"Methane Recovery and Power Generation in a Distillery plant"

By GMR Industries Ltd. (GIDL)
UNFCCC0505

III Monitoring Report

Version 1.0
Date: 15/08/2008

Monitoring Period:
From: 01/10/2007
To: 31/03/2008
(Inclusive of both days)

GMR Industries Limited (Sugar Division)
Sankili, Regidi, Amadalavalasa Mandal,
Srikakulam District – 532 440
Andhra Pradesh, India

Table of contents

1. Introduction

2. Monitoring plan

3. GHG Calculations

4. Reference

5. Appendices

5.1. Appendix -1 Flow of Spent-Wash in digester
5.2. Appendix -2 Chemical Oxygen Demand of untreated Spent-Wash into the digester
5.3. Appendix -3 Chemical Oxygen Demand of treated water from digester
5.4. Appendix -4 Biogas flow into boiler
5.5. Appendix -5 %CH4, Volumetric content of Methane in biogas
5.6. Appendix -6 Pressure and temperature of biogas
5.7. Appendix -7 Gross Electricity generated in the power plant
5.8. Appendix -8 Auxiliary Electricity Consumption
5.9. Appendix -9 Net electricity generation
5.10. Appendix -10 Quantity of fossil fuel i combusted in boiler
5.11. Appendix -11 Calorific value of fossil fuel i combusted
5.12. Appendix -12 Power consumed in equipment in digester plant
5.13. Appendix -13 Quantity of digester solid residues generated
5.14. Appendix -14 Quantity of digester solid residue treated by composting
5.15. Appendix -15 Coefficient of emission for fossil fuel i combusted in boiler
5.16. Appendix -16 Quantity of biomass residues combusted in boiler for power and steam generation

1. Introduction

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.

This project activity from GIDL entails treatment of 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.

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

This monitoring report covers the activity from **01/10/2007 to 31/03/2008** as third 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. The second monitoring report covered activity from 01/04/07 to 30/09/07.

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. Monitoring Plan

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*	Appendix -3

									Pollution Control Board norms	
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	kcal/ kg	*e*	*Monthly*	*100%*	*Paper*	*Credit period + 2*		Appendix -11

		combusted						*yrs*		
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-16

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 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.

3. GHG Calculations

The GHG calculation for this project is divided in two parts –

- **For Methane Avoidance / Spent wash Treatment part**
- **For Power Generation part**

These are explained in following pages.

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 (No leakages has been identified for the project activity)

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

Baseline emissions have been calculated in two ways, first based on actual biogas generation and second based on formula as described in the PDD. Amongst the two values obtained, the least value is taken for emission reduction calculation.

Based on actual generation of biogas in the project activity:

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

Results:

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:

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

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

Month	BEy Spent wash treatment (tCO2) Actual
Oct-07	601
Nov-07	3872
Dec-07	4835
Jan-08	3365
Feb-08	4613
Mar-08	5128
Total	**22414**

Based on the formulae described in the registered PDD:

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

$Q_{y, ww}$	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)

Results:

Month	BE_y Spent wash treatment (tCO2) As per Meth formula
Oct-07	503
Nov-07	2732
Dec-07	3273
Jan-08	2418
Feb-08	3720
Mar-08	5154
Total	**17799**

Out of the above values, conservative figure considered for baseline emissions are 17799 tCO2e.

Calculate PE_y i.e. Project emissions for Methane Avoidance

Project emissions are on account of power consumption in the digester plant and dissolved methane in the treated waste water.

Project Emissions due to Power Consumption in digester plant

PE_y (Power consumption in 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 CO2/MWh)	0.845	Fixed ex-ante in the PDD

Results:

PE_y (power consumption in digester plant) for six months:

Month	PEy tCO2 (Power consumption in digester plant)
Oct-07	11
Nov-07	26
Dec-07	25
Jan-08	18
Feb-08	23
Mar-08	27
Total	130

Project emissions for Dissolved Methane in Treated waste water

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

Results:

Month	Project emissions tCO2 (for Dissolved Methane)
Oct-07	7
Nov-07	24
Dec-07	27
Jan-08	19
Feb-08	23
Mar-08	32
Total	131

Calculate L_y i.e. Project Leakages

Leakages are zero. (Refer section E.1.1 of the registered PDD)

For Power Generation

This calculation is based on AMS ID
$ER_y = BE_y – (PE_y + L_y)$

Baseline emissions:
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	Fixed ex-ante in the PDD

Results:
BE_y (power generation) for the six months:

Month	**BE_y tCO2 (Power Generation)**
Oct-07	18
Nov-07	318
Dec-07	348
Jan-08	264
Feb-08	374
Mar-08	411
Total	1733

Project emissions due to auxiliary power consumption:
PE_y (Auxiliary electricity consumption in the power plant) = (Auxiliary electricity consumption in the power plant) * (GEF) / 1000

Variable	Value	Reference
Auxiliary electricity consumption in the power plant) (KWh)[2]	Tabulated in Appendix	Appendix – 8
GEF (t CO2/MWh)	0.845	Fixed ex-ante in the PDD

Results:
PE_y (Auxiliary electricity consumption) for six months:

Month	**PEy tCO2 (Auxiliary electricity consumption in the power plant)**
Oct-07	48

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

Nov-07	73
Dec-07	79
Jan-08	70
Feb-08	78
Mar-08	91
Total	**438**

Project emissions due to fossil fuel combustion:

$PE_{y, FF}$ (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

Results:

PEy, $_{FF}$ (fossil fuel usage) for six months:

Month	Ly tCO2 (Project emissions due to fossil fuel usage)
Oct-07	0
Nov-07	0
Dec-07	0
Jan-08	0
Feb-08	0
Mar-08	0
Total	0

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	
OCT'07	**503.3**	**18.5**	**10.6**	**47.9**	**0.0**	**6.6**	**457**
NOV'07	**2731.54**	**318.3**	**25.8**	**73.2**	**0.0**	**23.7**	**2927**
DEC'07	**3273.2**	**347.5**	**25.4**	**78.7**	**0.0**	**27.4**	**3489**
JAN'07	**2418.0**	**264.2**	**18.0**	**69.5**	**0.0**	**19.0**	**2576**
FEB'07	**3719.8**	**373.6**	**23.4**	**77.7**	**0.0**	**23.0**	**3969**
MAR'07	**5153.6**	**410.9**	**26.7**	**90.8**	**0.0**	**31.8**	**5415**
Total							**18833**

4. Reference

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

http://cdm.unfccc.int/UserManagement/FileStorage/PYKWM3K4AATF0Q2PNQZ46DEHNXT1VA

Revised Monitoring plan

Revision: 01/11/07

http://cdm.unfccc.int/Projects/DB/SGS- UKL1152270393.27/MonitoringPlanRevisions/01/RevisedMonitoringPlan

Methodologies

***AMS - III.H. Methane Recovery in Wastewater Treatment*, Version 01, Scope 13,15, 03 March 2006**

http://cdm.unfccc.int/UserManagement/FileStorage/CDM_AMSIV7OBP5KXY3HNLLBAAVR1AS8G8IKKQ

***AMS - I.D. 'Grid connected renewable electricity generation',* Version 08, Scope 1, 03 March 2006**

http://cdm.unfccc.int/UserManagement/FileStorage/CDMWF_AM_88PZMJZZR5KRJ6L9V7AXGGWHG7W2HH

5. Appendices

5.1 Appendix – 1

Flow of Spent Wash in digester (m^3)

Appendix -1, Flow of spent wash in digester in m3						
Date/Month	Oct-07	Nov-07	Dec-07	Jan-08	Feb-08	Mar-08
1	0	114	496	0	332	556
2	0	131	341	0	376	535
3	0	46	499	273	348	547
4	0	168	319	415	373	527
5	0	299	487	150	392	446
6	0	274	488	0	418	490
7	0	309	480	0	437	458
8	0	385	433	0	434	471
9	0	351	493	0	418	494
10	0	383	450	53	457	443
11	0	412	425	216	268	489
12	0	469	415	311	281	479
13	40	486	448	456	274	461
14	81	457	457	490	288	472
15	80	490	454	369	314	483
16	77	500	455	403	319	468
17	70	434	479	418	334	486
18	61	416	513	348	342	502
19	89	421	481	350	351	428
20	120	442	496	100	388	474
21	132	451	477	74	426	471
22	183	477	480	416	389	483
23	179	485	469	472	439	495
24	222	505	485	387	440	519
25	279	487	495	386	244	533
26	240	492	506	516	350	494
27	178	114	479	617	486	501
28	251	301	187	519	472	523
29	311	506	151	436	540	476
30	350	501	157	457	-	453
31	223	-	34	419	-	465

5.2 Appendix – 2

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

Appendix -2, COD of untreated spent wash (mg/l)						
Date/Month	Oct-07	Nov-07	Dec-07	Jan-08	Feb-08	Mar-08
1	0	105000	110000	0	139000	138000
2	0	106000	113000	0	138000	138000
3	0	105000	111000	100000	140000	139000
4	0	100000	108000	108000	139000	140000
5	0	98000	113000	111000	138000	141000
6	0	95000	112000	0	141000	140000
7	0	99000	115000	0	139000	141000
8	0	95000	118000	0	138000	139000
9	0	107000	109000	0	137000	140000
10	0	106000	114000	112000	139000	139000
11	0	111000	120000	109000	141000	138000
12	0	110000	126000	107000	140000	139000
13	80000	111000	121000	113000	138000	140000
14	80000	119000	118000	109000	138000	139000
15	81000	112000	115000	120000	137000	141000
16	80000	111000	113000	121000	139000	140000
17	81000	110000	114000	122000	141000	138000
18	80000	116000	107000	119000	140000	139000
19	85000	119000	108000	123000	141000	138000
20	80000	116000	106000	117000	139000	137000
21	80000	110000	109000	115000	138000	139000
22	80000	108000	108000	117000	142000	138000
23	83000	110000	109000	110000	141000	137000
24	82000	110000	107000	123000	139000	136000
25	83000	108000	106000	125000	140000	139000
26	86000	109000	102000	119000	140000	140000
27	80000	104000	107000	120000	141000	139000
28	87000	107000	110000	120000	138000	139000
29	82000	109000	111000	117000	139000	140000
30	84000	108000	112000	115000	-	141000
31	90000	-	110000	121000	-	140000

5.3 Appendix – 3

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

Appendix -3, COD of treated spent wash (mg/l)						
Date / Month	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**March**
1	0	34000	35000	0	35000	34000
2	0	35000	35000	0	34000	35000
3	0	34000	36000	35000	35000	34000
4	0	35000	36000	35000	34000	35000
5	0	34000	35000	34000	34000	34000
6	0	36000	35000	0	35000	34000
7	0	35000	36000	0	35000	34000
8	0	34000	35000	0	35000	34000
9	0	34000	36000	0	34000	34000
10	0	35000	35000	34000	34000	35000
11	0	36000	35000	33000	35000	34000
12	0	35000	35000	34000	36000	33000
13	34000	36000	35000	34000	35000	35000
14	33000	36000	35000	33000	35000	34000
15	34000	36000	34000	33000	34000	35000
16	34000	35000	34000	34000	34000	36000
17	34000	35000	34000	35000	35000	35000
18	33000	34000	34000	33000	35000	34000
19	34000	35000	34000	34000	36000	34000
20	33000	36000	33000	35000	35000	33000
21	34000	35000	34000	35000	34000	34000
22	34000	34000	33000	34000	35000	35000
23	33000	33000	33000	34000	36000	34000
24	35000	34000	34000	34000	35000	34000
25	35000	33000	33000	34000	35000	35000
26	34000	34000	33000	35000	35000	35000
27	34000	34000	34000	36000	35000	34000
28	35000	34000	33000	34000	34000	35000
29	35000	34000	34000	35000	34000	34000
30	34000	34000	33000	35000	-	35000
31	35000	-	32000	35000	-	34000

5.4 Appendix – 4

Biogas Flow into Boiler (m^3)

Appendix -4, Biogas flow into boiler (m3)						
Date / Month	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**March**
1	0	5589	19964	552	18411	19053
2	0	4860	14147	0	18875	18017
3	0	4200	19928	7615	18285	19038
4	0	5794	12091	13599	18861	18535
5	0	1869	20120	4538	19128	19007
6	0	7360	20009	0	18994	18928
7	0	10497	20252	0	19217	18956
8	0	12173	19367	0	19349	19122
9	0	13758	18980	0	19448	18814
10	0	14627	18915	2289	19210	18310
11	0	16322	19275	7494	15355	18150
12	0	18741	20195	11642	15360	17935
13	0	19357	20541	19013	14646	17760
14	0	20229	20140	19729	15582	18665
15	0	19787	19601	18920	16641	18453
16	0	20086	19107	18785	17587	18629
17	0	17338	20346	19278	17961	18506
18	1074	18092	19606	18811	18393	18430
19	2607	18698	18676	19219	16436	18337
20	2322	18872	18862	2545	17574	18762
21	2872	17860	19109	1182	18429	18857
22	4380	18657	19223	18183	18541	18569
23	4700	19833	18952	19074	18926	14811
24	5570	20269	18804	18984	18203	14388
25	6990	19436	19161	19023	10903	17690
26	6636	19603	18753	18927	18219	20032
27	3231	4258	18724	19114	18911	19894
28	6907	11757	11703	18803	19133	20044
29	7341	20163	9396	19086	19065	20259
30	7800	19776	8256	19163	-	18127
31	6606		3684	19310	-	20664

5.5 Appendix – 5

%CH4, Volumetric content of Methane in biogas

Appendix -5, %CH4, Volumetric content of Methane in biogas						
Date / Month	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**March**
1	0	63.3	62.1	63.6	62.65	63.36
2	0	63.45	62.35	0	63.15	63.18
3	0	63.6	62.15	63.35	62.7	63.72
4	0	63.5	61.9	63.16	62.6	63.26
5	0	63.15	62.3	63.75	63.15	62.97
6	0	63	62.85	0	63.6	63.06
7	0	62.95	62.7	0	63.75	63.17
8	0	63.1	62.65	0	62.95	63.21
9	0	62.85	62.5	0	62.8	63.33
10	0	62.6	62.8	63.25	63.35	63.18
11	0	62.65	62.95	63.65	63.15	63.66
12	0	62.55	62.9	63.1	62.8	62.98
13	0	62.35	62.65	63.15	62.9	62.82
14	0	62.25	62.45	62.95	63.45	62.91
15	0	62.75	63.1	62.8	63.55	63.15
16	0	62.6	63	63.2	62.9	63.22
17	0	62.3	62.75	63.35	63.85	63.41
18	63.3	62.2	62.35	63.4	63.7	63.4
19	63.15	62.15	62.2	63.35	63.55	63.27
20	62.95	62.05	62.25	63.85	63.95	63.31
21	62.9	62.15	62	63.9	63.7	63.05
22	63.2	62.23	63.1	63.65	63.65	62.79
23	63.1	62.38	63.2	63.5	63.2	62.9
24	62.9	62.08	63.15	63.25	63.3	62.98
25	62.85	62.27	63.25	63.45	63.47	63.16
26	62.6	62.36	63.1	63.55	62.97	63.21
27	62.85	62.88	63.15	62.85	63.15	63.44
28	63.4	62.76	63.25	62.7	62.98	63.3
29	63.15	62.18	62.8	62.6	62.86	63.1
30	63.35	62.27	62.65	62.8	-	63.06
31	62.75		62.7	63	-	62.94

5.6 Appendix – 6

Pressure of Biogas (mm of water column)

Appendix -6, Pressure of Biogas (mm of water column)						
Date / Month	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**March**
1	0	300	850	550	750	800
2	0	200	600	0	800	750
3	0	150	850	300	750	800
4	0	250	500	550	800	750
5	0	200	850	550	800	800
6	0	300	850	0	800	800
7	0	450	850	0	800	800
8	0	500	800	0	800	800
9	0	550	800	0	800	800
10	0	600	800	100	800	750
11	0	700	800	300	650	750
12	0	800	850	500	650	750
13	0	800	850	800	600	750
14	0	850	850	800	650	750
15	0	800	800	800	700	750
16	0	850	800	800	750	750
17	0	700	850	800	750	750
18	50	750	800	800	750	750
19	100	800	800	800	700	750
20	100	800	800	600	750	800
21	100	750	800	150	750	800
22	200	800	800	750	800	750
23	200	850	800	800	800	600
24	250	850	800	800	750	600
25	300	800	800	800	450	750
26	250	800	800	800	750	850
27	150	150	800	800	800	850
28	300	500	500	800	800	850
29	300	850	400	800	800	850
30	300	800	350	800	-	750
31	250		150	800	-	850

Temperature of Biogas (Deg Celsius)

Appendix -6, Temperature of Biogas (Deg Celsius)						
Date / Month	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**March**
1	0	33	40	36	38	38
2	0	33	39	0	38	38
3	0	34	40	37	38	39
4	0	35	38	37	39	38
5	0	36	39	37	40	39
6	0	36	40	0	40	40
7	0	37	41	0	40	40
8	0	38	41	0	40	39
9	0	38	40	0	39	39
10	0	39	40	36	38	40
11	0	39	40	36	38	40
12	0	39	41	37	38	41
13	0	40	40	37	38	41
14	0	40	40	37	39	40
15	0	40	40	38	39	40
16	0	40	41	39	39	40
17	0	39	41	38	38	41
18	30	39	41	39	39	41
19	31	39	40	38	39	41
20	30	40	40	37	39	40
21	30	39	40	37	38	40
22	31	39	41	37	38	41
23	31	40	41	38	39	39
24	31	40	40	38	39	39
25	32	40	40	38	39	40
26	32	40	41	38	39	41
27	31	38	40	37	39	41
28	32	40	40	37	40	42
29	32	40	39	36	40	42
30	32	40	38	37	-	41
31	32		38	37	-	42

Appendix -6, Density of Biogas (kg/m3)						
Date / Month	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**March**
1	0.72	0.66	0.68	0.67	0.68	0.68
2	0.72	0.65	0.66	0.72	0.68	0.68
3	0.72	0.65	0.68	0.65	0.68	0.68
4	0.72	0.65	0.66	0.67	0.68	0.68
5	0.72	0.65	0.68	0.67	0.67	0.68
6	0.72	0.65	0.68	0.72	0.67	0.67
7	0.72	0.66	0.68	0.72	0.67	0.67
8	0.72	0.66	0.67	0.72	0.67	0.68
9	0.72	0.66	0.67	0.72	0.68	0.68
10	0.72	0.66	0.67	0.64	0.68	0.67
11	0.72	0.67	0.67	0.65	0.67	0.67
12	0.72	0.68	0.68	0.66	0.67	0.67
13	0.72	0.67	0.68	0.68	0.67	0.67
14	0.72	0.68	0.68	0.68	0.67	0.67
15	0.72	0.67	0.67	0.68	0.67	0.67
16	0.72	0.68	0.67	0.68	0.67	0.67
17	0.72	0.67	0.68	0.68	0.68	0.67
18	0.65	0.67	0.67	0.68	0.67	0.67
19	0.65	0.68	0.67	0.68	0.67	0.67
20	0.65	0.67	0.67	0.67	0.67	0.67
21	0.65	0.67	0.67	0.64	0.68	0.67
22	0.66	0.68	0.67	0.68	0.68	0.67
23	0.66	0.68	0.67	0.68	0.68	0.66
24	0.66	0.68	0.67	0.68	0.67	0.66
25	0.66	0.67	0.67	0.68	0.66	0.67
26	0.66	0.67	0.67	0.68	0.67	0.68
27	0.65	0.64	0.67	0.68	0.68	0.68
28	0.66	0.66	0.66	0.68	0.67	0.67
29	0.66	0.68	0.65	0.68	0.67	0.67
30	0.66	0.67	0.65	0.68	-	0.67
31	0.66		0.64	0.68	-	0.67

5.7 Appendix – 7

Gross Electricity Generation in Power Plant (KWh)

Appendix -7, Gross Electricity Generation in Power Plant (KWh)						
Date / Month	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**March**
1	0	4569	12552	2500	15674	16300
2	0	11668	11835	3435	16326	16268
3	0	12263	12634	10246	15550	16530
4	0	13281	6746	14129	15510	15116
5	0	12463	13013	3481	15726	14620
6	0	12607	14039	0	15580	14563
7	0	12909	13903	0	15731	14390
8	0	13473	13286	0	16268	15036
9	0	13688	12246	0	15973	15049
10	0	14280	11717	4241	15738	14742
11	0	14717	11661	8258	15260	14454
12	799	15115	12816	12629	15733	14937
13	0	14238	14340	13408	15392	15079
14	0	14801	14413	14797	15880	15228
15	0	14230	13282	15767	15321	14056
16	5128	14750	14489	15201	16271	16659
17	6489	14924	13751	14005	15528	16885
18	4748	14780	14328	14151	15567	16760
19	2436	11956	14701	14027	15331	17639
20	0	11032	14491	1723	15068	17182
21	0	13314	14835	0	13948	17217
22	0	13177	14651	12808	14432	17374
23	0	13092	15089	14166	13851	16536
24	0	14200	15364	15190	14110	16570
25	0	14884	15729	15180	8632	16468
26	0	14053	14771	15723	15258	16635
27	0	2820	15255	15245	15687	16870
28	0	7333	8693	15733	16452	16763
29	0	10992	12450	15739	16302	17097
30	0	11081	12722	15448	-	9144
31	2267		11455	15480	-	14158

5.8 Appendix – 8

Auxiliary Electricity Consumption (KWh)

Appendix -8, Auxiliary power consumption						
Date / Month	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**March**
1	100	2749	2846	1654	3369	3404
2	100	2917	3001	1604	3343	3422
3	100	2920	3002	3408	3411	3492
4	156	2990	2135	3644	3329	3473
5	180	2776	2954	1376	3312	3358
6	180	3027	3019	120	3141	3434
7	180	2813	3018	96	3348	3470
8	328	2964	2899	289	3404	3425
9	328	3033	2892	280	3501	3471
10	328	2935	2898	2802	3497	3435
11	1195	2916	2881	3184	2942	3506
12	2416	3577	2909	3501	3384	3443
13	2730	3200	2932	3503	3080	3432
14	2879	3014	2983	3512	3074	3513
15	2879	2817	2986	3531	2948	3479
16	2703	3054	3083	3415	3085	3409
17	2842	3065	2938	3507	2987	3507
18	2705	3022	2905	3444	2999	3432
19	2798	2923	3114	3492	3063	3488
20	2762	2848	3020	1530	3035	3502
21	2670	2987	3103	1335	2959	3508
22	2567	2679	3124	3226	3040	3536
23	2682	3219	2969	3178	2912	3400
24	2625	2955	2847	3356	2964	3521
25	2704	3014	3227	3233	2232	3558
26	2975	3022	2958	3394	3119	3515
27	1561	956	3072	3309	3502	3519
28	2714	2567	2924	3357	3478	3497
29	2714	2780	3325	3349	3436	3760
30	2838	2936	3583	3311	-	3203
31	2752		3568	3338	-	3402

5.9 Appendix – 9

Net Electricity Generation (KWh)

Appendix -9, Net electricity generation (kWh)						
Date / Month	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**March**
1	-100	1820	9706	846	12305	12896
2	-100	8751	8834	1831	12983	12846
3	-100	9343	9632	6838	12139	13038
4	-156	10291	4611	10485	12181	11643
5	-180	9693	10059	2105	12414	11262
6	-180	9580	11020	-120	12439	11129
7	-180	10096	10885	-96	12383	10920
8	-328	10509	10387	-289	12864	11611
9	-328	10655	9354	-280	12472	11578
10	-328	11345	8819	1439	12241	11307
11	-1195	11801	8780	5074	12318	10948
12	-1617	11538	9907	9128	12349	11494
13	-2730	11038	11408	9905	12312	11647
14	-2879	11787	11430	11285	12806	11715
15	-2879	11413	10296	12236	12373	10577
16	2425	11696	11406	11786	13186	13250
17	3647	11859	10813	10498	12541	13378
18	2043	11758	11423	10707	12568	13328
19	-362	9033	11587	10535	12268	14151
20	-2762	8184	11471	193	12033	13680
21	-2670	10327	11732	-1335	10989	13709
22	-2567	10498	11527	9582	11392	13838
23	-2682	9873	12120	10988	10939	13136
24	-2625	11245	12517	11834	11146	13049
25	-2704	11870	12502	11947	6400	12910
26	-2975	11031	11813	12329	12139	13120
27	-1561	1864	12183	11936	12185	13351
28	-2714	4766	5769	12376	12974	13266
29	-2714	8212	9125	12390	12866	13337
30	-2838	8145	9139	12137	-	5941
31	-485		7887	12142	-	10756

5.10 Appendix – 10

Quantity of Fossil fuel burnt (tonnes)

Appendix -10, Quantity of fossil fuel combusted						
Month	Apr-07	May-07	Jun-07	Jul-07	Aug-07	Sep-07
Quantity (t)	0	0	0	0	0	0

5.11 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)	0	0	0	0	0	0

5.12 Appendix – 12

Power consumed in equipment in digester plant (KWh)

Appendix -12, Power consumed in equipment in digester plant (KWh)						
Date / Month	Oct	Nov	Dec	Jan	Feb	March
1	212	920	1010	603	949	1019
2	212	724	884	168	980	947
3	212	611	1036	609	986	1004
4	264	853	845	712	916	1034
5	245	803	1081	477	1025	1006
6	244	939	1077	378	998	1029
7	244	999	1007	95	988	1060
8	250	1027	1004	556	978	1047
9	251	1030	1009	360	1012	1040
10	250	1099	1000	328	986	1038
11	350	1167	984	572	775	1073
12	250	1301	1016	664	863	1072
13	365	1259	1014	830	844	1047
14	396	1151	1040	808	927	1049
15	361	1177	1042	752	975	1037
16	338	1134	1031	730	1029	1039
17	318	1089	956	894	976	1021
18	319	1107	992	791	964	1009
19	423	1193	1047	809	852	1034
20	440	1139	1047	347	916	1032
21	423	1178	1083	409	955	1069
22	494	1152	1067	881	949	1105
23	620	931	946	975	945	754
24	602	1056	1022	956	963	763
25	653	1041	1109	919	804	983
26	646	1025	1011	1025	1005	1088
27	530	549	1022	977	1069	1082
28	651	743	803	956	1062	1071
29	645	1046	721	956	1032	1119
30	682	1050	689	894		923
31	644		482	927		1062

5.13 Appendix – 13

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

Appendix -13, Quantity of digester solid residues generated (in form of liquid) m3						
Month	Oct	Nov	Dec	Jan	Feb	March
Quantity (m^3)	0	0	0	0	0	17.235

5.14 Appendix – 14

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

Appendix -14, Quantity of digester solid residue treated by composting (in form of liquid) m3						
Month	Oct	Nov	Dec	Jan	Feb	March
Quantity (m^3)	0	0	0	0	0	17.235

No digester solids were removed during current monitoring period

5.15 Appendix – 15

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

Appendix -15, Coefficient of emission for fossil fuel i combusted in boiler (tCO2/tonne) (IPCC default value taken)						
Month	Oct	Nov	Dec	Jan	Feb	March
Value	**2.08919**	**2.08919**	**2.08919**	**2.08919**	**2.08919**	**2.08919**

5.16 Appendix -16

Appendix -16, Quantity of biomass residues combusted in boiler for power and steam generation (tonnes)						
Month	Oct	Nov	Dec	Jan	Feb	March
Value	665	1259	1291	926	956	892