MONITORING REPORT

Monitoring Period
01.10.2004 to 27.12.2006
(Both days included)

Version 4
Dated 19.11.2007

18 MW Biomass Power Project in Tamilnadu, India
of
RAGHU RAMA RENEWABLE ENERGY LTD
Electricity Generation from Biomass Fuels
Project Registration No. UNFCCC 0111

Project Site
Pamboor Village, Paramakkudi Taluk, Ramnad Dist.
Tamilnadu, India

Raghu Rama Renewable Energy Ltd

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Current Status of the Project

Raghu Rama Renewable Energy Ltd (RRREL) 18 MW biomass based Power Plant is located at Pamboor Village, Paramakkudi Taluk, Ramnad Dist; Tamilnadu, India. The plant has been commissioned and is operational since 01.10.2004.

First synchronization of the Project with 110 KV sub station at Paramakkudi (TNEB grid) was performed on 01.10.2004, after trial operations and after obtaining permission for commercial operations, Plant exported 250.69 MU to TNEB grid and consumed 365,758 MT of biomass fuel and 16,026 MT of coal since beginning of the operations to 27.12.2006.

The list of vendors who supplied major equipments for the Plant is given below.

Sl No.	Equipment	Supplier
1	**Boiler :** Sr. No: 452 Capacity : 80TPH, Working Pressure : 66 Kg/cm^2, Temperature : 500^oC Traveling grate Bi-drum natural circulated water tube boiler	M/s. Walchand Nagar Industries Ltd, Pune. Year of Manufacturing : 2004
2	**Turbine :** Prod. No : 13001 Rated Power : 18MW Speed : 3000 RPM Stages : 18 Type : K – 18 -6, 4T Rated Steam Flow : 75.05 TPH Live Steam Pressure : 64 Kg/cm^2 abs Inlet Steam Temperature:490^oC Steam Pressure Passed turbine : 0.15 Kg/cm^2 abs Outlet Steam Temperature:55^oC	M/s. Kaluga, Russia Year of Manufacturing : 2003
3	**Generator :** Capacity : 18 MW Voltage : 11KV Stator Current : 1181 Amps Power factor : 0.8 Frequency : 50 Hz Speed : 3000 RPM	M/s Elecrosila, Russia Year of Manufacturing : 2004

	Connection : Star	
4	**Generator Transformer** Sr. No : 4789/1 Rated KVA : 20000/25000 Voltage:110000–HV, 11000-LV Amps: 100.4/125.5A – HV 1049.7/1312.1A – LV Frequency : 50 Hz Phase HV / LV : 3/3	M/s. Bharath Bijilee Ltd Year of Manufacturing : 2004
5	**Air Cooled Condenser** Fan capacity : 6 Numbers of 100 HP double speed motor	M/s GEA Year of Manufacturing : 2004
6	**RO Plant & DM Plant**	M/s AQUA MAX Systems, Hyderabad

Statement to what extent the Project has been implemented as planned

The Project has been completed as planned and described in the Project Design Document (PDD).

The Plant is in operation continuously (with outages – forced & planned) since 01.10.2004. The Plant is using Biomass fuels like Prosophis Juliflora, Rice Husk, and other biomass fuels. Coal is used as supplementary (less than the permitted quantity). In addition, plant also uses small quantity of diesel very occasionally for power generation using DG set to meet emergency power requirement during complete black out for running the critical equipments and also for internal vehicles for fuel transfer.

Year	Running Hours	Planned Outages		Forced Outages	
	Hrs	Hrs	Weeks	Hrs	Weeks
2004	1889.11	64.31	0.38	254.58	1.52
2005	7943.08	263.51	1.57	553.41	3.29
2006	8019.7	477.29	2.84	263.01	1.56

Monitoring Period

The Monitoring period is chosen from 01.10.2004 to 27.12.2006 (both days included).

Sustainability – Economic and Social well being

The Company has spent Rs 380.82 Million during the monitoring period towards fuel usage in the Plant. Procurement of biomass fuel from local farmers and biomass suppliers has generated additional income and improved economic condition of the community in the area.

This has also resulted in local employment generation. Plant has generated employment opportunities directly / indirectly to more than 350 people.

The Company also encouraged local farmers for developing waste lands in the Paramakudi Taluk by providing the seeds to the farmers and resulted in utilization of the waste lands by the farmers resulting in additional revenue generation.

As a part of social responsibility, Plant has been contributing to social infrastructure by way of employing local people for the Plant operations and also paying significant amount as tax for the local panchayat.

Parameters being monitored according to Monitoring Plan

For the Project, the following parameters are being monitored on continuous basis:

1 ***Power Generation:*** Power generation from the plant is measured continuously using the generation meter installed in the switch yard of the plant. The total generated power will also be used to evaluate the auxiliary consumption of the plant after deducting power exported to the grid.

2 ***Power Export and Import:*** Power exported to the grid and imported from the grid is monitored from energy meters installed at TNEB sub station on 27th day of every month. A joint meter reading for the energy exported to the Grid will be recorded by representatives of TNEB and Company and the readings will be jointly signed by both the parties as a proof of export of Power to the grid from power plant and import of Power from grid by the power plant. These meter readings are the basis for the invoices raised by the Company.

3 ***Biomass Fuel of all kinds:*** The Biomass fuel on receipt in the Plant is weighed in the Electronic Weigh Bridge installed in the Plant and unloaded in the fuel storage yard. The biomass fuel after necessary preparation is fed to the Boiler as per the requirement and consumption will be recorded on daily basis.

4 ***Calorific value of the Biomass fuel of all kinds:*** The calorific value of the Biomass fuel being used is being done in external reputed and accredited laboratories as per the requirement and average value will be considered on monthly basis for energy balance calculations. The moisture is checked for each sample for evaluating the price for biomass.

5 ***Coal/Diesel:*** Coal on receipt in the Plant is weighed in the Electronic Weigh Bridge installed in the Plant and unloaded in the fuel storage yard. Coal is fed to the Boiler as and when required and consumption will be recorded whenever it is used. In addition, Diesel consumption in the DG set and vehicles will be monitored on regular basis.

6 ***Carbon content in Coal***: Carbon content in the coal received is being considered as per the analysis reports of laboratories which are furnished by the coal suppliers or calculated by standard formula from the analysis values furnished in the received analysis reports.

7 ***Calorific value of coal***: Calorific value for each lot is furnished by the coal suppliers, which is carried out in reputed and accredited laboratories

8. **Methane in Stack gas** The chimney flue gas analysis is carried out by reputed accredited laboratory for methane in flue gases, Carbon Dioxide, carbon monoxide etc. The flue gas analysis was carried out 4 times in a year i.e., once in every three months and the values presented in the reports were used for calculations. The methane emissions less than 0.5% are considered as below detectable limit. The monitored Methane values are furnished in the table given below:

S.No	Date	Report No	Methane %
1	24/12/2004	1825	BDL*
2	16/02/2005	2612	BDL
3	29/04/2005	0100	BDL
4	01/07/2005	0430	BDL
5	04/08/2005	0628	BDL
6	14/11/2005	1160	BDL
7	13/01/2006	1435	BDL
8	06/02/2006	1576	BDL
9	10/05/2006	0234	BDL
10	01/08/2006	0876	BDL

* BDL – Below Detectable Limit

9. **On site use of transport fuel** is monitored separately for each vehicle used for transportation inside the project boundary. Separate log books are maintained for each vehicle as per fuel issued from stores on daily basis and aggregated to monthly.

10. **Offsite transport distance**

Biomass Transport

The Biomass fuel on receipt in the Plant, the details like supplier name, address, details of the village where the biomass has been lifted is recorded in inward registers. The supply of biomass is from nearby villages and distance varies from 5 to 40 Kms. But for conservative approach, maximum distance of 75 Kms (one way) is considered.

Coal Transport

Coal used is of imported type and is supplied from Tuticorin port. A distance of 200 Kms (one way).

11. **Ash Generated and Offsite ash transport distance** The ash generated is taken away by local farmers and nearby brick manufacturing industries. The quantity of ash disposed per day is weighed in the electronic weigh bridge located in project site which is taken away by local farmers and brick manufacturers.

12. **Plant Heat rate or efficiency of the boiler** is calculated based on biomass consumption, coal consumption, calorific values of fuels and power generated. The plant heat rate is calculated four times in a year and furnished in Table 1 given below:

Table-1:

Sl No.	Month	Gross Electricity Generation	Fuel Used			Average Calorific Value	Heat Rate	
			Biomass	Coal	Total		Kcal / KWh	t fuel/ MWh
		KWh	MT	MT	MT	Kcal/Kg		
1	Nov-04	5535000	6641	500	7141	3275	4225	1.29
2	Feb-05	8277000	10707	782	11489	3331	4623	1.39
3	Apr-05	11364000	13937	774	14711	3287	4255	1.29
4	Jul-05	11533000	14816	737	15553	3211	4330	1.35
5	Nov-05	9497000	11318	755	12073	3292	4185	1.27
6	Mar-06	9790000	11799	665	12464	3189	4060	1.27
7	Jun-06	12635000	17503	435	17938	3043	4319	1.42
8	Sep-06	11181000	15693	335	16028	3032	4347	1.43
9	Dec-06	9647000	13370	425	13795	3768	5388	1.43

13. **Grid CEF**: As Tamilnadu State falls under southern grid and for authentication, the carbon emission factor of Southern Regional grid is used for calculating baseline emissions. The Central Electricity Authority published data is considered for calculations of **Version 2, dated 21st June, 2007**.

14. **Biomass assessment study** has been carried out by a third party on yearly basis for assessing surplus biomass availability in the district and if required for calculating the leakage, The supply demand as per biomass assessment studies conducted for the year 2004-05 & 2005-06 is more than 2:1. Hence, no leakage is considered for the project. The details of biomass generation, consumption and surplus available are presented in the Table 1 & Table 2.

Table 1 Generation, consumption and surplus potential biomass residue in Ramanathapuram – 2004-05

Tones / year

Residue	Generation	Consumption	Surplus
Paddy Straw	641700	641700	0
Millet stalks	11800	8300	3500
Pulses stalks	1500	600	900
Oil stalks	25100	11300	13800
Cotton stalks	15400	3100	12300
Cane tops& trash	1500	200	1300
Chilly stalks	23300	2000	21300
Coconut fronds	35400	8900	26500
Coconut husk	31500	7900	23600
Coconut shell	18900	5700	13200
Rice husk	117900	41300	76600
Groundnut shell	0	0	0
Saw dust	9000	2250	6750
Woody Biomass	683400	434460	248940
TOTAL	1616400	1167710	448690

Table 2 Generation, consumption and surplus potential biomass residue in Ramanathapuram – 2005-06

Tones / year

Residue	Generation	Consumption	Surplus
Paddy Straw	523400	523400	0
Millet stalks	9400	6600	2800
Pulses stalks	1600	600	1000
Oil stalks	10000	4500	5500
Cotton stalks	10500	2100	8400
Cane tops& trash	0	0	0
Chilly stalks	23300	2000	21300
Coconut fronds	35900	9000	26900
Coconut husk	31900	8000	23900
Coconut shell	30400	9100	21300
Rice husk	103700	36300	67400
Groundnut shell	0	0	0
Saw dust	8650	2200	6450
Woody Biomass	770200	560450	209750
TOTAL	1558950	1164250	394700

Emission Reductions

The emission reductions per year during the chosen monitoring period (01.10.2004 to 27.12.2006) are as given below:

Emission reductions are calculated based on the power exported to the grid, power imported from the grid, coal and diesel consumption in the plant during shut down and starts up from 01.10.2004 to 27.12.2006.

The detailed calculation sheet for the same is given in Annexure – 1 of the monitoring report.

Baseline and project emissions are calculated as per the formulas mentioned in Section E of the PDD. The same is given below:

Emissions	Formula Used
Baseline Emissions	= Electricity exported to the grid (GWh) X Grid Emission Factor (tCO_2 / GWh)
Project Emissions	
Due to Coal consumption	= Actual coal consumed in MT X % carbon in coal X (44 / 12)
Due to Diesel consumption	Off Site : Total Distance Traveled (km) X Emission Factor (tCO_2e/km)
	On Site : Quantity of Diesel (kg) X Emission factor for diesel (tCO_2e/kg)
Methane Emissions	= Quantity of biomass used in tonnes X Calorific value of biomass (TJ/t) X Methane emission factor (tCH_4/TJ) X GWP of CH_4 (tCO_2e/tCH_4)

Yearly Summary of Emission Reductions:

Year	BASE LINE EMISSIONS	PROJECT EMISSIONS DUE TO			
		Methane Emissions	Coal Used	Diesel Used	Total
	tCO_2	tCO_2	tCO_2	tCO_2	tCO_2
2004	12935	241	2725	313	3279
2005	88483	1705	19589	2209	23503
2006	85042	1757	11815	2191	15763
Total	**186460**	**3703**	**34129**	**4712**	**42545**

Total Emission Reductions (tCO_2) = 186460 – 42545 = 143915 tCO_2

Measures to ensure the Results / uncertainty analysis

Export meters:

As per the Power Purchase Agreement (PPA), the energy exported to the TNEB Grid is recorded from two independent meters viz., Main Meter and Check Meter and reading of main meter is used for billing. In the event of main meter not in operation / fails, the reading of the check meter shall be used for Billing.

The calibration of monitoring equipment is being maintained as per the requirement of TNEB and the same is being done regularly. Power Generation, Export & Auxiliary Consumption, fuel consumption are being recorded daily and

the same is being verified by General Manager (GM) and approved by Dy. General Manager (DGM).

Roles & Responsibilities

A CDM team has been formed in the plant for monitoring and verification of all the monitoring parameters as per the guidelines formulated by the management of the Company. Qualified and trained people monitor the parameters and emission reduction calculations. In the complete implementation and monitoring Plan, the Company is the sole agency responsible for implementation and monitoring.

CDM Team Members

1. Shri. K. Raghu Rama Krishna Raju – Chairman
2. Shri. K. Suryanarayana Raju – Executive Director
3. Shri. Durai Raj – DGM
4. Shri. M. Prabhakar – General Manager
5. Shri. B. Prabha – Supervisor
6. Shri. K. Satyanarayanam – Shift Incharge
7. Shri. K. J. Shiva Kumar – Shift Incharge