.1
May-2007	370.5
June-2007	236.9
July-2007	68.5
August-2007	195.6
September-2007	0.0
Total	**1282.7**

b) PE $_y$ (Combustion Process) = (Power Consumption in combustion process) * (GEF) / 1000

Variable	Value	Reference
Power Consumption in combustion process (KWh)[3]	Tabulated in Appendix	Appendix – 8
GEF (t CO2/MWh)	0.845	Appendix – 16

PE_y (power generation) for six months:

PE_y (t CO2)	
Month	**Value**

[3] This power accounts for all the auxiliary consumption, also in situations when there is no gross generation.

April-2007	88.0
May-2007	89.1
June-2007	76.2
July-2007	26.5
August-2007	59.2
September-2007	0.0
Total	**325.4**

c) L_y (Fossil fuel combustion) = (fossil fuel consumption) * (Net calorific value of fossil fuel) * (IPCC default oxidation factor) * (Emission factor for sub-bituminous coal) * 4.187 / 1000000

Variable	Value	Reference
Quantity of fossil fuel combusted (tonnes)	Tabulated in Appendix	Appendix –10
NCV of Fossil fuel	4514	IPCC default
Oxidation factor	0.98	IPCC default value
Emission factor for sub-bituminous	96.1 tCO2 / TJ	IPCC default value

L_y (fossil fuel usage) for six months:

L_y (t CO2)	
Month	**Value**
April-2007	798.9
May-2007	311.4
June-2007	71.2
July-2007	115.7
August-2007	1181.5
September-2007	0.0
Total	**2516.9**

Emission reductions can be summarized as below:

Month	Baseline Emissions		Project Emissions				Emission Reductions
	Methane Avoidance	Power Generation	Power Consumption in treatment process	Power Consumption in combustion process	Fossil fuel Combustion	Dissolved Methane	
Apr-07	3182.7	411.1	20.5	88.0	798.9	25.4	**2661**
May-07	3309.34	370.5	22.1	89.1	311.4	26.2	**3231**
Jun-07	2978.8	236.9	18.2	76.2	71.2	22.8	**3027**
Jul-07	623.9	68.5	7.9	26.5	115.7	6.4	**536**
Aug-07	1162.0	195.6	9.5	59.2	1181.5	12.5	**95**
Sep-07	0.0	0.0	0.0	0.0	0.0	0.0	**0**
Total						**93.2**	**9550**

Appendix – 1

Flow of Spent Wash in digester (m^3)

Date / month	Apr-07	May-07	Jun-07	Jul-07	Aug-07	Sep-07
1	244	410	400	0	0	0
2	384	420	353	230	0	0
3	368	432	431	120	0	0
4	430	414	390	0	144	0
5	400	432	430	0	280	0
6	384	430	400	312	0	0
7	410	432	408	547	0	0
8	410	440	456	622	222	0
9	432	425	432	580	396	0
10	408	452	410	619	415	0
11	400	418	440	0	557	0
12	410	432	405	0	437	0
13	380	420	400	0	500	0
14	432	414	410	0	304	0
15	415	425	408	0	240	0
16	420	415	432	0	274	0
17	430	408	408	0	286	0
18	440	304	152	0	285	0
19	430	414	59	0	290	0
20	420	408	335	0	343	0
21	456	432	460	0	218	0
22	440	420	432	0	216	0
23	450	410	165	0	317	0
24	460	415	270	0	158	0
25	450	415	375	0	72	0
26	120	420	400	0	0	0
27	340	410	410	0	0	0
28	448	390	400	0	0	0
29	440	415	390	0	0	0
30	430	405	0	0	0	0
31	-	417	-	0	0	-

Appendix – 2

Chemical Oxygen Demand of untreated Spent-Wash into the digester (mg/l)

Date / month	Apr-07	May-07	Jun-07	Jul-07	Aug-07	Sep-07
1	80000	120000	122000	0	0	0
2	90000	119000	123000	90000	0	0
3	125000	115000	117000	90000	0	0
4	120000	120000	118000	0	80000	0
5	120000	116000	124000	0	82000	0
6	120000	115000	123000	122000	0	0
7	125000	112000	123000	100000	0	0
8	125000	114000	116000	94000	85000	0
9	112000	120000	122000	100000	98000	0
10	122000	113000	125000	94000	106000	0
11	125000	121000	120000	0	94000	0
12	125000	120000	126000	0	108000	0
13	120000	121000	130000	0	104000	0
14	120000	125000	126000	0	100000	0
15	120000	120000	127000	0	90000	0
16	115000	122000	117000	0	92000	0
17	112000	117000	124000	0	95000	0
18	115000	100000	105000	0	94000	0
19	120000	110000	110000	0	95000	0
20	120000	109000	105000	0	90000	0
21	112000	114000	120000	0	88000	0
22	118000	116000	123000	0	90000	0
23	112000	115000	120000	0	95000	0
24	115000	111000	105000	0	85000	0
25	115000	114000	104000	0	80000	0
26	105000	110000	117000	0	0	0
27	120000	118000	120000	0	0	0
28	118000	125000	119000	0	0	0
29	112000	117000	116000	0	0	0
30	116000	126000	0	0	0	0
31	-	120000	-	0	0	-

Appendix – 3

Chemical Oxygen Demand of treated water from digester (mg/l)

Date / month	Apr-07	May-07	Jun-07	Jul-07	Aug-07	Sep-07
1	35000	35000	35000	0	0	0
2	35000	35000	36000	35000	0	0
3	35000	35000	35000	35000	0	0
4	35000	35000	35000	0	35000	0
5	36000	36000	37000	0	35000	0
6	37000	35000	36000	35000	0	0
7	36000	35000	35000	36000	0	0
8	35000	35000	35000	35000	35000	0
9	36000	36000	35000	35000	35000	0
10	35000	35000	35000	36000	36000	0
11	36000	36000	36000	0	35000	0
12	36000	35000	35000	0	36000	0
13	35000	36000	36000	0	36000	0
14	35000	36000	36000	0	35000	0
15	36000	36000	37000	0	35000	0
16	35000	36000	35000	0	34000	0
17	35000	35000	36000	0	35000	0
18	35000	34000	35000	0	34000	0
19	36000	35000	35000	0	35000	0
20	35000	35000	35000	0	34000	0
21	35000	35000	35000	0	34000	0
22	36000	35000	36000	0	34000	0
23	36000	34000	35000	0	35000	0
24	36000	34000	36000	0	34000	0
25	35000	34000	35000	0	34000	0
26	35000	34000	35000	0	0	0
27	36000	35000	36000	0	0	0
28	37000	36000	35000	0	0	0
29	35000	35000	35000	0	0	0
30	36000	35000	0	0	0	0
31	-	35000	-	0	0	-

Appendix – 4

Biogas Flow into Boiler (m^3)

Date / month	Apr-07	May-07	Jun-07	Jul-07	Aug-07	Sep-07
1	5643	18627	18466	0	0	0
2	10294	18760	16334	6382	0	0
3	18175	18455	18817	3134	0	0
4	19703	18652	17230	0	2757	0
5	17742	18292	19961	0	6834	0
6	16575	18388	18800	14533	0	0
7	19562	17686	19118	18220	0	0
8	19580	18600	19601	19256	5675	0
9	17577	19332	19836	19929	13243	0
10	18868	18660	19595	19253	15449	0
11	18865	18950	19850	0	17587	0
12	18813	19406	19648	0	16670	0
13	17304	18864	19908	0	17942	0
14	19701	19605	19538	0	10487	0
15	18224	19220	19502	0	6999	0
16	17904	19070	18721	0	8426	0
17	17849	17763	19022	0	9089	0
18	18682	10242	5692	0	9068	0
19	19345	16443	2346	0	9215	0
20	19117	16007	12374	0	10196	0
21	18656	18100	20722	0	6244	0
22	19142	18135	20024	0	6411	0
23	18152	17669	7721	0	10092	0
24	19302	16946	9282	0	4263	0
25	18896	17642	13435	0	1769	0
26	4705	16850	17600	0	0	0
27	15007	18145	19040	0	0	0
28	19173	18423	17986	0	0	0
29	18005	18100	16801	0	0	0
30	18188	19653	0	0	0	0
31	-	18709	-	0	0	-

Appendix – 5

%CH4, Volumetric content of Methane in biogas

Date / month	Apr-07	May-07	Jun-07	Jul-07	Aug-07	Sep-07
1	63.31	62.75	61.5	0	0	0
2	62.05	61.3	62.05	63.25	0	0
3	62.33	62.75	61.05	63.05	0	0
4	62.56	62.31	61.25	0	62.25	0
5	61.82	62.38	61.2	0	62.68	0
6	62.65	62.55	61.35	63	0	0
7	62.25	62.75	62.36	62.85	0	0
8	62.35	62.08	62.25	62.65	62.9	0
9	62.14	62.18	61.1	62.9	61.8	0
10	62.3	62.38	60.96	62.6	61.65	0
11	61.41	62.11	61.56	0	62.15	0
12	62.83	62.55	61.8	0	62.6	0
13	62.85	61.43	61.55	0	62.9	0
14	62.15	62.16	61.38	0	63.2	0
15	61.05	62.21	61.58	0	63.4	0
16	62.85	61.36	62.52	0	62.2	0
17	62.24	62.38	61.56	0	63.1	0
18	62.51	62.55	61.86	0	62.8	0
19	62.75	61.33	61.55	0	62.65	0
20	62.3	62.38	61.65	0	62.55	0
21	61.88	61.99	62.38	0	63.15	0
22	62.15	62.38	62.53	0	63.4	0
23	62.35	61.31	62.4	0	62.9	0
24	62.98	62.43	62.65	0	62.85	0
25	62.51	62.05	62.85	0	61.95	0
26	61.5	61.38	61.75	0	0	0
27	62.65	62.31	62.75	0	0	0
28	62.25	62.86	63.04	0	0	0
29	61.36	62.36	62.95	0	0	0
30	61.26	61.14	0	0	0	0
31	-	61.15	-	0	0	-

Appendix – 6

Pressure of Biogas (mm of water column)

Date / month	Apr-07	May-07	Jun-07	Jul-07	Aug-07	Sep-07
1	200	750	750	0	0	0
2	400	750	650	350	0	0
3	750	750	750	100	0	0
4	800	750	700	0	100	0
5	700	750	800	0	250	0
6	650	750	750	600	0	0
7	800	700	750	750	0	0
8	800	750	800	800	200	0
9	700	800	800	800	500	0
10	750	750	800	800	600	0
11	750	750	800	0	700	0
12	750	800	800	0	650	0
13	700	750	800	0	700	0
14	800	800	800	0	400	0
15	750	800	800	0	250	0
16	700	800	750	0	350	0
17	700	700	750	0	350	0
18	750	650	750	0	350	0
19	800	650	100	0	350	0
20	750	650	600	0	400	0
21	750	750	850	0	250	0
22	750	750	800	0	250	0
23	750	700	300	0	400	0
24	800	700	350	0	150	0
25	750	700	550	0	100	0
26	150	700	700	0	0	0
27	600	750	750	0	0	0
28	750	750	700	0	0	0
29	700	750	700	0	0	0
30	700	800	0	0	0	0
31	-	750	-	0	0	-

Temperature of Biogas (Deg Celsius)

Date / month	Apr-07	May-07	Jun-07	Jul-07	Aug-07	Sep-07
1	43	43	41	0	0	0
2	44	43	41	41	0	0
3	44	41	42	41	0	0
4	45	43	42	0	39	0
5	45	43	41	0	40	0
6	44	41	43	42	0	0
7	45	42	42	43	0	0
8	45	44	42	43	40	0
9	44	44	43	43	41	0
10	44	45	43	43	41	0
11	45	45	43	0	42	0
12	44	45	41	0	42	0
13	43	44	41	0	42	0
14	44	41	41	0	41	0
15	44	43	41	0	41	0
16	43	44	42	0	41	0
17	43	45	42	0	41	0
18	44	46	42	0	41	0
19	45	46	42	0	41	0
20	45	45	41	0	41	0
21	44	45	42	0	40	0
22	45	41	42	0	40	0
23	44	43	41	0	41	0
24	44	44	41	0	40	0
25	45	46	41	0	40	0
26	42	46	42	0	0	0
27	43	45	42	0	0	0
28	44	44	42	0	0	0
29	44	45	42	0	0	0
30	45	44	0	0	0	0
31	-	40	-	0	0	-

Density of Methane kg/cm^3 (calculated from pressure and temperature)

Date / month	Apr-07	May-07	Jun-07	Jul-07	Aug-07	Sep-07
1	0.63	0.66	0.67	0.72	0.72	0.72
2	0.64	0.66	0.66	0.64	0.72	0.72
3	0.66	0.67	0.67	0.63	0.72	0.72
4	0.66	0.66	0.66	0.72	0.63	0.72
5	0.66	0.66	0.67	0.72	0.64	0.72
6	0.66	0.67	0.66	0.66	0.72	0.72
7	0.66	0.66	0.67	0.66	0.72	0.72
8	0.66	0.66	0.67	0.67	0.64	0.72
9	0.66	0.67	0.67	0.67	0.65	0.72
10	0.66	0.66	0.67	0.67	0.66	0.72
11	0.66	0.66	0.67	0.72	0.66	0.72
12	0.66	0.66	0.67	0.72	0.66	0.72
13	0.66	0.66	0.67	0.72	0.66	0.72
14	0.67	0.67	0.67	0.72	0.65	0.72
15	0.66	0.67	0.67	0.72	0.64	0.72
16	0.66	0.67	0.67	0.72	0.64	0.72
17	0.66	0.66	0.67	0.72	0.64	0.72
18	0.66	0.65	0.67	0.72	0.64	0.72
19	0.66	0.65	0.63	0.72	0.64	0.72
20	0.66	0.65	0.66	0.72	0.65	0.72
21	0.66	0.66	0.67	0.72	0.64	0.72
22	0.66	0.67	0.67	0.72	0.64	0.72
23	0.66	0.66	0.64	0.72	0.65	0.72
24	0.67	0.66	0.64	0.72	0.63	0.72
25	0.66	0.66	0.66	0.72	0.63	0.72
26	0.63	0.66	0.66	0.72	0.72	0.72
27	0.66	0.66	0.67	0.72	0.72	0.72
28	0.66	0.66	0.66	0.72	0.72	0.72
29	0.66	0.66	0.66	0.72	0.72	0.72
30	0.66	0.67	0.72	0.72	0.72	0.72
31	-	0.67	-	0.72	0.72	-

Appendix – 7

Gross Electricity Generation in Power Plant (KWh)

Date / month	Apr-07	May-07	Jun-07	Jul-07	Aug-07	Sep-07
1	15186.0	15791.0	9732.0	15186.0	0.0	0.0
2	16560.0	14800.0	0.0	0.0	0.0	0.0
3	16582.0	14655.0	0.0	0.0	0.0	0.0
4	17456.0	9908.0	8637.0	0.0	3226.0	0.0
5	17251.0	15058.0	14674.0	0.0	10632.0	0.0
6	16987.0	15151.0	13919.0	9290.0	0.0	0.0
7	17041.0	14953.0	14519.0	12209.0	0.0	0.0
8	16972.0	15244.0	14202.0	12957.0	10244.0	0.0
9	16727.0	14619.0	14754.0	12249.0	9536.0	0.0
10	17128.0	15029.0	14801.0	13074.0	7917.0	0.0
11	16965.0	15250.0	14805.0	6134.0	14885.0	0.0
12	16535.0	14964.0	15452.0	0.0	14160.0	0.0
13	16782.0	14555.0	15438.0	0.0	14331.0	0.0
14	16453.0	14879.0	14881.0	0.0	13632.0	0.0
15	16609.0	15042.0	14582.0	0.0	15646.0	0.0
16	16943.0	14868.0	14632.0	0.0	15690.0	0.0
17	17167.0	15048.0	14454.0	0.0	9965.0	0.0
18	16824.0	14794.0	3761.0	0.0	15488.0	0.0
19	16821.0	15165.0	0.0	0.0	16089.0	0.0
20	17343.0	15144.0	8832.0	0.0	16600.0	0.0
21	17315.0	14523.0	11720.0	0.0	17167.0	0.0
22	17320.0	14816.0	10565.0	0.0	16964.0	0.0
23	16861.0	14721.0	616.0	0.0	5916.0	0.0
24	17627.0	12923.0	0.0	0.0	3381.0	0.0
25	17229.0	13742.0	3748.0	0.0	0.0	0.0
26	1981.0	14569.0	11285.0	0.0	0.0	0.0
27	13810.0	14661.0	12674.0	0.0	0.0	0.0
28	14336.0	14063.0	7718.0	0.0	0.0	0.0
29	16152.0	14960.0	0.0	0.0	0.0	0.0
30	17547.0	14590.0	0.0	0.0	0.0	0.0
31	-	14407.0	-	0.0	0.0	-

Appendix – 8

Auxiliary Electricity Consumption (KWh)

Date / month	Apr-07	May-07	Jun-07	Jul-07	Aug-07	Sep-07
1	3516.0	3563.0	3371.0	3516.0	576.0	0.0
2	3533.0	3070.0	3017.0	2233.0	2627.0	0.0
3	3491.0	3544.0	3246.0	1516.0	2395.0	0.0
4	3599.0	3445.0	3072.0	754.0	3043.0	0.0
5	3592.0	3496.0	3487.0	982.0	3004.0	0.0
6	3555.0	3507.0	3410.0	3199.0	840.0	0.0
7	3523.0	3491.0	3540.0	3285.0	417.0	0.0
8	3479.0	3418.0	3430.0	3253.0	3151.0	0.0
9	3568.0	3392.0	3391.0	3147.0	3530.0	0.0
10	3553.0	3336.0	3390.0	3149.0	3359.0	0.0
11	3508.0	3397.0	3437.0	1828.0	3466.0	0.0
12	3329.0	3253.0	3405.0	0.0	3431.0	0.0
13	3455.0	3334.0	3428.0	202.0	3425.0	0.0
14	3441.0	3335.0	3477.0	171.0	3469.0	0.0
15	3372.0	3190.0	3551.0	124.0	3435.0	0.0
16	3447.0	3285.0	3511.0	176.0	3448.0	0.0
17	3575.0	3490.0	3483.0	301.0	3293.0	0.0
18	3483.0	3377.0	1348.0	136.0	3447.0	0.0
19	3512.0	3468.0	1557.0	184.0	3300.0	0.0
20	3604.0	3535.0	3886.0	223.0	3525.0	0.0
21	3512.0	3388.0	3406.0	637.0	3273.0	0.0
22	3557.0	3522.0	3346.0	476.0	3042.0	0.0
23	3506.0	3488.0	2447.0	416.0	2612.0	0.0
24	3539.0	3327.0	2973.0	445.0	2461.0	0.0
25	3623.0	3324.0	3209.0	225.0	0.0	0.0
26	2506.0	3306.0	3279.0	158.0	0.0	0.0
27	3325.0	3461.0	3245.0	100.0	0.0	0.0
28	3415.0	3373.0	3120.0	93.0	0.0	0.0
29	3449.0	3476.0	676.0	62.0	1268.0	0.0
30	3517.0	3476.0	0.0	216.0	149.0	0.0
31	-	3318.0	-	197.0	63.0	-

Appendix – 9

Net Electricity Generation (KWh)

Date / month	Apr-07	May-07	Jun-07	Jul-07	Aug-07	Sep-07
1	11670.0	12228.0	6361.0	11670.0	-576.0	0.0
2	13027.0	11730.0	-3017.0	-2233.0	-2627.0	0.0
3	13091.0	11111.0	-3246.0	-1516.0	-2395.0	0.0
4	13857.0	6463.0	5565.0	-754.0	183.0	0.0
5	13659.0	11562.0	11187.0	-982.0	7628.0	0.0
6	13432.0	11644.0	10509.0	6091.0	-840.0	0.0
7	13518.0	11462.0	10979.0	8924.0	-417.0	0.0
8	13493.0	11826.0	10772.0	9704.0	7093.0	0.0
9	13159.0	11227.0	11363.0	9102.0	6006.0	0.0
10	13575.0	11693.0	11411.0	9925.0	4558.0	0.0
11	13457.0	11853.0	11368.0	4306.0	11419.0	0.0
12	13206.0	11711.0	12047.0	0.0	10729.0	0.0
13	13327.0	11221.0	12010.0	-202.0	10906.0	0.0
14	13012.0	11544.0	11404.0	-171.0	10163.0	0.0
15	13237.0	11852.0	11031.0	-124.0	12211.0	0.0
16	13496.0	11583.0	11121.0	-176.0	12242.0	0.0
17	13592.0	11558.0	10971.0	-301.0	6672.0	0.0
18	13341.0	11417.0	2413.0	-136.0	12041.0	0.0
19	13309.0	11697.0	-1557.0	-184.0	12789.0	0.0
20	13739.0	11609.0	4946.0	-223.0	13075.0	0.0
21	13803.0	11135.0	8314.0	-637.0	13894.0	0.0
22	13763.0	11294.0	7219.0	-476.0	13922.0	0.0
23	13355.0	11233.0	-1831.0	-416.0	3304.0	0.0
24	14088.0	9596.0	-2973.0	-445.0	920.0	0.0
25	13606.0	10418.0	539.0	-225.0	0.0	0.0
26	-525.0	11263.0	8006.0	-158.0	0.0	0.0
27	10485.0	11200.0	9429.0	-100.0	0.0	0.0
28	10921.0	10690.0	4598.0	-93.0	0.0	0.0
29	12703.0	11484.0	-676.0	-62.0	-1268.0	0.0
30	14030.0	11114.0	0.0	-216.0	-149.0	0.0
31	-	11089.0	-	-197.0	-63.0	-

Appendix – 10

Quantity of Fossil fuel burnt (tonnes)

Month	Apr-2007	May-2007	Jun-2007	Jul-2007	Aug-2007	Sep-2007
Quantity(t)	449	175	40	65	664	0

Appendix – 11

Calorific value of fossil fuel i combusted

Month	Apr-2007	May-2007	Jun-2007	Jul-2007	Aug-2007	Sep-2007
Value (Kcal/kg)	5300	5300	5300	5300	5300	5300

Appendix – 12

Power consumed in equipment in digester plant (KWh)

Date / month	Apr-07	May-07	Jun-07	Jul-07	Aug-07	Sep-07
1	327.0	753.0	809.0	182.0	65.0	0.0
2	509.0	855.0	733.0	327.0	64.0	0.0
3	727.0	832.0	767.0	282.0	150.0	0.0
4	981.0	817.0	797.0	281.0	301.0	0.0
5	846.0	861.0	849.0	270.0	414.0	0.0
6	822.0	867.0	731.0	556.0	400.0	0.0
7	921.0	870.0	809.0	818.0	370.0	0.0
8	885.0	885.0	849.0	891.0	304.0	0.0
9	928.0	857.0	794.0	884.0	514.0	0.0
10	898.0	865.0	842.0	862.0	573.0	0.0
11	883.0	893.0	867.0	603.0	460.0	0.0
12	859.0	912.0	835.0	157.0	583.0	0.0
13	813.0	901.0	864.0	217.0	687.0	0.0
14	858.0	920.0	783.0	379.0	643.0	0.0
15	850.0	925.0	836.0	219.0	543.0	0.0
16	869.0	860.0	834.0	300.0	449.0	0.0
17	846.0	864.0	842.0	137.0	376.0	0.0
18	792.0	891.0	466.0	127.0	367.0	0.0
19	823.0	877.0	375.0	250.0	330.0	0.0
20	868.0	857.0	542.0	284.0	398.0	0.0
21	865.0	851.0	854.0	200.0	347.0	0.0
22	845.0	811.0	787.0	136.0	408.0	0.0
23	847.0	828.0	481.0	131.0	341.0	0.0
24	840.0	785.0	402.0	128.0	262.0	0.0
25	882.0	796.0	529.0	135.0	280.0	0.0
26	439.0	751.0	717.0	133.0	275.0	0.0
27	801.0	785.0	762.0	132.0	270.0	0.0
28	834.0	796.0	712.0	130.0	282.0	0.0
29	852.0	815.0	674.0	48.0	285.0	0.0
30	767.0	823.0	340.0	117.0	275.0	0.0
31	-	788.0	-	45.0	261.0	-

Appendix – 13

Quantity of digester solid residues generated (in form of liquid) m^3

Month	Apr-2007	May-2007	Jun-2007	Jul-2007	Aug-2007	Sep-2007
Quantity(m^3)	0	0	0	0	0	0

Appendix – 14

Quantity of digester solid residue treated by composting (in form of liquid) m^3

Month	Apr-2007	May-2007	Jun-2007	Jul-2007	Aug-2007	Sep-2007
Quantity(m^3)	0	0	0	0	0	0

No digester solids were removed during current monitoring period

Appendix – 15

Coefficient of emission for fossil fuel i combusted in boiler (tCO2/tonne) (IPCC default value taken)

Month	Apr-2007	May-2007	Jun-2007	Jul-2007	Aug-2007	Sep-2007
Value	1.78	1.78	1.78	1.78	1.78	1.78

Appendix -16

Estimation of baseline emissions

Baseline scenario is that the electricity generated by the project would otherwise have been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations (for SR Grid) described below.

Step 2.1: Calculate the Operating Margin emission factor ($EF_{OM,y}$)

ACM0002, version 05 dated 03 March 2006, suggested following methods to calculate the Operating Margin emission factor(s) ($EF_{OM,y}$):

(a) Simple OM, or

(b) Simple adjusted OM, or

(c) Dispatch Data Analysis OM, or

(d) Average OM.

As per the approved methodology ACM0002 Dispatch data analysis should be the first methodological choice. However due to lack of data availability 'Dispatch Data Analysis' is not selected for the project activity.

The Simple adjusted OM and Average OM methods are applicable to project activities connected to the project electricity system (grid) where the low-cost/must run resources constitute more than 50% of the total grid generation.

'Simple OM' method is applicable to project activity connected to the project electricity system (grid) where the low-cost/must run resources constitute less than 50% of the total grid generation in 1) average of the five most recent years, or 2) based on long-term normal for hydroelectricity production.

The low-cost/must run resources contribute to less than 50% of total power in the grid hence 'Simple OM' option has been chosen.

Generation Mix of Power in Southern Grid

Type	2002-03	2003-04	2004-05
Thermal	93350.1	96664.0	97964.3
Diesel	4457.0	3225.0	2370.1
Gas	15138.0	16183.0	12276.6
Total (Thermal + Gas)	**112945.1**	**116072.0**	**112611.1**
Wind*	1577.3	2055.7	1270.7
Hydro	18167.8	17317.0	25280.4
Nuclear	4390.0	4700.0	4406.7
Low cost/Must run	**24135.1**	**24072.7**	**30957.8**
Total	**137080.1**	**140144.7**	**143568.8**
% of Low cost/must run	**18%**	**17%**	**22%**

Unit: Million Units
Source: www.cea.nic.in

The Simple OM emission factor ($EF_{OM,simple,y}$) is calculated as the generation-weighted average emissions per electricity unit (tCO_2/MU) of all generating sources serving the project electricity system, not including low-operating cost and must-run power plants.

The Simple OM emission factor can be calculated using either of the two following data vintages for years(s) y:

- A 3-year average, based on the most recent statistics available at the time of PDD submission, or
- The year in which project generation occurs, if $EF_{OM,y}$ is updated based on ex post monitoring.

The project activity uses the OM emission factor as per the 3-year average of Simple OM calculated based on the most recent statistics available at the time of PDD submission.

Source	MoU	OM (2002-03)	OM (2003-04)	OM (2004-05)
Year-wise OM	tCO2/ MWh	0.952	0.978	0.992
OM	tCO2/ MWh		0.974	

Emissions due to imports from other grids into the southern grid have been considered as "0 tCO2/MWh". This is conservative.

Step 2.2: Calculate the Build Margin emission factor ($EF_{BM,y}$)

As per the methodology the Build Margin emission factor ($EF_{BM,y}$) is calculated as the generation-weighted average emission factor (tCO_2/MU) of a sample of power plants. The project activity calculates the Build Margin emission factor $EF_{BM,y}$ ex ante based on the most recent information available on plants already built for sample group m at the time of PDD submission.

The sample group *m* consists of either:

(a) The five power plants that have been built most recently, or
(b) The power plants' capacity additions in the electricity system, that comprise 20% of the system generation (in MU) and that have been built most recently.

As per the baseline information data the option (b) comprises the larger annual generation. Therefore for the project activity the sample group m consists of power plants capacity additions in the electricity system that comprise 20% of the system generation (in MU) and that have been built most recently. Power plant capacity additions registered as CDM project activities are excluded from the sample group.

Power Plants considered for Build Margin (BM) estimation:

Type	State	Station	Capacity (MW)	Commissioning Date
Hydro	AP	Mini Hydro	30.0	01.12.2005
Hydro	Karnataka	Narayanpur	6.6	01.12.2005
Hydro	Kerala	Other Hydro	5.0	01.12.2005
Hydro	Kerala	Malampuzha	2.5	01.12.2005
Hydro	Karnataka	Almattidam 6	55.0	10.08.2005
Hydro	Karnataka	Almattidam 5	55.0	06.07.2005
Hydro	Karnataka	Almattidam 4	55	26.03.2005
Hydro	Karnataka	Almattidam 3	55	13.01.2005
Hydro	Karnataka	Almattidam 2	55	04.11.2004
Hydro	Kerala	Malankara	10.5	30.05.2004

Gas	Tamilnadu	Kuttalam	36	30.03.2004
Hydro	Karnataka	Almattidam 1	15	26.03.2004
Hydro	Kerala	Chembukadavu	6.5	30.12.2003
Hydro	Kerala	Urumi	6.2	30.12.2003
Gas	Tamilnadu	Kuttalam	64	30.11.2003
Thermal	Tamilnadu	NLC TS I extension	420	15.09.2003
Hydro	AP	Srisailam Left 6	150.0	04.09.2003
Hydro	Karnataka	Shahpur	1.4	01.08.2003
Hydro	AP	Srisailam Left 5	150.0	28.03.2003
Gas	Tamilnadu	Valuthur	94	13.03.2003
Thermal	Tamilnadu	Neyvelli Zero	250	16.12.2002
Thermal	Karnataka	Raichur TPS	210	10.12.2002
Hydro	AP	Srisailam Left 4	150.0	29.11.2002
Thermal	AP	Simhadri	500	15.08.2002
Hydro	AP	Srisailam Left 3	150.0	19.04.2002
Gas	AP	LANCO- Kondapalli	355	01.03.2002
Diesel	AP	LVS power	36.8	15.01.2002
Thermal	AP	Simhadri	500	15.01.2002
Gas	AP	BSES- Peddapuram	220	30.11.2001
Hydro	AP	Srisailam Left 2	150.0	12.11.2001
Diesel	Tamilnadu	Samayanallur DEPP	106	22.09.2001
Diesel	Tamilnadu	Samalpatti DEPP	105.7	15.07.2001
Diesel	Karnataka	Belgaum	81.3	01.07.2001
Hydro	Karnataka	Madhavmantrii	3	01.07.2001
Hydro	Kerala	Kuthungal	21	01.07.2001
Gas	Karnataka	Tanir Bavi	220	15.05.2001
Hydro	Karnataka	Gerusuppa	240	01.05.2001
Hydro	AP	Srisailam Left 1	150.0	26.04.2001
Gas	Tamilnadu	Pillai Perumal Nallur GTPP	330.5	26.04.2001
Diesel	Kerala	Kasargode	21.84	15.03.2001
Hydro	Kerala	Kuttiadi	50	27.01.2001
Nuclear	Karnataka	Kaiga 1	220	16.11.2000
Gas	Tamilnadu	Kovilkalapai	108	30.09.2000
Hydro	Tamilnadu	Mukurthy Mini	0.7	18.08.2000
Diesel	Karnataka	Bellay	25.2	15.05.2000
Hydro	Tamilnadu	Parsons Valley	30	29.03.2000
Hydro	Tamilnadu	Thirumurthy Mini	1.95	20.03.2000
Nuclear	Karnataka	Kaiga 2	220	16.03.2000
Hydro	AP	Singur	15.0	31.03.2000
Thermal	Karnataka	Torangulu Steam	130	15.12.1999
Thermal	Karnataka	Torangulu Steam	130	15.12.1999
Hydro	Kerala	Kakkad	50	14.10.1999
Gas	Kerala	Kayamkulam GT3	129.2	01.10.1999
Hydro	Karnataka	Kodasalli 3	40	28.08.1999
Hydro	Karnataka	Rajankollur	2	01.08.1999
Hydro	Karnataka	Harangi	9	19.07.1999
Gas	Pondichery	PPCL GTG	32.5	25.05.1999
Hydro	Karnataka	Kadra 3	50	21.05.1999
Hydro	Karnataka	Kodasalli 2	40	20.04.1999
Hydro	Tamilnadu	Sathanur	7.5	30.03.1999
Diesel	Tamilnadu	GMR Vasavi DEPP	196	01.02.1999

Source	MoU	Thermal	Diesel	Gas	Hydro	Nuclear	Wind	
Gross Generation	MU	23929.8	1796.0	7339.4	3296.5	2926.3	1270.7	
Net Generation	MU	23096.9	1742.3	7252.9	3279.7	2575.1	1270.7	39217.6
Heat Rate	kcal/kWh	2490.0	2062.0	2000.0	0.0	0.0		
Fuel CV	kcal/kg	3820.0	10186.0	10350.0	0.0	0.0		
Fuel Consumption	Tonnes per annum	15598220.4	363572.7	1418241.5				
Total Emissions	tCO2/ annum	23495832.6	1137499.9	3430674.0				28064006.6
Emission Factor-BM	tCO2/ MWh	0.716						

Step 2.3: Calculate the Electricity Baseline Emission Factor ($EF_{electricity,\ y}$)

Electricity baseline emission factor is calculated as the weighted average of the Operating Margin emission factor (*EFOM,y*) and the Build Margin emission factor (*EFBM,y*) where the weights *wOM* and *wBM*, by default, are 50% (i.e., *wOM* = *wBM* = 0.5). This is presented in the table below.

Source	MoU	OM (2002-03)	OM (2003-04)	OM (2004-05)
Year-wise OM	tCO2/ MWh	0.952	0.978	0.992
OM	tCO2/ MWh	0.974		
BM	tCO2/ MWh	0.716		
Emission Factor-CM	tCO2/ MWh	**0.845**		

Appendix – 17

Quantity of biomass residues combusted in boiler for power and steam generation

Month	Apr-2007	May-2007	Jun-2007	Jul-2007	Aug-2007	Sep-2007
Quantity (Tonnes)	485	745	684	100	328	0