

UNFCCC Reference No: 0970

6 MW renewable energy project for a grid system by
Ind-Barath Energies Limited

MONITORING REPORT

Ver. 01, 18 September 2009

[The Monitoring period is chosen from **25 March 2008** to **24 March 2009** both days included]

Net Emission Reductions: 17694 tCO₂ e

Registered Office	Project Site
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1. Current Status of the project

Ind-Barath Energies Limited (IBEL) - 6 MW biomass based Power Plant at Miryalguda, Nalgonda Dist. Andhra Pradesh, India has been commissioned and is in operation since 12 September 2000. The project activity is generation of electricity for the APTRANSCO grid system by utilizing the surplus biomass residues such as rice husk, ground nut shells, cotton stalks, pulse stalks and woody biomass like juliflora twigs.

The project has registered with UNFCCC on 14 April 2007. For details on the project, please refer to the following link on the UNFCCC web site.

<http://cdm.unfccc.int/Projects/DB/DNV-CUK1172489420.48/view>

During the present monitoring period i.e. from 25 March 2008 to 24 March 2009, the plant exported 38.351 GWh of electricity to APTRANSCO grid and consumed 50382 MT of biomass residues and 7798.7 MT of coal for the reported period. The details of the earlier periodic verifications of CERs as mentioned below:

Description	Period	Net Electricity Displaced (GWh)	Net emission reductions (tCO ₂)	Status of Issuance of CERs
1 st Periodic Verification	1 October 2000 to 24 March 2006	237.433	148766	Issued
2 nd Periodic Verification	25 March 2006 to 24 March 2008	86.750	44429	Issued

2. Monitoring Period

The present monitoring period covers the activity from 25 March 2008 to 24 March 2009.

The purpose of this Monitoring report is to calculate the emission reductions achieved by the project activity during the monitored period mentioned above which is the basis for verification and issuance of CERs.

3. Details of Major Equipment of the Project & Plant Outages for the Reported Period

The details of major equipments of the plant and suppliers are presented in Table 1.

Table 1: Details of Plant Major Equipments and Suppliers

S.No	Equipment Details	Suppliers
1	Boiler Type: Multifuel fired travelling grate, Bi-drum, Natural circulation, Bottom supported and Balanced draught boiler. Capacity: 35 TPH, Pressure 45 Kg/cm ² (g), 455 Deg. C	Walchandnagar Industries Limited, Pune.
2	Turbine Capacity: 6000 KW (Net TG capable output 6.7 MW with 0.9 p.f), Steam Inlet Pressure – 44 Kg/cm ² Temp. - 450 Deg. C, Exhaust Pressure: 0.1 ata, Max.Inlet Steam Flow- 35 TPH.	D.L.F. Industries Limited
3	Alternator Make : BHEL , Capacity - 7.5 MVA, Speed 1500 rpm, Generation Level : 11 kV / 3 Phase / 0.8 pf / 50 Hz Excitations : Brush less Type of Cooling: Closed air and water cooled.	Walchandnagar Industries Limited, Pune.
4	Cooling Tower Make: Shri Ram Tower Tech Ltd Type: RCC Induced draft type, Capacity: 1600 cu.m /hr, Hot water temp. 42 Deg. C, Cold water temp. 32 Deg. C, Wet bulb temp. 27 Deg. C.	Walchandnagar Industries Limited, Pune.
5	D.M. Plant Make: Ion-Exchange Capacity: 8 cu.m/hr	Walchandnagar Industries Limited, Pune.

The details of forced shut down periods, planned shut down periods and reasons for shut downs are detailed below.

Table 2: Details of Operating Hours for Reported period

		Hrs:Min
A	Total No. of hours available	8760:00
B	Planned Shut down hours	1073:00
C	Forced Shut down hours	103:00
D	Total no .of shut down's (B+C)	1176:00
E	Total No of hours Plant operated (A-D)	7584:00

* The reasons for the planed & forced shut downs are furnished in Enclosure III

4. Parameters being monitored according to monitoring plan

The monitoring methodology proposed is as per indicative simplified baseline and monitoring methodologies for selected small scale CDM project category I.D Renewable energy generation for a grid as per the Appendix B. It has been referred from the list of approved methodologies for CDM project activities in the UNFCCC CDM website

(<http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html>)

The following parameters were monitored on continuous basis

Electricity Generated (in kWh) and Aux. Electricity Consumption (in kWh):

Gross electricity generation from the plant and auxiliary consumption in the plant are measured continuously using the energy meters installed in the control room of the plant. The daily readings were aggregated to monthly readings.

Electricity Export and Import (in kWh):

Electronic energy meters were installed at 220/132/33 kV Sub-station, Miryalguda for the measurement of electricity exported to the State grid and the electricity imported from the State grid. Monthly energy meter readings have been recorded and jointly certified by the representatives of APTRANSCO & IBEL.

Biomass Fuels used (of all types in MT):

The rice husk is being used as a main fuel. Seasonal agro residues like cotton stalks, chilly stalks, red gram stalks, ground nut shells and Juliflora branches were also used during the monitored period. The fuel on receipt in the plant premises is weighed at the Electronic weighbridge installed at the plant main gate, unloaded in the fuel yard and stacked properly. The type of fuel, quantities, vehicle No., etc are recorded by weighbridge staff and the same was certified by the fuel yard staff and security personnel.

NCV of fuels used (in kcal/kg)

The analysis of coal & other major biomass fuels for calorific value is being carried out periodically by independent third party laboratory and also reviewed the information provided by the fuel suppliers. The project has taken the calorific values of coal, which were furnished by the supplier (The Singareni Collieries Company Limited, Hyderabad) for project emission estimations.

Weighted average Emission factor for Southern region grid (tCO₂/GWh)

As mentioned under sec. B.2 of registered PDD, the project has been considered the ex-post emission factor for the weighted average emissions of the current generation mix (incl. imports) of Southern

regional grid. The project has reviewed the emission factors were mentioned in the registered PDD and also the Carbon Dioxide Baseline Data base, Version 4, September 2008 published by Government of India, Ministry of Power Central Electricity Authority¹, Government of India and the same has been provided as Enclosure-I.

Though the registered PDD contains validated emission factor for 2008-09 as 739.14 tCO₂/GWh as a conservative approach, authentic data from Table B of CO₂ data base of CEA is 722.28 tCO₂/GWh for the year 2007-08 has been used for emission reduction calculations.

The energy statistics for the period i.e. 2008-09 are not yet publicly available in India. It is difficult to collect & use data for this period in which project emissions occurred. The PP has considered the data of the previous year to the year in which project generation occur conform to Response form for request for clarification on Approved Methodologies (F-CDM-AM-Clar_Resp_ver 01.1 - AM_CLA_0038).

¹ <http://www.cea.nic.in/planning.c%20and%20e.Government%20of%20India%20website.htm>

Data being collected in order to monitor the GHG reduction is mentioned in the Table under sec D.3 of registered PDD:

ID number	Data type	Data variable	Data unit	Measured (m), calculated (c) 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?	Comments
D.3.1	Power	Gross Generation	kWh	m	Continuous	100%	Electronic / Paper	Crediting period plus 2 years	Readings are being recorded from energy meter which is installed in the plant control room
D.3.2	Power	Auxiliary Consumption	kWh	m	Continuous	100%	Electronic and Paper	Crediting period plus 2 years	Readings are being recorded from energy meter which is installed in the plant control room
D.3.3	Power	Power import	kWh	m	Continuous	100%	Electronic and Paper	Crediting period plus 2 years	Readings are being recorded from Trivector meter which is installed in the Sub-Station
D.3.4	Power	Power export	kWh	m	Continuous	100%	Electronic and Paper	Crediting period plus 2 years	Readings are being recorded from Trivector meter which is installed in the Sub-Station
D.3.5	Fuel	Type of Biomass used	MT	m	Daily	100%	Electronic and Paper	Crediting period plus 2 years	Biomass deliveries are weighed and build upon receipt at the plant
D.3.6	Fuel	Fossil	kcal/kg	m	Daily	100%	Electronic and	Crediting	Fossil fuel deliveries

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		fuel(coal) used					Paper	period plus 2 years	are weighted and build upon receipt at the plants
D.3.7	Fuel	NCV of Biomass used	kcal/kg	m	Quarterly	100%	Electronic and Paper	Crediting period plus 2 years	Calorific value of each type of biomass used in the plant will be tested periodically
D.3.8	Calorific Value	NCV of coal used in the plant	kcal/kg	m	Batch wise for coal	100%	Electronic and Paper	Crediting period plus 2 years	If supplier's data on calorific value is available for coal, then the same would be considered without testing the sample again.
D.3.9	Emission factor	Grid Emission Factor (EF)	tCO ₂ /G Wh	c	Yearly	100%	Electronic and Paper	Crediting period plus 2 years	Taken latest information of CEA.

As per the billing period, the Month wise data on electricity generation, auxiliary electricity consumption, electricity exported to grid and electricity imported from grid and fuel consumption for the plant is presented in the tables given below:

Table 3.a: Details of Gross electricity generation, auxiliary consumption, electricity exported to grid, electricity imported from grid, net electricity displaced for the reported period

S.No.	Monitored Period	Gross Electricity Generation	Auxiliary Power Consumption, KWh		Electricity Exported to Grid	Electricity Imported from Grid	Net Electricity Displaced
		kWh	Measured at Proj. Site (See Note-1)	Calculated (See Note-2)	kWh	kWh	GWh
1	25.03.08 to 24.04.08	3583340	476690	514040	3086400	17100	3.069
2	24.04.08 to 24.05.08	2979000	424740	464200	2535000	20200	2.515
3	24.05.08 to 24.06.08	4230800	503150	538400	3703300	10900	3.692
4	24.06.08 to 24.07.08	4334100	532675	553600	3784800	4300	3.781
5	24.07.08 to 24.08.08	1839260	258309	302560	1571200	34500	1.537
6	24.08.08 to 24.09.08	2292700	321336	363300	1959300	29900	1.929
7	24.09.08 to 24.10.08	4242800	518760	546600	3701600	5400	3.696
8	24.10.08 to 24.11.08	4233422	521162	551383	3688742	6703	3.682
9	24.11.08 to 24.12.08	4103480	493805	522350	3587780	6650	3.581
10	24.12.08 to 24.01.09	4478710	543673	568270	3913610	3170	3.910
11	24.01.09 to 24.02.09	4127020	504816	539360	3600820	13160	3.588
12	24.02.09 to 24.03.09	3872500	469952	501920	3379050	8470	3.371
	Total	44317132	5569068	5965983	38511602	160453	38.351

Note-1: Measured aux. consumption includes part of electricity generated by the project activity and electricity imported from grid taken through energy meter located on LT panel at project site. The losses on account of power transformer & transmission line are not included in the measured aux. consumption.

Note-2: Computed based on the gross electricity generation recorded in the plant and electricity exported to the grid & electricity imported from grid readings certified by APTRANSCO & IBEL personnel.

The project activity has been operated with 0.3% excess electricity generation on rated capacity for a few months during the reported period to meet the requirement of PPA the project proponent had agreement with State utility i.e. APTRANSCO by utilizing the equipments inbuilt capacity. The installed

DLF make turbine performance parameters² confirm that the installed turbine is capable to generate net TG output 6.7 MW and it requires 35 TPH steam at 44 kg/sq.cm (a) @ 450 Deg. C. As there is no restriction on the monthly plant load factor from the state electricity board authorities, the excess generation is deemed acceptable. The details are furnished below:

Period	TG Installed Rated Cap., KWh	Actual Gross Generation, KWh	Excess Generation on Rated Capacity
	Calculation	Recorded at Project site	Calculation
24.06.08 to 24.07.08	4320000	4334100	0.3%
24.12.08 to 24.01.09	4464000	4478710	0.3%

Table 3.b: Details of Biomass & Coal consumption for the reported period

S.No.	Monitored Period	Biomass Consumption, MTs					Coal Consumption	
		Husk	GN Shell	Juliflora branches	Stalks	Total	MTs	NCV, Kcal/kg
1	25.03.08 to 24.04.08	2875.0	392.2	665.3	99.7	4032.2	556.7	3600
2	24.04.08 to 24.05.08	2468.1	230.4	640.9	20.0	3359.4	525.3	3600
3	24.05.08 to 24.06.08	3842.8	179.8	729.5	21.9	4773.8	737.0	3600
4	24.06.08 to 24.07.08	3823.8	108.0	900.0	21.5	4853.3	779.4	2950
5	24.07.08 to 24.08.08	1462.8	77.7	484.3	35.7	2060.5	330.5	2950
6	24.08.08 to 24.09.08	798.8	38.2	1686.5	75.6	2599.2	432.0	2950
7	24.09.08 to 24.10.08	2499.0	134.3	2254.4	4.4	4892.1	713.2	2950
8	24.10.08 to 24.11.08	2939.0	212.0	1718.2	0.4	4869.5	717.8	2950
9	24.11.08 to 24.12.08	3549.5	98.6	1100.9	0.0	4748.9	715.6	2950
10	24.12.08 to 24.01.09	4137.0	85.7	900.0	1.3	5124.0	807.0	3600
11	24.01.09 to 24.02.09	3346.1	160.1	1116.0	19.5	4641.7	414.8	3600
							350.3	2950
12	24.02.09 to 24.03.09	2667.0	306.0	1448.9	5.6	4427.6	719.3	2950
	Total	34408.8	2022.9	13644.8	305.5	50382.0	7798.7	

² PERFORMANCE – IND BARATH -1x6 TPH TG SET ORDER NO. 10049 of Manual for 6 MW SKODA Turbine.

5. Formulae Used

Project type: **Type I - Renewable Energy Projects**

Approved Baseline methodology: **AMS I D. Version 10**

The following formula is adopted for calculating emission reductions generated by the project activity:

The emission reductions for a given year are baseline emissions minus the project emissions and leakage.

$$ER_y = BE_y - PE_y - L_y$$

Where ER_y is emission reductions in a given year
 BE_y is baseline emissions in a given year
 PE_y is project emissions in a given year
 L_y is leakage in a given year

Baseline Emissions

The baseline emissions are calculated as follows:

$$BE_y = EG_y * EF_y$$

Where EG_y is the net electricity export to grid in a given year (GWh)
 EF_y is the emission factor for a given year (tCO₂/GWh)

Project Emissions

$$PE_y = (FF_y * NCV * [4.18 * EF_{CO_2}] * OXID) / 10^6$$

Where PF_y : CO₂ emissions from project activities in a given year (tCO₂)
 FF_y : The quantity of Coal used during the year (MT)
 NCV : The net calorific value of Coal in Kcal/kg
 EF_{CO_2} : The CO₂ emission factor for Coal, 95.81 t CO₂/TJ as per IPCC 2006 default value
 $OXID$: The oxidation factor (1 as per IPCC 2006 default value)

The project activity did not use any other fossil fuels during the monitored period except coal. The emissions occurred due to use of coal are considered as project emissions in estimations.

Leakage

The project procures available biomass residues within the 50 km radius from project site and the same is considered as project region. Thus the leakage emissions are considered zero.

Biomass leakages, $L_y = 0$

Using the above formulas, the Emission reductions from the project activity are shown below.

6. Net Emission Reductions for the Reported Period

Emission reductions are calculated based on grid electricity displaced by the project activity for the reported period.

Table 4: Net Emission Reductions for the reported period

Monitored Period	Net Electricity Displaced	Coal Consumption		Baseline Emission Factor	Baseline Emissions	Project Emissions	Leakage Emissions	Net Emission Reductions
	GWh	MTs	NCV, Kcal/kg	tCO ₂ /GWh	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e
25.03.08 to 24.04.08	3.069	556.7	3600	722.28	2216.9	802.6	0.0	1414.3
24.04.08 to 24.05.08	2.515	525.3	3600	722.28	1816.4	757.4	0.0	1059.0
24.05.08 to 24.06.08	3.692	737.0	3600	722.28	2666.9	1062.5	0.0	1604.4
24.06.08 to 24.07.08	3.781	779.4	2950	722.28	2730.6	920.8	0.0	1809.8
24.07.08 to 24.08.08	1.537	330.5	2950	722.28	1109.9	390.5	0.0	719.5
24.08.08 to 24.09.08	1.929	432.0	2950	722.28	1393.6	510.3	0.0	883.2
24.09.08 to 24.10.08	3.696	713.2	2950	722.28	2669.7	842.6	0.0	1827.1
24.10.08 to 24.11.08	3.682	717.8	2950	722.28	2659.5	848.0	0.0	1811.5
24.11.08 to 24.12.08	3.581	715.6	2950	722.28	2586.6	845.4	0.0	1741.2
24.12.08 to 24.01.09	3.910	807.0	3600	722.28	2824.4	1163.5	0.0	1660.9
24.01.09 to 24.02.09	3.588	414.8	3600	722.28	2591.3	598.0	0.0	1579.5
		350.3	2950			413.8		
24.02.09 to 24.03.09	3.371	719.3	2950	722.28	2434.5	849.9	0.0	1584.7
Total	38.351	7798.7			27700.3	10005.2	0.0	17695.1
Project Considered					27700	10006	0	17694

The PP has reviewed the actual estimated emissions w.r.t. emissions indicated in the registered PDD and the details are furnished below:

Monitored Period	As per PDD			Actual			Deviation
	Baseline Emissions	Project Emissions	Emission Reductions	Baseline Emissions	Project Emissions	Emission Reductions	
25.03.08 to 24.03.09	31468	12402	19066	27700	10006	17694	(-) 7.2 %

7. Measures to ensure the results/uncertainty analysis

The energy exported by Ind-Barath Energies Limited is recorded from independent main meter installed at 220/132/33 KV Sub-Station, Miryalguda. In the event, the main meter is not in operation, and the reading from check meter is used for billing.

The calibration of monitoring meters is being maintained as per the requirement of APTRANSCO and the same is being done regularly. Electricity export to grid and electricity import is being recorded daily and the same is being verified by the respective officials. Both meters are of same specifications & frequency and approved by APTRANSCO. The accuracy clause of these meters is 0.2.

Methods of data transfer and archiving policy

The data will be recorded both at the project site as well as at the grid substation, which is under the control of APTRANSCO. The energy will be measured using calibrated meters and recorded at the APTRANSCO substation. Records of measurements will be used for verification of emissions reductions. Sales bills / receipts may be compared as an alternative proof of the power exported to the grid.

Technical details of monitoring instruments like type, make, accuracy class, etc.

Description	Main Meter			Check Meter		
Period	25.03.08 to 30.10.08	30.10.08 to 03.11.08	03.11.08 to 24.03.09	25.03.08 to 30.10.08	30.10.08 to 03.11.08	03.11.08 to 24.03.09
SL No	34105	8081475	34105	34107	8081476	34107
Meter tested on	08.05.2007	27.10.08	30.10.2008	08.05.2007	27.10.08	30.10.2008
Type	ER 300P	Alpha A1800	ER 300P	ER 300P	Alpha A1800	ER 300P
Make	L&T	Elster	L&T	L&T	Elster	L&T
Accuracy class	0.2s	0.2s	0.2s	0.2s	0.2s	0.2s
Multiplying Factor	1000	1000	1000	1000	1000	1000
C.T. Ratio	200/1A	200/1A	200/1A	200/1A	200/1A	200/1A
Voltage Ratio	33 KV / 110	33 KV / 110	33 KV / 110	33 KV / 110	33 KV / 110	33 KV / 110

8. Details of Monitoring team and Responsibilities

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

Table 5 - Monitoring Team

S.No	Name of the Person	Designation
1	Mr. K. Raghu	Chairman
2	Mr. D. Madhusudan Reddy	Director

3	Mr. K. Venka Reddy	General Manager
4	Mr. P.V.S. Chalam Reddy	Commercial Officer
5	Mr. G.S.S. Rama Raju	Shift Incharge
6	Mr. V. Shankar Reddy	Shift Incharge
7	Mr.V. Sudhakar	Shift Incharge

Chairman

Chairman is responsible for the total monitoring plan. Review of the quarterly reports submitted by Director, guidance for necessary corrective actions to the concerned person.

Director

The Director will examine the reports generated by General Manger w.r.t, the monthly electricity generated, exported and annual emission reduction calculations as per the monitoring plan. He also examines the internal audit reports prepared by internal auditor. He will in particular take note of any deviations in data over the norms and monitor that the corrective actions have resulted in adherence to standards.

General Manager

General Manager is assisting and reporting to Director for completing the task discussed above. The GM is responsible for the electricity generations at their individual locations. He will cross check, sign the log book regularly, and report to Director for any abnormality. The calibration of the meters installed will be taken care by him as per the monitoring plan.

The responsibility of storage and archiving of information in good condition also lies with the General Manager. He also generate internal audit reports as per the monitoring plan and when ever necessary, and will be submitted to Director.

Commercial cum Biomass Procurement Officer

Biomass Procurement Officer is responsible to assess the suppliers based on the key parameters and submits recommendation to General Manager for approval. He is also responsible to procure the fuels permitted by the Local statutory authorities and to meet the plant daily requirement without any shortage.

Shift Incharge

Shift Incharge is responsible for recording the electricity meter readings at project site on daily basis. He will also responsible to take note of gross power generation, auxiliary power consumption, and export power to grid., plant shut down times, fuel consumption, if any etc. Based on the daily reports, the monthly reports will be generated and submitted to the General Manager for verification and emission reduction calculations.

Enclosure I

BASE LINE INFORMATION

From Carbon Dioxide Baseline Data base, Version 4, September 2008 published by Government of India, Ministry of Power Central Electricity Authority, Government of India.

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

Appendix A Assumptions for CO₂ Emission Calculations

Fuel Emission Factors (EF) (Source: Coal/Lignite - Initial National Communication, Gas/Oil/Diesel/Naphtha - IPCC 2006, Corex - own assumption)

	Unit	Coal	Lignite	Gas	Oil	Diesel	Naphtha	Corex
EF based on NCV	gCO ₂ /MJ	95.8	106.2	54.3	75.5	72.6	69.3	0.0
Delta GCV NCV	%	3.6%	3.6%	10%	5%	5%	5%	n/a
EF based on GCV	gCO ₂ /MJ	92.5	102.5	49.4	71.9	69.1	66.0	0.0
Oxidation Factor	-	0.98	0.98	1.00	1.00	1.00	1.00	n/a
Fuel Emission Factor	gCO ₂ /MJ	90.6	100.5	49.4	71.9	69.1	66.0	0.0

n/a = not applicable (i.e. no assumptions were needed)

Assumptions at Station Level (only where data was not provided by station)

	Unit	Coal	Lignite	Gas-CC	Gas-OC	Oil	Diesel-Eng	Diesel-OC	Naphtha	Hydro	Nuclear
Auxiliary Power Consumption	%	8.0	10.0	3.0	1.0	3.5	3.5	1.0	3.5	0.5	10.5
Gross Heat Rate	kcal /KWh (gross)	2,500	2,713	2,013	3150	2,117	1,975	3,213	2,117	n/a	n/a
Net Heat Rate	kcal /KWh (net)	2,717	3,014	2,075	3,192	2,193	2,047	3,330	2,193	n/a	n/a
Specific Oil Consumption	ml /KWh (gross)	2.0	3.0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
GCV	kcal /kg (or m3)	9,755	n/a	8,800	n/a	10,100	10,500	10,500	11,300	n/a	n/a
Density	t /1,000 lt	n/a	n/a	n/a	n/a	0.95	0.83	0.83	0.70	n/a	n/a
Specific CO ₂ emissions	1002 /MW h	1.04	1.28	0.43	0.56	0.66	0.59	0.96	0.61	n/a	n/a

n/a = not applicable (i.e. no assumptions were needed)

Assumptions at Unit Level (by capacity; only for units in the BM, where data was not provided by station)

Coal	Unit	67.5 MW	120 MW	200-250 MW	500 MW
Gross Heat Rate	kcal /KWh	2,750	2,500	2,500	2,425
Auxiliary Power Consumption	%	12.0	9.0	9.0	7.5
Net Heat Rate	kcal /KWh	3,125	2,747	2,747	2,622
Net Efficiency	%	28%	31%	31%	33%
Specific Oil Consumption	ml /KWh	2.0	2.0	2.0	2.0
Specific CO ₂ Emissions	1002 /MW h	1.19	1.05	1.05	1.00
Lignite	Unit	75 MW	125 MW	210/250 MW	
Gross Heat Rate	kcal /KWh	2,750	2,560	2,713	
Auxiliary Power Consumption	%	12.0	12.0	10.0	
Net Heat Rate	kcal /KWh	3,125	2,909	3,014	
Net Efficiency	%	28%	30%	29%	
Specific Oil Consumption	ml /KWh	2.0	3.0	3.0	
Specific CO ₂ Emissions	1002 /MW h	1.32	1.23	1.28	
Gas	Unit	0-49.9 MW	50-99.9 MW	>100 MW	
Gross Heat Rate	kcal /KWh	1,950	1,910	1,970	
Auxiliary Power Consumption	%	3.0	3.0	3.0	
Net Heat Rate	kcal /KWh	2,010	1,969	2,031	
Net Efficiency	%	43%	44%	42%	
Specific CO ₂ Emissions	1002 /MW h	0.42	0.41	0.42	
Diesel	Unit	0.1-1 MW	1-3 MW	3-10 MW	>10 MW
Gross Heat Rate	kcal /KWh	2,350	2,250	2,100	1,975
Auxiliary Power Consumption	%	3.5	3.5	3.5	3.5
Net Heat Rate	kcal /KWh	2,435	2,332	2,176	2,047
Specific CO ₂ Emissions	1002 /MW h	0.70	0.67	0.63	0.59
Naphtha	Unit	All sizes			
Increment to Gas Heat Rate	%	2%			
Gross Heat Rate	kcal /KWh	2,117			
Auxiliary Power Consumption	%	3.5			
Net Heat Rate	kcal /KWh	2,193			
Specific CO ₂ Emissions	1002 /MW h	0.61			

Combined Margin	Unit	
Weight CM	%	50%
Weight BM	%	50%

Conversion Factors	Unit	
Energy	KJ /kcal	4.1868
	MJ /KWh	3.6

Oil		
Specific Emission	gCO ₂ /ml	2.89

Appendix B Grid Emission Factors

Table A: Values for all regional grids for FY 2005-06 until FY 2007-08, Excluding inter regional and cross-border electricity transfers.

Note: values are rounded off to two decimals see the web link given above for additional decimals places (Database – Excel worksheet)

Weighted Average Emission Rate (tCO ₂ /MWh) (excl. Imports)			
	2005-06	2006-07	2007-08
NEWNE	0.8407	0.8287	0.8196
South	0.7341	0.7163	0.72228
India	0.8151	0.8010	0.7961

Simple Operating Margin (tCO ₂ /MWh) (excl. Imports)			
	2005-06	2006-07	2007-08
NEWNE	1.0246	1.0163	1.0123
South	1.0057	0.9991	0.9906
India	1.0205	1.0124	1.0074

Build Margin (tCO ₂ /MWh) (excl. Imports)			
	2005-06	2006-07	2007-08
NEWNE	0.6725	0.6313	0.5977
South	0.7067	0.7013	0.7133
India	0.6808	0.6485	0.6253

Combined Margin (tCO ₂ /MWh) (excl. Imports)			
	2005-06	2006-07	2007-08
NEWNE	0.8486	0.8238	0.8050
South	0.8562	0.8502	0.8520
India	0.8506	0.8305	0.8164

Table B: Values for all regional grids for FY 2005-06 until FY 2007-08, including inter-regional and cross-border electricity transfers.

Weighted Average Emission Rate (tCO₂/MWh) (Incl. Imports)			
	2005-06	2006-07	2007-08
NEWNE	0.8386	0.8243	0.8121
South	0.7341	0.7163	0.7228
India	0.8126	0.7972	0.7898

Simple Operating Margin (tCO₂/MWh) (Incl. Imports)			
	2005-06	2006-07	2007-08
NEWNE	1.01949	1.00835	0.99917
South	1.00567	0.99912	0.99062
India	1.0166	1.0063	0.9973

Bulld Margin (tCO₂/MWh) (not adjusted for Imports)			
	2005-06	2006-07	2007-08
NEWNE	0.6725	0.6313	0.59771
South	0.7067	0.7013	0.71332
India	0.6808	0.6485	0.6253

Combined Margin In (tCO₂/MWh) (Incl. Imports)			
	2005-06	2006-07	2007-08
NEWNE	0.8460	0.8198	0.7984
South	0.8562	0.8502	0.8520
India	0.8487	0.8274	0.8113

Enclosure – II
Turbine Performance Parameters

PERFORMANCE											
IND BARATH – 1X6 MW TG SET ORDER NO.10049											
	Main Steam			Uncontr.Extrn.			Contr.Extrn.			Net TG output in MW	Remarks
	Pressure Kg/Cm2a	Temp Deg.C	Qty * Tph	Pressure Kg/Cm2a	Temp Deg.C	Qty * Tph	Pressure Kg/Cm2a	Temp Deg.C	Qty * Tph		
I	44	450	26.7	3.9	208	2.2	N.A.	N.A.	0	6.0	Guaranteed
II	44	450	32.2	3.2	193	2.9	9.25	285.3	8.5	6.0	Only capability No guarantee
III	44	450	35	3.6	189	3.17	9.5	281	8.5	6.7	With 0.9 p.f. Only capability No guarantee

* Ejector steam of appx. 250 kg/hr to be supplied in addition
Above figure does not include instrument tolerance

Enclosure-III

Reasons for planned & forced shut downs during Reported Period

Period	Type of shut down, Hrs:Min		Reasons
	Planned	Forced	
08.04.08 to 11.04.08	54:00		Boiler and Turbine Maintenance
14.04.08		11:00	Economiser Tubes Maintenance
22.04.08 to 23.04.08	30:00		AVR Pot Maintenance
24.04.08 to 25.04.08		20:00	Generator Exciter Maintenance
28.04.08 to 01.05.08	63:00		Travelling Grate Maintenance
10.05.08 to 13.05.08	69:00		Boiler and Turbine Maintenance
24.05.08 to 26.05.08	39:00		Condenser Tube and Economiser Tubes Maintenance
06.06.08 to 07.06.08		9:00	Boiler top drives pressure gauge line flange packing leakage at sub station
23.06.08		3:00	ID Fan Maintenance
05.07.08 to 06.07.08		11:00	Economiser Coil Maintenance
27.07.08 to 06.08.08	216:00		Boiler and Turbine Maintenance
09.08.08 to 11.08.08	45:00		TG Manually tripped due to Heavy Rains
18.08.08 to 20.08.08	59:00		Boiler and Turbine Maintenance
22.08.08 to 02.09.08	268:00		Boiler and Turbine Maintenance
06.09.08 to 10.09.08	102:00		ESP Maintenance
12.09.08		5:00	Incoming supply Failure from Substation
27.09.08 to 28.09.08		14:00	ESP Maintenance
14.10.08		2:00	Incoming supply Failure from Substation
29.10.08 to 30.10.08	30:00		Electrical energy meter changing
23.11.08 to 26.11.08	85:00		General Maintenance
12.01.09 to 13.01.09	13:00		General Shut Down
23.02.09		2:00	Incoming supply Failure from Substation
24.02.09 to 26.02.09		11:00	ESP Maintenance
22.03.09 to 23.03.09		15:00	Travelling Grate Maintenance
Total	1073:00	103:00	