

**MONITORING REPORT  
(VERSION – 01)**

**“VGL - Waste Heat based 4 MW Captive Power Project at Raipur”  
Reference no. UNFCCC 00000432-CDMP**

*Project Site:*  
**Siltara Industrial Area, Phase II, Siltara,  
Raipur – 493111  
Chhattisgarh, India.**

**Vandana Global Limited**  
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### **Current Status of the Project**

The 4 MW Waste Heat Recovery (WHR) Project at Vandana Global Limited (VGL) in Raipur, Chattisgarh, India has started commercial production from 1<sup>st</sup> April 2005.

The project has been completed with major equipment supplied as follows:

<b>Sl. No.</b>	<b>Equipment</b>	<b>Specifications</b>	<b>Supplier</b>
1	WHR Boiler	Steam generation : 30 tonnes per hour, 67 cm <sup>2</sup> g, 510 +/- 5 °C Flue gas: 75000 nm <sup>3</sup> /hr, Inlet temperature – 950 °C, Outlet temperature – 160 °C	M/s Thermal Systems (Hyderabad) Pvt. Limited
2	Turbogenerator (TG)	Capacity of turbine: 8 MW Inlet steam parameter: 65 kg/cm <sup>2</sup> , 495 °C	Alstom Projects India Limited, Baroda.

**Statement to what extent the project has been implemented as planned**

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

The plant is in operation continuously (with outages – forced & planned) since 1<sup>st</sup> April 2005. VGL sponge iron plant has a 200 tonnes per day (tpd) capacity DRI kiln and is currently producing around 60000 tonnes per annum (tpa) of sponge iron. The WHR boiler is using waste heat of the flue gas from the sponge iron kiln to produce steam.

The steam is used to generate around 4MW of gross power [equivalent to around net electricity generation of 25 million kWh (MkWh) per annum. The power generated is used to meet the captive power requirement of VGL plant and the surplus is wheeled through CSEB grid for supply to group companies.

### **Monitoring Period**

The monitoring period is from 1<sup>st</sup> November 2006 to 14<sup>th</sup> August 2007(both days included).

### **Sustainability Issues**

***Environmental well-being:*** The project activity is a demonstration of clean technology implementation and does not by itself generate or release harmful gases. Hence, the project activity contributes to a better quality environment to the employees and the surrounding community. In India, coal is the most abundantly available fossil fuel and is mainly used for power generation. Power plants run by coal contribute around 70% of total power generation in the Western Regional electricity grid. The project activity curtails further depletion of non-renewable energy resources like coal, thus increasing its availability to other important processes in future. It also leads to reduction in GHG (CO<sub>2</sub>), SOx and NOx emissions. The waste gases after heat transfer in the WHRB is led to exhaust stack through Electrostatic Precipitator (ESP) which reduces Suspended Particulate Matter (SPM) load to a large extent. SPM is collected in the hoppers of the ESP. The particulate matter collected in the hoppers is conveyed to existing ash silo by a conveyor belt and the ash is sold to brick manufacturer.

VGL regularly obtains the necessary environmental clearances from the Chattisgarh Environment Conservation Board (CECB).

***Socio-economic well-being:*** Project activity has led to direct and indirect employment during stages of power plant construction and operation in the region. Also, with growing technological advancement the project activity contributes to capacity building in terms of technical knowledge and managerial skills.

The project shows less dependence of project proponent on grid electricity and better management of waste. This brings in related benefit for the employees and the local community.

### **Obtained Parameters According To Monitoring Plan**

**Table 1:** As mentioned in section D.2.1.3 of the PDD, following project related parameters are monitored:

For Electricity Generated by Project Activity

ID No.	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
1. $EG_{GEN}$	Quantitative	Total Electricity Generated	MWh/year	Online measurement	Continuously	100%	Electronic/ paper	Credit Period + 2 years	MONITORING LOCATION: The data will be measured by meters at plant and DCS. Manager In-charge would be responsible for calibration of the meters.
2. $EG_{AUX}$	Quantitative	Auxiliary consumption of Electricity	MWh/year	Online measurement	Continuously	100%	Electronic/paper	Credit period + 2 years	MONITORING LOCATION: The data will be measured by meters at plant and DCS. Manager In-charge would be responsible for regular calibration.
3. $EG_y$	Quantitative	Net Electricity supplied	MWh/year	Calculated ( $EG_{GEN} - EG_{AUX}$ )	Continuously	100%	Electronic/paper	Credit Period + 2 years	Calculated from the above measured parameters. Algorithm for project emissions given in baseline methodology

Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHGs within the project boundary and how such data will be collected and archived :

ID No.	Data type	Data variable	Data unit	Measured (m), calculated (c) or estimated (e)	For which baseline method(s) must this element be included	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
4. $EF_y$	Emission factor	CO2 emission factor of the grid	tCO2/MWh	Calculated	Simple OM, BM	Yearly	100%	Electronic	During the crediting period and two years after	Calculated as weighted sum of OM and BM emission factors
5. $EF_{OM,y}$	Emission factor	CO2 operating margin emission factor of the grid	tCO2/MWh	Calculated	Simple OM	Yearly	100%	Electronic	During the crediting period and two years after	Calculated as indicated in the relevant OM baseline method above
6. $EF_{BM,y}$	Emission factor	CO2 Build Margin emission factor of the grid	tCO2/MWh	Calculated	BM	Yearly	100%	Electronic	During the crediting period and two years after	Calculated as $[\sum F_{i,y} * COEF_i] / [\sum mGEN_{m,y}]$ over recently built power plants defined in the baseline methodology
7. $F_{i,j,y}$	Fuel Quantity	Amount of each fossil fuel consumed by each power source/ plant	t or m3/year	measured	Simple OM BM	Yearly	100%	Electronic	During the crediting period and two years after	Obtained from authorised latest local statistics

Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHGs within the project boundary and how such data will be collected and archived :										
ID No.	Data type	Data variable	Data unit	Measured (m), calculated (c) or estimated (e)	For which baseline method(s) must this element be included	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
8. COEF <sub>i,k</sub>	Emission factor coefficient	CO2 emission coefficient of each fuel type and each power source/plant	tCO2/ t or m3	measured	Simple OM BM	Yearly	100%	Electronic	During the crediting period and two years after	Calculated based on the IPCC default value of the Emission Factor, Net Calorific Value and Oxidation Factor of the fuel used by the power plants feeding to CSEB.
9. GEN <sub>j,y</sub>	Electricity quantity	Electricity generation of each power source/plant	MWh/ year	measured	Simple OM BM	Yearly	100%	Electronic	During the crediting period and two years after	Obtained from authorised latest local statistics

As per the monitoring plan of the registered PDD, updated values of OM and BM of the Western Regional Electricity grid calculated by Central Electricity Authority (CEA) [as per combined margin method of ACM0002 methodology and publicly made available in the official website of CEA in the form of CO<sub>2</sub> Baseline Database, Version 2.0 (21/06/2007)], could be considered for the calculation of emission factor for arriving at the baseline emissions for the project activity. The combined margin emission factor (of 0.814 kg CO<sub>2</sub>/kWh) for the Western Regional Electricity grid calculated on the basis of the CO<sub>2</sub> Baseline Database, Version 2.0 (21/06/2007), is higher than the combined margin emission factor (of 0.759 kg CO<sub>2</sub>/kWh) used in the registered PDD. However, in order to arrive at a conservative estimate of the emission reductions arising out of the project activity, the value of 0.759 kg CO<sub>2</sub>/kWh emission factor of the Western Regional Electricity grid, as used in the registered PDD, has been considered for the verification period under consideration.

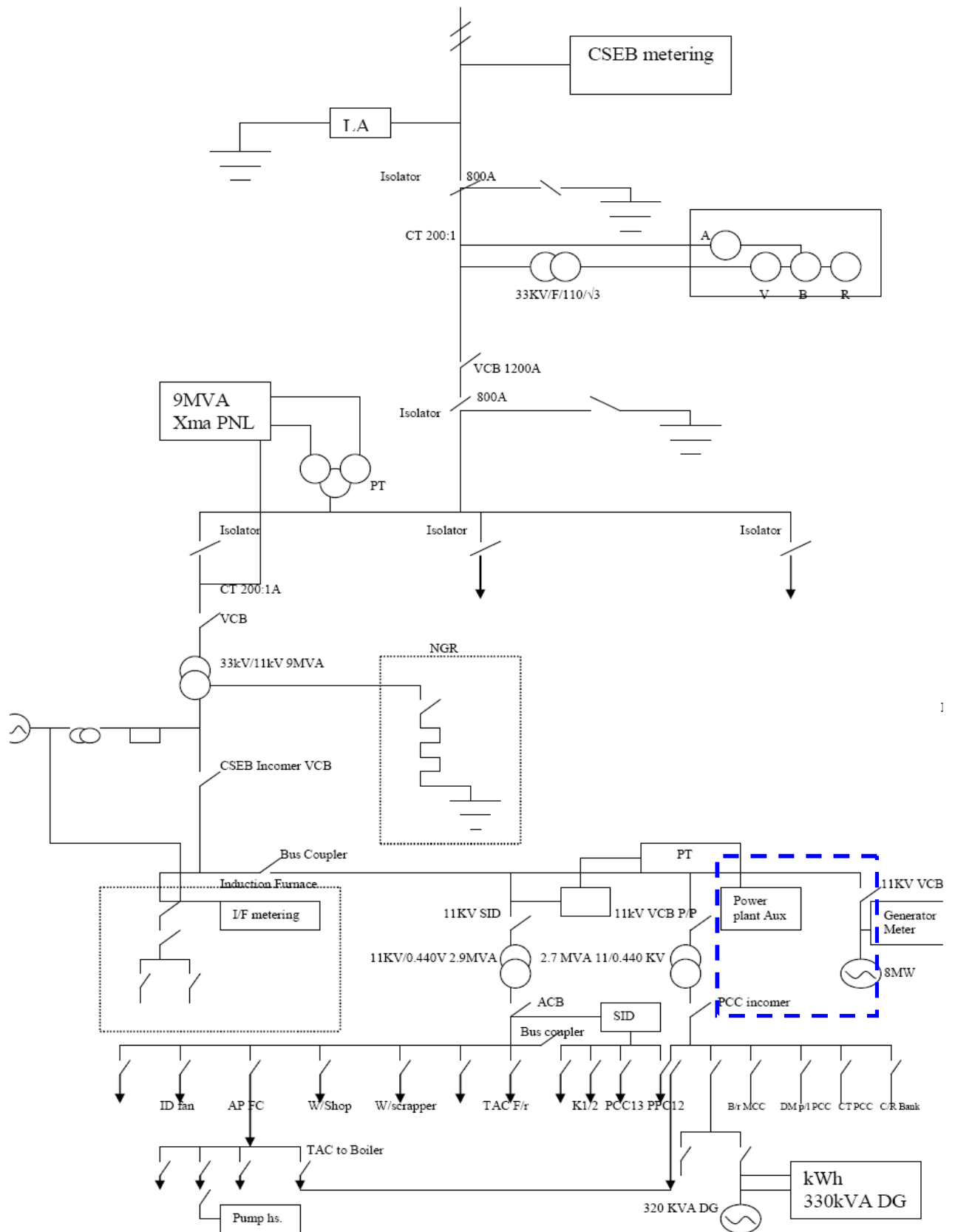
The details of the equipment relevant for the monitoring of parameters are given below:

<b>Table- 1.1: Monitoring Parameters as per Registered Project Design Document</b>	
<b>Parameter 1: Total power generation from turbo-generator (TG) set</b>	
<b>Parameter</b>	<b>Description</b>
Measured, Calculated, Estimated	Measured
Source of Data	The data is monitored hourly in the generation log book and also eight hourly shift reports are compiled. The daily data of the same parameter is also recorded in daily reports.
Data unit	kWh
Recording frequency	Hourly
Monitoring Equipment	DIG Generation Meter (Trai Vector Meter)
Specification of Monitoring Equipment	Serial No.: 031643073 Make: SOCOMEC Rating: Voltage – 110V-400V, 50-60Hz, Current- 50:1A Configuration: 3 ph-4 wire
Calibration of Monitoring Equipment	The energy meter is calibrated regularly according to the calibration schedule (once a year). The calibration certificate of the energy meter as well as of the master calibrator is available at the project site.
Accuracy of Monitoring Equipment	Class of accuracy: 0.5
Uncertainty of Data	Low
Justification	As the meter used is of standard make and regularly calibrated the accuracy of the monitored parameter is ensured.

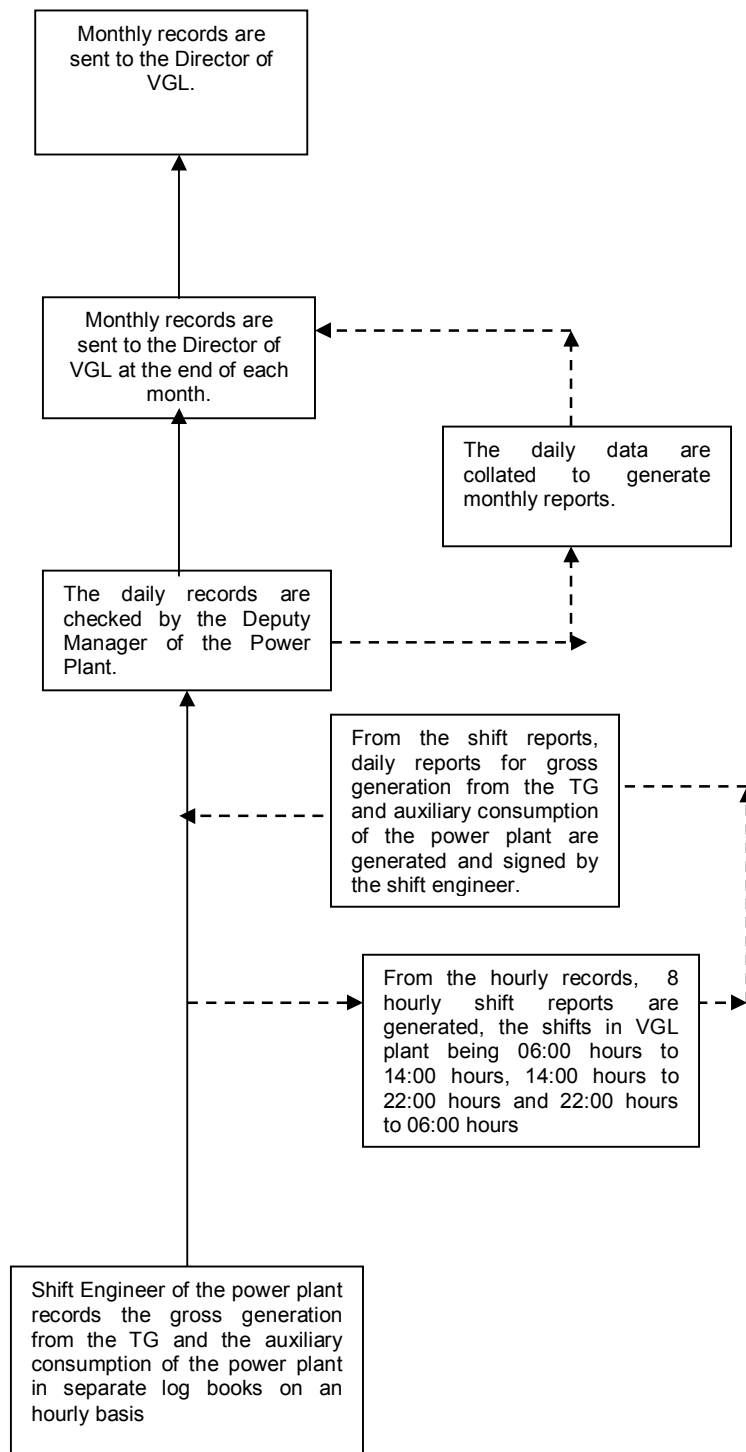
<b>Table- 1.2: Monitoring Parameters as per Registered Project Design Document</b>	
<b>Parameter 1: Auxiliary electricity consumption of the power plant</b>	
<b>Parameter</b>	<b>Description</b>
Measured, Calculated, Estimated	Measured
Source of Data	The data is monitored hourly in the Generation Log Book and also eight hourly Shift Reports are compiled. The daily data of the same parameter is also recorded in daily reports.
Data unit	kWh
Recording frequency	hourly
Monitoring Equipment	Auxiliary meter of the power plant
Specification of Monitoring Equipment	Serial No.: 03024771 Make: Data Pro Electronic P.L.Pune Rating: Voltage – 3×110V, 50-60Hz, Current-16:1A Configuration: 3 ph-3 wire
Calibration of Monitoring Equipment	The energy meter is calibrated regularly according to the calibration schedule (once a year). The calibration certificate of the energy meter as well as of the master calibrator is available at the project site.
Accuracy of Monitoring Equipment	Class of accuracy: 0.5
Uncertainty of Data	Low
Justification	As the meter used is of standard make and regularly calibrated the accuracy of the monitored parameter is ensured.



# Single line diagram showing the metering system of VGL power plant



## Flow diagram for the process of recording and archiving of relevant data for the project activity



### **Calculation of WHR Power Generation**

Daily data on net electricity generated from the waste heat based power plant of VGL during the period from 1 November 2006 to 14 August 2007 is placed below.

<b>Date</b>	<b>Gross Generation</b>	<b>Auxiliary Generation</b>	<b>Net Generation</b>
1-Nov-06	90958	9349	81609
2-Nov-06	95335	8741	86594
3-Nov-06	99432	8729	90703
4-Nov-06	83505	8125	75380
5-Nov-06	98680	8883	89797
6-Nov-06	93908	9155	84753
7-Nov-06	95145	8444	86701
8-Nov-06	98064	9501	88563
9-Nov-06	96241	11475	84766
10-Nov-06	95100	8904	86196
11-Nov-06	61400	7626	53774
12-Nov-06	36876	5197	31679
13-Nov-06	91724	10348	81376
14-Nov-06	92437	9458	82979
15-Nov-06	97138	9290	87848
16-Nov-06	87125	9797	77328
17-Nov-06	91920	9137	82783
18-Nov-06	96410	9455	86955
19-Nov-06	91473	7964	83509
20-Nov-06	93107	8751	84356
21-Nov-06	96150	9423	86727
22-Nov-06	91440	9533	81907
23-Nov-06	99800	9417	90383
24-Nov-06	101565	9744	91821
25-Nov-06	105107	8990	96117
26-Nov-06	93755	9474	84281
27-Nov-06	95939	9547	86392
28-Nov-06	101216	11700	89516
29-Nov-06	100098	8828	91270
30-Nov-06	104002	9301	94701
Total Nov 06	2775050	274286	2500764
1-Dec-06	112148	9322	102826
2-Dec-06	108698	9406	99292
3-Dec-06	112602	8860	103742
4-Dec-06	108696	8723	99973
5-Dec-06	97794	9058	88736
6-Dec-06	105791	8773	97018
7-Dec-06	101406	9444	91962
8-Dec-06	102901	9183	93718
9-Dec-06	105694	8916	96778
10-Dec-06	103563	9358	94205
11-Dec-06	106928	9172	97756
12-Dec-06	98447	9981	88466
13-Dec-06	93470	9071	84399
14-Dec-06	104460	9472	94988

<b>Date</b>	<b>Gross Generation</b>	<b>Auxiliary Generation</b>	<b>Net Generation</b>
15-Dec-06	102925	9580	93345
16-Dec-06	100825	10242	90583
17-Dec-06	99130	10306	88824
18-Dec-06	101100	10112	90988
19-Dec-06	100565	9830	90735
20-Dec-06	98943	9863	89080
21-Dec-06	100439	10653	89786
22-Dec-06	105358	11048	94310
23-Dec-06	100753	10240	90513
24-Dec-06	101541	10137	91404
25-Dec-06	100991	8611	92380
26-Dec-06	103425	9252	94173
27-Dec-06	111492	9171	102321
28-Dec-06	105944	9080	96864
29-Dec-06	103186	8249	94937
30-Dec-06	102044	9137	92907
31-Dec-06	106247	8862	97385
Total Dec 06	3207506	293112	2914394
1-Jan-07	106186	8489	97697
2-Jan-07	107370	9406	97964
3-Jan-07	107147	10282	96865
4-Jan-07	99086	8057	91029
5-Jan-07	100228	8456	91772
6-Jan-07	100045	8225	91820
7-Jan-07	78990	7210	71780
8-Jan-07	101906	8708	93198
9-Jan-07	102344	8283	94061
10-Jan-07	88147	9956	78191
11-Jan-07	0	2011	-2011
12-Jan-07	45373	6110	39263
13-Jan-07	93070	9131	83939
14-Jan-07	95025	9115	85910
15-Jan-07	92086	9854	82232
16-Jan-07	93759	8600	85159
17-Jan-07	88200	9194	79006
18-Jan-07	85423	8187	77236
19-Jan-07	80277	8929	71348
20-Jan-07	100600	8861	91739
21-Jan-07	98175	8600	89575
22-Jan-07	104951	8245	96706
23-Jan-07	107972	11404	96568
24-Jan-07	107917	11499	96418
25-Jan-07	101300	8994	92306
26-Jan-07	103000	7915	95085
27-Jan-07	105336	8589	96747
28-Jan-07	108724	8455	100269
29-Jan-07	106000	9835	96165
30-Jan-07	110430	8504	101926
31-Jan-07	89057	8764	80293
Total Jan 07	2908124	267868	2640256

<b>Date</b>	<b>Gross Generation</b>	<b>Auxiliary Generation</b>	<b>Net Generation</b>
1-Feb-07	106886	10848	96038
2-Feb-07	113347	11272	102075
3-Feb-07	110103	8481	101622
4-Feb-07	106782	8627	98155
5-Feb-07	102206	8499	93707
6-Feb-07	101154	9048	92106
7-Feb-07	70519	8857	61662
8-Feb-07	43840	6067	37773
9-Feb-07	0	4633	-4633
10-Feb-07	0	3797	-3797
11-Feb-07	64389	7876	56513
12-Feb-07	98043	9989	88054
13-Feb-07	91819	8984	82835
14-Feb-07	92265	10736	81529
15-Feb-07	102400	9730	92670
16-Feb-07	102900	10738	92162
17-Feb-07	88500	9661	78839
18-Feb-07	97000	9667	87333
19-Feb-07	100050	9565	90485
20-Feb-07	105000	9699	95301
21-Feb-07	80409	9663	70746
22-Feb-07	82986	9379	73607
23-Feb-07	74489	8633	65856
24-Feb-07	60212	7635	52577
25-Feb-07	73929	8544	65385
26-Feb-07	84542	9806	74736
27-Feb-07	69754	8558	61196
28-Feb-07	78589	9113	69476
Total Feb 07	2302113	248105	2054008
1-Mar-07	83671	9983	73688
2-Mar-07	80304	8836	71468
3-Mar-07	90789	9796	80993
4-Mar-07	89070	10587	78483
5-Mar-07	92800	9834	82966
6-Mar-07	95069	8727	86342
7-Mar-07	99244	8849	90395
8-Mar-07	108000	9044	98956
9-Mar-07	102900	10114	92786
10-Mar-07	103240	10451	92789
11-Mar-07	99338	9629	89709
12-Mar-07	97250	9108	88142
13-Mar-07	93400	8413	84987
14-Mar-07	105585	8030	97555
15-Mar-07	93715	9907	83808
16-Mar-07	94512	9654	84858
17-Mar-07	103013	10274	92739
18-Mar-07	95989	10182	85807
19-Mar-07	93650	9927	83723
20-Mar-07	78862	9909	68953
21-Mar-07	84719	9476	75243

Date	Gross Generation	Auxiliary Generation	Net Generation
22-Mar-07	106271	10466	95805
23-Mar-07	92000	9366	82634
24-Mar-07	83484	9108	74376
25-Mar-07	80390	9037	71353
26-Mar-07	75337	9066	66271
27-Mar-07	74928	8992	65936
28-Mar-07	78835	9611	69224
29-Mar-07	80000	9493	70507
30-Mar-07	73500	8974	64526
31-Mar-07	68000	8944	59056
Total Mar 07	2797865	293787	2504078
1-Apr-07	75000	9304	65696
2-Apr-07	69000	9032	59968
3-Apr-07	70000	8892	61108
4-Apr-07	73792	9118	64674
5-Apr-07	4395	2639	1756
6-Apr-07	0	2169	-2169
7-Apr-07	0	2165	-2165
8-Apr-07	0	2469	-2469
9-Apr-07	0	2374	-2374
10-Apr-07	0	2411	-2411
11-Apr-07	0	2340	-2340
12-Apr-07	0	2482	-2482
13-Apr-07	0	2052	-2052
14-Apr-07	0	2459	-2459
15-Apr-07	0	2425	-2425
16-Apr-07	0	2051	-2051
17-Apr-07	0	2376	-2376
18-Apr-07	0	2157	-2157
19-Apr-07	0	2226	-2226
20-Apr-07	0	2408	-2408
21-Apr-07	0	3244	-3244
22-Apr-07	0	2523	-2523
23-Apr-07	0	2325	-2325
24-Apr-07	13864	3202	10662
25-Apr-07	55660	7908	47752
26-Apr-07	45148	7071	38077
27-Apr-07	43438	6717	36721
28-Apr-07	74276	9554	64722
29-Apr-07	93759	9803	83956
30-Apr-07	90117	9572	80545
Total Apr 07	708449	135468	572981
1-May-07	95100	9808	85292
2-May-07	100190	9786	90404
3-May-07	93344	10101	83243
4-May-07	81368	9550	71818
5-May-07	69340	8388	60952
6-May-07	104000	10032	93968
7-May-07	105201	10044	95157
8-May-07	50786	7063	43723

Date	Gross Generation	Auxiliary Generation	Net Generation
9-May-07	94399	9949	84450
10-May-07	93762	9849	83913
11-May-07	106780	10183	96597
12-May-07	99112	9807	89305
13-May-07	93360	9630	83730
14-May-07	90294	9240	81054
15-May-07	101354	9732	91622
16-May-07	84600	9137	75463
17-May-07	97500	9587	87913
18-May-07	98400	9614	88786
19-May-07	91983	9733	82250
20-May-07	94700	9681	85019
21-May-07	87500	9702	77798
22-May-07	91943	10066	81877
23-May-07	100400	9698	90702
24-May-07	102754	9889	92865
25-May-07	108160	10080	98080
26-May-07	108910	9779	99131
27-May-07	114618	9522	105096
28-May-07	108816	9966	98850
29-May-07	101004	9928	91076
30-May-07	104663	9947	94716
31-May-07	108000	9800	98200
Total May 07	2982341	299291	2683050
1-Jun-07	106000	9781	96219
2-Jun-07	102600	9996	92604
3-Jun-07	96698	9475	87223
4-Jun-07	101500	9976	91524
5-Jun-07	93000	9887	83113
6-Jun-07	97394	10205	87189
7-Jun-07	95100	9322	85778
8-Jun-07	101800	9881	91919
9-Jun-07	101400	9978	91422
10-Jun-07	90200	9431	80769
11-Jun-07	101300	9968	91332
12-Jun-07	92851	10086	82765
13-Jun-07	89509	9404	80105
14-Jun-07	86506	9142	77364
15-Jun-07	103035	9917	93118
16-Jun-07	99893	10266	89627
17-Jun-07	104064	8913	95151
18-Jun-07	96021	8915	87106
19-Jun-07	98927	9875	89052
20-Jun-07	99900	10534	89366
21-Jun-07	101122	9027	92095
22-Jun-07	105509	9807	95702
23-Jun-07	104992	10155	94837
24-Jun-07	22537	5442	17095
25-Jun-07	26663	6143	20520
26-Jun-07	93348	9972	83376

Date	Gross Generation	Auxiliary Generation	Net Generation
27-Jun-07	28769	9509	19260
28-Jun-07	91707	9842	81865
29-Jun-07	92261	8901	83360
30-Jun-07	71700	8695	63005
Total Jun 07	2696306	282445	2413861
1-Jul-07	15689	6217	9472
2-Jul-07	0	6881	-6881
3-Jul-07	0	5817	-5817
4-Jul-07	0	5747	-5747
5-Jul-07	0	3479	-3479
6-Jul-07	0	3810	-3810
7-Jul-07	0	3994	-3994
8-Jul-07	0	4988	-4988
9-Jul-07	0	4884	-4884
10-Jul-07	0	4959	-4959
11-Jul-07	0	4887	-4887
12-Jul-07	0	4044	-4044
13-Jul-07	4617	4149	468
14-Jul-07	60416	8747	51669
15-Jul-07	97241	9047	88194
16-Jul-07	100499	9660	90839
17-Jul-07	107040	10111	96929
18-Jul-07	106000	10034	95966
19-Jul-07	108598	10714	97884
20-Jul-07	107100	10370	96730
21-Jul-07	95100	10486	84614
22-Jul-07	114670	10500	104170
23-Jul-07	107026	10091	96935
24-Jul-07	81958	9963	71995
25-Jul-07	102393	10484	91909
26-Jul-07	79798	10171	69627
27-Jul-07	103066	10424	92642
28-Jul-07	111820	10844	100976
29-Jul-07	86287	10269	76018
30-Jul-07	100772	10247	90525
31-Jul-07	84990	10026	74964
Total Jul 07	1775080	246044	1525036
1-Aug-07	24672	6178	18494
2-Aug-07	32067	6216	25851
3-Aug-07	62226	8997	53229
4-Aug-07	97616	9191	88425
5-Aug-07	97611	9345	88266
6-Aug-07	73324	9244	64080
7-Aug-07	0	5283	-5283
8-Aug-07	0	3912	-3912
9-Aug-07	0	3118	-3118
10-Aug-07	0	1817	-1817
11-Aug-07	25900	4539	21361
12-Aug-07	111400	9301	102099
13-Aug-07	91300	8333	82967



Date	Gross Generation	Auxiliary Generation	Net Generation
14-Aug-07	84851	9492	75359
Total Aug 07	700967	94966	606001
Grand Total	<b>22853801</b>	<b>2435372</b>	<b>20418429</b>

#### Synopsis of Results for the Monitoring Period:

Period	Gross Generation (in kWh)	Auxiliary Consumption (in kWh)	Net Generation (in kWh)
Total for the period from 1 Nov'06 to 14 Aug'07	<b>22853801</b>	<b>2435372</b>	<b>20418429</b>

#### Emission Reductions

##### Baseline Emissions:

Carbon dioxide emission factor as per the baseline adopted (kg CO<sub>2</sub>/ kWh) = 0.759

Net WHR based power generated (kWh) = 20,418,429

Baseline emissions (tonnes of CO<sub>2</sub> equivalent) = 15,498

##### Project Emissions:

Project Emissions (tonnes of CO<sub>2</sub> e) = NIL

##### Emission Reductions:

Baseline emissions – Project emissions = 15,498 – NIL  
= **15,498** tonnes of CO<sub>2</sub> e

#### Measures to ensure the results/uncertainty analysis

VGL has an In-house metering system and export metering system, which monitor the overall performance of the waste heat recovery based CPP. The In-house metering system affecting the emission reductions from the project activity, mainly comprises of two meters

- One in-house generation meter for TG set
- In-house auxiliary consumption meter

The in-house generation meter (or the energy meter) is a micro-processor based metering device that monitors the total electricity units generated.

The in-house auxiliary consumption meter (or the static meter) is a micro-processor based metering device which monitors the net units of auxiliary electricity consumed by the CPP.

The net electricity generated from the waste heat recovery based power plant can be calculated as a difference between the gross electricity generation and the auxiliary consumption of the power plant.

In-house captive consumer meter (or the Kilowatt Hour Meters) is a micro-processor based metering device which gives data on consumption by various consuming units in VGL.

The external metering system of CSEB consists of one export meter and one import meter both of which are micro-processor based metering devices installed within VGL plant premises. These meters are sealed, maintained and calibrated by CSEB.

The part of the net electricity generated from the waste heat recovery based power plant that is used for captive consumption of the sponge iron plant of VGL can be calculated as the difference between the total In-house consumption of VGL and the amount of electricity imported from CSEB grid (measured by the import meter). The net electricity generated from the waste heat recovery based power plant can be verified against the sum of the part of the net electricity generated from the waste heat recovery based power plant that is used for captive consumption of the manufacturing facility of VGL and the amount of electricity that is exported to CSEB grid (measured by the export meter).

All the metering devices of the In-house metering system are calibrated at regular intervals (as per statutory requirements and Electricity Act guidelines) so that the accuracy of measurement is ensured all the time. The other meters are calibrated internally and externally as per equipment supplier's calibration schedule following the standard procedures for calibration.

The CSEB personnel read the export meter reading and provide a monthly invoice of total power exported (wheeled) and imported. CSEB personnel regularly calibrate the meter. The calibration of this meter is not in the control of VGL.

Moreover, VGL regularly undertakes Internal Audits to determine whether the GHG abatement project conforms to the planned arrangements of the monitoring methodology and plan (including other criteria related to GHG performance parameters). The audit report provides information on results of audits and recommends improvements to VGL management. All these measures ensure that uncertainty levels for all parameters are low.

### **Roles & Responsibilities**

In the complete implementation and monitoring plan referred above, VGL is the sole agency responsible for implementation and monitoring.