15.4 MW wind farm at Satara District, Maharashtra in India

UNFCCC registration reference number: 0593
Date of registration of project: 24th December 2006

MONITORING REPORT

From – 01/04/2002 to 31/03/2007

Version 04
Date: 10th December 2007

1. Title of the project activity

15.4 MW wind farm at Satara District, Maharashtra.
PDD Version IV
Dated: October 18, 2006

Date of registration of project: 24th December 2006
UNFCCC registration reference number: 0593

2. Introduction

The project activity has been undertaken to harness the available wind power potential at Satara vis-à-vis development of local economy. The project activity has established 44 number of sophisticated, Wind Energy Generators (WEG) of 350 kW capacities aggregating to a total installed capacity of 15.4 MW in Satara District. The generated electricity is wheeled to the nearest grid sub-station through a 33 kV supply line and fed into the grid after stepping up to 132 kV.

Name of Investor
Ellora Time Limited

3. Methodology used

Project Type: I Renewable energy project
Project Category: ACM0002, Grid connected renewable electricity generation
Reference: UNFCCC CDM website (http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html)

The project activity is considered under "Zero emissions grid-connected electricity generation from renewable sources", the project activity has a capacity more than 15 MW. Therefore, as per the scope of the project activity enlisted in the 'list of sectoral scopes and related approved baseline and monitoring methodologies', the project activity may principally be categorized in:
Scope Number 1
Sectoral Scope – Energy Industries (renewable/non-renewable sources).

4. Abbreviations in the report

CDM – Clean Development Mechanism
PDD – Project Design Document
GHG – Green House Gas / Gases
IPCC – Intergovernmental Panel on Climate Change
SEB – State Electricity Board
MSEB – Maharashtra State Electricity Board

5. General description of the project

5.1 Project Activity

The candidate CDM project will generate electricity from WEGs in Chikhali, Nivkhane and Bhambe villages in the district of Satara, Maharashtra. The generated electricity is sold to a third

party; DGP Hinoday industries Limited. Since wind power is GHG emissions free, the electricity, which is fed into the regional electricity grid (through local grid sub-station) replaces the fossil fuel intensive generation supplying the electricity to the grid.

The project activity started in May 2000 and was estimated to generate approximately 25.96 million kWh per year, contributing an estimated reduction of 223,570 tCO_2e over the ten year crediting period of the project from 2002-2012. This reduction is the result of displacement of fossil fuel fired power plants that would otherwise have delivered the electricity to Western Region Grid in the absence of the project activity.

5.2 Technical description of the project

Location of project activity

The wind electricity generators have been installed at three different sites in the Satara District as follows:

Site I:	Village Chikhali:	14 WEGs of capacity 0.350 MW
Site II:	Village Nivkhane:	15 WEGs of capacity 0.350 MW
Site III:	Village Bhambe:	15 WEGs of capacity 0.350 MW

District:	Satara
State:	Maharashtra
Latitude:	17^0 27’ N
Longitude:	73^0 50’ E
Height	1100 m above mean sea level

Technology employed by the project activity

The project activity leads to the promotion of 350 kW Wind Electric Generators (WEGs) into the region, demonstrating the success of these small sized wind turbines, which feed the generated power into the nearest sub-station, thus increasing energy availability and improving quality of power under the service area of the substation. Hence the project leads to technological well being.

The technology to be employed, converts wind energy to electricity using a Wind Electric Generator. The product that is employed is of 0.35 MW capacity.

Suzlon 350 kW Wind Turbine is a stall-regulated turbine with a three-bladed high efficiency rotor. The rotor is coupled to the generator through flange. This unique integrated power-train design incorporates torsionally flexible coupling to avoid problems of misalignment and vibration. The salient features of this technology are as follows:

1. Specially designed for tropical climates and remote operations
2. A High Coefficient of Power for ensuring optimum harnessing capacities
3. Integrated power transmission mechanism to ensure high efficiency
4. Carefully devised electrical system to withstand weak grid conditions
5. Microprocessor-based fully automatic control system deploying user-friendly operation and remote monitoring
6. Polyamide slide bearings for yawing
7. Unique soft braking logic

8. ISO-certified vendors confirm high quality components
9. ISO 9001:2000 for Design, Development, Manufacture and Supply of Wind Turbines
10. ISO 9001:2000 certification for Installation, Commissioning, Operation and Maintenance
11. Type certification by Germanischer Lloyd, Germany
12. Approved by the Ministry of Non-Conventional Energy Sources (MNES)

SAFETY SYSTEM

1. Safety System consists of four levels of independent systems:
2. Electronic sensing of faults by the computer for immediate action.
3. Independent electrical circuitry to act when over-speed is detected.
4. Hydraulic sensing and active device to prevent over-speeding.
5. Mechanical flexible couplings with shearing studs.

Technology Transfer
No technology transfer from other countries is involved in this project activity.

5.3 Crediting Period

The project activity has sought a 10 year fixed crediting period starting from 1/4/2002.

6. Monitoring methodology & Plan:

Approved consolidated monitoring methodology ACM0002/Version 06, 19th May 2006 Sector Scope: 1, "Consolidated monitoring methodology for zero-emissions grid connected electricity generation from renewable sources" by CDM Meth Panel.

The parameter to be monitored is Electricity Supplied to the Western Regional Grid of India (As per D2.1.1 of the PDD of the registered project activity)

ID number	Data variable	Source of data	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)	Comment
1A.	Generation of electricity from wind farm	Electronic meter installed by MSEB.	kWh	M	Monthly	100%	Electronic & Paper	Three meters have been set up by the MSEB namely: Meter 1 (HTSC No. 4038) metering 14 * 0.35 kW WEGs, Meter 2 (HTSC N0. 4064) metering 15 * 0.35 kW WEGs, Meter 3 (HTSC No. 4237) Metering 15 * 0.35 kW WEGs. The total of these three meters gives the electricity generated by the 15.4 MW wind farm. The detailed

								data monitored has been presented in Annex 1.
1B.	Generation of electricity from individual wind turbine	Electronic meter integrated within the wind turbine	kWh	M	Daily	100%	Electronic	To monitor the generation & performance of individual turbines. Refer Annex 2 for details.

6.1 Calibration / Maintenance of Measuring and Analytical Equipments

1. The proposed project activity requires evacuation facilities for sale to grid and the evacuation facility is essentially maintained by the state power utility (MSEB).
2. The electricity generation measurements are required by the utility and the investors to assess electricity sales revenue and / or wheeling charges.
3. The project activity has therefore envisaged two independent measurements of generated electricity from the wind turbines.
4. The primary recording of the electricity fed to the state utility grid will be carried out jointly at the incoming feeder of the state power utility (MSEB).
5. The joint measurement is being carried out once in a month in presence of both parties (the developer's representative and officials of the state power utility). This reading is then translated into a monthly generation report which is forwarded by MSEB to the project participant. The double check for the monthly generation reports is done by comparing them with the invoices raised by the project proponent towards the third party and MSEB (which buys the surplus electricity after consumption by third party at the end of the year).
6. Metering equipment - Metering is carried out through electronic tri vector meters. The main meter is installed and owned by MSEB, whereas the check meters are owned by the project promoters and the metering equipments is maintained in accordance with electricity standards. The responsibility of calibration for both main & check meters is with the state government electricity utility (MSEB). The calibration and other maintenance of the meters is done by MSEB as per the standard procedures.
7. There are 3 meters in the project. Two meters are of 0.5 accuracy class while one meter of 0.5 accuracy class recently got replaced by a meter of 0.2 accuracy class as per MSEDCL letter dated 28th December 2005 which recommends change of meters from class 0.5 to 0.2 for the entire state of Maharashtra in a phased manner. The documental proof for the same has been submitted to the verifier for reference.
8. The secondary monitoring, which will provide a backup (fail-safe measure) in case the primary monitoring is not carried out, would be done at the individual WEGs. Each WEG is equipped with an integrated electronic meter. These meters are connected to the Central Monitoring Station (CMS) of the entire wind farm. The generation data of individual machine can be monitored as a real-time entity at CMS. The snapshot of generation on the last day of every calendar month will be kept as a record both in electronic as well as printed (paper) form.

6.2 Environmental Impact

1. The electricity from wind electricity generator has no negative environmental impacts.
2. As per the Schedule 1 of Ministry of Environment and Forests (Government of India) notification dated January 27, 1994, - 30 activities are required to undertake environmental

impact assessment studies. The details of these activities are available at: http://envfor.nic.in/divisions/iass/notif/eia.htm

3. The proposed project doesn't fall under the list of activities requiring EIA as it will not involve any negative environmental impacts, because the WEGs installed for generation of power use wind (cleanest possible source of renewable energy).

7. GHG Emission Reduction Calculations

7.1 Project Activity Emissions: Nil

Emissions by sources of GHGs due to the project activity within the project boundary are zero since wind power is a GHG emission free source of energy.

7.2 Leakage: Nil

This is not applicable as the renewable energy technology used is not equipment transferred from another activity. Therefore, as per the simplified procedures for SSC project activities, no leakage calculation is required.

There is no alternate fuel which can generate electricity from the installed plant and machinery in absence of wind.

7.3 Baseline Emissions

As per the registered PDD, the wind power project uses the Combined Margin methodology as stated in ACM 0002.

The total baseline emissions $\mathbf{BE_y\,(tCO_2/yr) = EG_y * EF_y}$

Where
BE_y = Baseline emissions in year *y* (tCO_2).
EG_y (MWh/yr) = Electricity generated by the project in year *y*;
EF_y = Combined margin emissions factor (Baseline emission factor) for the year *y* (tCO_2/MWh).

The emission factor EF_y of the Western Region Grid is calculated as a combination of the Operating Margin emission factor ($EF_{OM,\,y}$) and the Build Margin emission factor ($EF_{BM,\,y}$):

$$\mathbf{EF_y = w_{OM}\,EF_{OM,y} + w_{BM}\,.EF_{BM,y}}$$

Where the weights w_{OM} and w_{BM}, are 50% and 50%, and $EF_{OM,\,y}$ and $EF_{BM,\,y}$, the Operating Margin and Build Margin emission factors respectively are calculated as given below.

Operating Margin Emission Factor

The Operating Margin is the weighted average emissions of all generating sources serving the Western Grid excluding hydro, geothermal, wind, low-cost biomass, nuclear and solar generation. It is derived from the following equation:

$$EF_{OM,simple,y} = \frac{\Sigma F_{i,j,y} COEF_{i,j}}{\Sigma GEN_{j,y}}$$

where

$F_{i,j,y}$ is the amount of fuel *i* (in a mass or volume unit) consumed by relevant power sources *j* in year(s) *y*,

j refers to the power sources delivering electricity to the grid, not including low-operating cost and must-run power plants, and including imports to the grid.

$COEF_{i,j,y}$ is the CO_2 emission coefficient of fuel *i* (tCO_2 / mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources *j* and the percent oxidation of the fuel in year(s) *y*, and

$GEN_{j,y}$ is the electricity (MWh) delivered to the grid by source *j*.

The CO_2 emission coefficient $COEF_i$ is obtained as

$$COEF_i = NCV_i * EF_{CO2,i} * OXID_i$$

where:

NCV_i is the net calorific value (energy content) per mass or volume unit of a fuel *i*,

$OXID_i$ is the oxidation factor of the fuel (see page 1.29 in the 1996 Revised IPCC Guidelines for default values),

$EF_{CO2,i}$ is the CO_2 emission factor per unit of energy of the fuel *i*.

The Operating Margin for the purpose of this project has been updated based on *ex-post* monitoring, using the data vintage for the year in which the project generation occurs (as mentioned in the monitoring plan of the registered PDD).

Data of Operating Margin for the three financial years from 2002-03 to 2005-06 has been obtained from -

'The CO_2 Baseline Database for the Indian Power Sector', Central Electricity Authority (CEA), Ministry of Power, Govt. of India.

Version 2

Dated: 21st June 2007

This database is prepared as per ACM0002 version 6.

Key baseline information is furnished as Annex 3. The detailed excel sheet is available at:

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

The $EF_{OM,Y}$ for the year 2002-03 is 0.9830 tCO_2/MWh

The $EF_{OM,Y}$ for the year 2003-04 is 0.9903 tCO_2/MWh

The $EF_{OM,Y}$ for the year 2004-05 is 1.0120 tCO_2/MWh

The $EF_{OM,Y}$ for the year 2005-06 is 0.9934 tCO_2/MWh

The $EF_{OM,Y}$ for the year 2006-07[1] is 0.9934 tCO_2/MWh

[1] Since data for the year 2006-07 is not available in the CEA database, the OM value of the year 2005-06 has been taken for the year 2006-07

Build Margin Emission Factor

The Build Margin emission factor ($EF_{BM, y}$) is calculated as the generation weighted average emission factor (tCO_2/MWh) of a sample of power plants *m*, as follows:

$$\mathbf{EF_{BM, y} = \frac{\Sigma F_{i, m, y} . COEF_{i, m}}{\Sigma GEN_{m, y}}}$$

Where

$F_{i, m,y}$ = quantity of fuel *i* used in plant *m* (kt/yr) in year *y*

$COEF_{i, m}$ = carbon emissions factor for fuel *i* in plant *m* (tCO_2/kt), taking into account the carbon content of the fuels by power sources and the percent oxidation of the fuel

$GEN_{m, y}$ = annual generation from plant *j* (MWh/yr) in year *y*

The build margin emission factor has also been calculated *ex-post* based on the values available at the time of monitoring of project generation (as mentioned in the monitoring plan of the registered PDD).

Baseline Emission Factor (EF_y)

The emission factor EF_y of the Western Region Grid is calculated as a combination of the *ex-post* updated Operating Margin emission factor ($EF_{OM, y}$) and the *ex-post* updated Build Margin emission factor ($EF_{BM, y}$)[2]:

$$\mathbf{EF_y = w_{OM} EF_{OM, y} + w_{BM} . EF_{BM, y}}$$

Where the weights w_{OM} and w_{BM}, are 50% and 50%, and $EF_{OM, y}$ and $EF_{BM, y}$ are the Operating Margin and Build Margin emission factors respectively are calculated as given below (as per the registered PDD).

Year	Operating Margin Emission Factor (tCO_2/MWh)	Built Margin Emission Factor (tCO_2/MWh)	Baseline Emission Factor (tCO_2/MWh)
2002-03	0.9830	0.7700	0.8765
2003-04	0.9903	0.7700	0.8802
2004-05	1.0120	0.7700	0.8910
2005-06	0.9934	0.6300	0.8117
2006-07	0.9934	0.6300	0.8117

The baseline emissions are estimated as the product of the electricity generated by the project activity and the Emission factor of the regional electricity grid as calculated above.

[2] The number of CERs have reduced due to *ex-post* calculations of both EF_{OM} and EF_{BM} in the current version of the Monitoring report (Version 3), which is based on the monitoring plan of the registered PDD; as compared to the calculations in the earlier version of Monitoring report (Version 1), which calculated *ex-post* EF_{OM} but *ex-ante* EF_{BM}, as was mentioned in Section B.2 of the registered PDD.

Name of Item	GEN
Description	Electricity Quantity – Electricity fed into the western grid
Crediting Period	01/04/2002 – 31/03/2012
Method of monitoring	Measured using energy meter
Recording frequency	Continuous
Reporting frequency	Monthly (Jointly by SEB and representative of the investor)
Background data	Joint meter reading available at the site
Archiving mode	Electronic & paper

The project started on 01/05/2000 and the crediting period starts from 01/04/2002.

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Annex 1

1 A – Generation of electricity from wind farm

Three meters have been set up by the MSEB namely:
Meter 1 (HTSC No. 4038) metering 14 * 0.35 kW WEGs
Meter 2 (HTSC N0. 4064) metering 15 * 0.35 kW WEGs
Meter 3 (HTSC No. 4237) Metering 15 * 0.35 kW WEGs

The total of these three meters gives the electricity generated by the 15.4 MW wind farm.

Crediting period	**Net electricity generated (in kWh)**			**Total electricity generated (in kWh)**	**Baseline Emission Factor (tCO_2e/MWh)**	**Total emissions reductions (tCO_2e)**
	MSEB Meter 1 (4038) (14*350) kW	MSEB Meter 2 (4064) (15*350) kW	MSEB Meter 3 (4237) (15*350) kW			
01/04/2002 - 30/04/2002	458177	500945	196147	1155269	0.8765	1012.62
01/05/2002 - 31/05/2002	909702	904554	525809	2340065	0.8765	2051.12
01/06/2002 - 30/06/2002	896248	870862	1121229	2888339	0.8765	2531.70
01/07/2002 - 31/07/2002	1401449	1484446	1593562	4479457	0.8765	3926.35
01/08/2002 - 31/08/2002	1518929	1555113	1422569	4496611	0.8765	3941.39
01/09/2002 - 30/09/2002	707304	730562	857900	2295766	0.8765	2012.29
01/10/2002 - 31/10/2002	189821	183443	168010	541274	0.8765	474.44
01/11/2002 - 31/12/2002	242093	211348	205318	658759	0.8765	577.42
01/01/2003 - 31/01/2003	294323	250393	251212	795928	0.8765	697.65
01/02/2003 - 28/02/2003	252806	274333	286899	814038	0.8765	713.52
01/03/2003 - 31/03/2003	306256	321795	348802	976853	0.8765	856.24
01/04/2003 - 30/04/2003	441846	435869	692631	1570346	0.8802	1382.18
01/05/2003 - 31/05/2003	761719	565990	971061	2298770	0.8802	2023.32
01/06/2003 - 30/06/2003	1001289	1302792	1114671	3418752	0.8802	3009.09
01/07/2003 - 31/07/2003	1534352	1447053	806346	3787751	0.8802	3333.88
01/08/2003 - 31/08/2003	1531960	1503924	1497176	4533060	0.8802	3989.88
01/09/2003 - 30/09/2003	1090431	1018897	907870	3017198	0.8802	2655.66
01/10/2003 - 31/10/2003	324076	350080	427263	1101419	0.8802	969.44
01/11/2003 - 30/11/2003	208428	196458	179874	584760	0.8802	514.69
01/12/2003 - 31/12/2003	270990	228120	223008	722118	0.8802	635.59
01/01/2004 - 31/01/2004	187722	154104	161298	503124	0.8802	442.84
01/02/2004 - 29/02/2004	288030	311934	253560	853524	0.8802	751.25
01/03/2004 - 31/03/2004	262260	263460	483900	1009620	0.8802	888.64
01/04/2004 - 30/04/2004	858540	899460	786240	2544240	0.8910	2266.92
01/05/2004 - 31/05/2004	777120	800580	766500	2344200	0.8910	2088.68
01/06/2004 - 30/06/2004	1146840	1359660	1424460	3930960	0.8910	3502.49
01/07/2004 - 31/07/2004	1775880	1686126	1302420	4764426	0.8910	4245.11
01/08/2004 - 31/08/2004	1475040	1685994	1673580	4834614	0.8910	4307.65
01/09/2004 - 30/09/2004	995280	1012440	885720	2893440	0.8910	2578.06
01/10/2004 - 31/10/2004	236340	277920	236760	751020	0.8910	669.16

01/11/2004 - 30/11/2004	434880	323340	341460	1099680	0.8910	979.82
01/12/2004 - 31/12/2004	676200	554820	504360	1735380	0.8910	1546.23
01/01/2005 - 31/01/2005	128760	125160	148260	402180	0.8910	358.34
01/02/2005 - 28/02/2005	162720	175680	356940	695340	0.8910	619.55
01/03/2005 - 31/03/2005	397980	456000	337860	1191840	0.8910	1061.93
01/04/2005 - 30/04/2005	423900	442320	364380	1230600	0.8117	998.86
01/05/2005 - 31/05/2005	388620	462480	575220	1426320	0.8117	1157.73
01/06/2005 - 30/06/2005	932100	1182912	952200	3067212	0.8117	2489.62
01/07/2005 - 31/07/2005	961560	1422330	1596762	3980652	0.8117	3231.05
01/08/2005 - 31/08/2005	908628	1517754	2125632	4552014	0.8117	3694.82
01/09/2005 - 30/09/2005	725106	650592	1114344	2490042	0.8117	2021.14
01/10/2005 - 31/10/2005	664800	651162	272352	1588314	0.8117	1289.22
01/11/2005 - 30/11/2005	198300	179526	254652	632478	0.8117	513.37
01/12/2005 - 31/12/2005	362742	300882	272238	935862	0.8117	759.63
01/01/2006 - 31/01/2006	122808	144048	120204	387060	0.8117	314.17
01/02/2006 - 28/02/2006	222108	166710	224226	613044	0.8117	497.60
01/03/2006 - 31/03/2006	1054746	427482	355074	1837302	0.8117	1491.32
01/04/2006 - 30/04/2006	440608	473787	439007	1353402	0.8117	1098.54
01/05/2006 - 31/05/2006	696203	752251	556856	2005310	0.8117	1627.69
01/06/2006 - 30/06/2006	1072549	932290	1114845	3119684	0.8117	2532.21
01/07/2006 - 31/07/2006	1002391	1251845	1410758	3664994	0.8117	2974.83
01/08/2006 - 31/08/2006	1587309	1801715	1880793	5269817	0.8117	4277.45
01/09/2006 - 30/09/2006	500972	564339	481956	1547267	0.8117	1255.90
01/10/2006 - 31/10/2006	316743	293396	338131	948270	0.8117	769.70
01/11/2006 - 30/11/2006	306309	164839	254108	725256	0.8117	588.68
01/12/2006 - 31/12/2006	318445	283280	174576	776301	0.8117	630.11
01/01/2007 - 31/01/2007	86306	103492	203045	392843	0.8117	318.87
01/02/2007 - 28/02/2007	217224	146626	249978	613828	0.8117	498.24
01/03/2007 - 31/03/2007	358348	293408	295751	947507	0.8117	769.08
					TOTAL	**99,414**

Yearly Emission Reductions

S.No	Crediting period	Emissions reductions
1	01/04/2002 - 31/03/2003	18794.75
2	01/04/2003 - 31/03/2004	20596.44
3	01/04/2004 - 31/03/2005	24223.93
4	01/04/2005 - 31/03/2006	18458.52
5	01/04/2006 - 31/03/2007	17341.29
	TOTAL CERs	**99,414**

Annex 2

I B – Generation of electricity from individual wind turbine

Each WEG is equipped with an integrated electronic meter. These meters are connected to the Central Monitoring Station (CMS) of the entire wind farm. The generation data of individual machine can be monitored as a real-time entity at CMS. The snapshot of generation will be kept as a record in electronic form and this is maintained at the Satara site office. The detailed values of electricity generated from each WEG have not been presented in this report as the values do not take into account the transmission losses incurred and hence would not present a true picture of the net electricity delivered to grid. However, this data is available at the site office in Satara, and the same will be made available to the verifier during verification.

Annex 3

CENTRAL ELECTRICITY AUTHORITY: CO2 BASELINE DATABASE

VERSION	**2.0**
	21 June
DATE	**2007**
BASELINE	**ACM0002**
METHODOLOGY	**/ Ver 06**

EMISSION FACTORS

Weighted Average Emission Rate (tCO2/MWh) (excl. Imports)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	0.7237	0.7265	0.7379	0.7095	0.7134	0.7137
East	1.0876	1.0573	1.1128	1.1035	1.0768	1.0756
South	0.7347	0.7451	0.8231	0.8417	0.7837	0.7353
West	0.8988	0.9247	0.9034	0.9020	0.9242	0.8746
North-East	0.4239	0.4140	0.4020	0.4281	0.3180	0.3309
India	0.8216	0.8309	0.8546	0.8507	0.8423	0.8170

Weighted Average Emission Rate (tCO2/MWh) (incl. Imports)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	0.7237	0.7265	0.7401	0.7098	0.7203	0.7240
East	1.0876	1.0320	1.0852	1.0758	1.0534	1.0473
South	0.7446	0.7478	0.8235	0.8417	0.7843	0.7355
West	0.8984	0.9242	0.9026	0.9009	0.9234	0.8829
North-East	0.4239	0.4140	0.4020	0.4281	0.4799	0.3309
India	0.8191	0.8284	0.8520	0.8479	0.8397	0.8145

Simple Operating Margin (tCO2/MWh) (excl. Imports)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	0.9768	0.9778	0.9988	0.9870	0.9745	0.9933
East	1.2198	1.2210	1.2025	1.2303	1.2037	1.1585
South	1.0219	1.0001	1.0071	1.0041	0.9997	1.0073
West	0.9791	1.0102	0.9845	0.9922	1.0132	0.9936
North-East	0.7335	0.7101	0.7418	0.7366	0.7143	0.6994
India	1.0169	1.0239	1.0207	1.0259	1.0274	1.0228

Simple Operating Margin (tCO2/MWh) (incl. Imports)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	0.9768	0.9778	0.9996	0.9871	0.9758	0.9946
East	1.2198	1.1874	1.1703	1.1959	1.1745	1.1255
South	1.0292	1.0001	1.0065	1.0041	0.9999	1.0073
West	0.9784	1.0094	0.9830	0.9903	1.0120	0.9934
North-East	0.7335	0.7101	0.7418	0.7366	0.8402	0.6994
India	1.0132	1.0202	1.0170	1.0217	1.0234	1.0189

Build Margin (tCO2/MWh) (excl. Imports)

Build Margin (tCO2/MWh) (not adjusted for imports)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North					0.5336	0.6005
East					0.9043	0.9672
South					0.7089	0.7113
West					0.7700	0.6300
North-East					0.1456	0.1489
India					0.6953	0.6841

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North					0.5336	0.6005
East					0.9043	0.9672
South					0.7089	0.7113
West					0.7700	0.6300
North-East					0.1456	0.1489
India					0.6953	0.6841

Combined Margin (tCO2/MWh) (excl. Imports)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	0.7552	0.7557	0.7662	0.7603	0.7540	0.7969
East	1.0620	1.0626	1.0534	1.0673	1.0540	1.0628
South	0.8654	0.8545	0.8580	0.8565	0.8543	0.8593
West	0.8746	0.8901	0.8773	0.8811	0.8916	0.8118
North-East	0.4395	0.4278	0.4437	0.4411	0.4299	0.4242
India	0.8561	0.8596	0.8580	0.8606	0.8614	0.8534

Combined Margin in tCO2/MWh (incl. Imports)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	0.7552	0.7557	0.7666	0.7603	0.7547	0.7976
East	1.0620	1.0458	1.0373	1.0501	1.0394	1.0463
South	0.8690	0.8545	0.8577	0.8565	0.8544	0.8593
West	0.8742	0.8897	0.8765	0.8802	0.8910	0.8117
North-East	0.4395	0.4278	0.4437	0.4411	0.4929	0.4242
India	0.8543	0.8578	0.8562	0.8585	0.8594	0.8515

GENERATION DATA

Gross Generation Total (GWh)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	144,292	151,185	155,385	165,735	168,438	179,751
East	58,936	64,048	66,257	75,374	85,776	93,902
South	129,035	131,902	136,916	138,517	144,086	147,355
West	162,329	165,805	177,399	172,682	183,955	188,606
North-East	5,319	5,332	5,808	5,867	7,883	7,778
India	499,911	518,272	541,764	558,175	590,138	617,392

Net Generation Total (GWh)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	135,230	141,415	144,743	155,043	157,291	168,206

EMISSION DATA

Absolute Emissions Total (tCO2)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	97,866,565	102,743,113	106,808,582	109,996,544	112,212,597	120,056,079
East	58,026,488	61,427,499	66,593,200	75,512,010	83,956,860	92,517,515
South	89,019,263	92,112,060	105,187,726	108,049,156	105,539,862	101,712,149
West	135,192,153	141,597,621	148,557,341	144,127,175	157,781,065	153,933,199
North-East	2,202,108	2,158,348	2,280,049	2,462,796	2,468,463	2,532,819
India	382,306,576	400,038,640	429,426,898	440,147,681	461,958,846	470,751,761

Absolute Emissions OM (tCO2)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	97,866,565	102,743,113	106,808,582	109,996,544	112,212,597	120,056,079

East	53,350	58,097	59,841	68,428	77,968	86,014
South	121,158	123,630	127,789	128,373	134,676	138,329
West	150,412	153,125	164,448	159,780	170,726	176,003
North-East	5,195	5,213	5,671	5,752	7,762	7,655
India	465,345	481,479	502,492	517,376	548,423	576,206

Share of Must-Run (Hydro/Nuclear) (% of Net Generation)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	25.9%	25.7%	26.1%	28.1%	26.8%	28.1%
East	10.8%	13.4%	7.5%	10.3%	10.5%	7.2%
South	28.1%	25.5%	18.3%	16.2%	21.6%	27.0%
West	8.2%	8.5%	8.2%	9.1%	8.8%	12.0%
North-East	42.2%	41.7%	45.8%	41.9%	55.5%	52.7%
India	19.2%	18.9%	16.3%	17.1%	18.0%	20.1%

Net Generation in Operating Margin (GWh)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	100,189	105,076	106,942	111,450	115,151	120,869
East	47,570	50,308	55,377	61,378	69,746	79,863
South	87,114	92,103	104,449	107,603	105,568	100,978
West	138,071	140,173	150,889	145,264	155,731	154,918
North-East	3,002	3,039	3,074	3,343	3,456	3,621
India	375,947	390,700	420,730	429,040	449,653	460,249

20% of Net Generation (GWh)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	27,046	28,283	28,949	31,009	31,458	33,641
East	10,670	11,619	11,968	13,686	15,594	17,203
South	24,232	24,726	25,558	25,675	26,935	27,666
West	30,082	30,625	32,890	31,956	34,145	35,201
North-East	1,039	1,043	1,134	1,150	1,552	1,531

East	58,026,488	61,427,499	66,593,200	75,512,010	83,956,860	92,517,515
South	89,019,263	92,112,060	105,187,726	108,049,156	105,539,862	101,712,149
West	135,192,153	141,597,621	148,557,341	144,127,175	157,781,065	153,933,199
North-East	2,202,108	2,158,348	2,280,049	2,462,796	2,468,463	2,532,819
India	382,306,576	400,038,640	429,426,898	440,147,681	461,958,846	470,751,761

Absolute Emissions BM (tCO2)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North					17,108,583	20,622,114
East					14,303,611	16,990,438
South					19,839,024	20,029,713
West					27,148,870	22,318,133
North-East					299,121	266,981
India					78,699,210	80,227,378

IMPORT DATA

Net Imports (GWh) - Net exporting grids are set to zero

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	0	0	0	0	3,616	5,748
East	489	555	357	1,689	0	0
South	1,162	1,357	518	0	0	0
West	321	0	797	962	285	11,982
North-East	0	0	0	0	2,099	0

India	93,069	96,296	100,498	103,475	109,685	115,241

Net Generation in Build Margin (GWh)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North					32,064	34,340
East					15,818	17,567
South					27,987	28,158
West					35,257	35,425
North-East					2,055	1,793
India					113,181	117,283

Share of Net Imports (% of Net Generation)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	0.0%	0.0%	0.0%	0.0%	2.3%	3.4%
East	0.9%	1.0%	0.6%	2.5%	0.0%	0.0%
South	1.0%	1.1%	0.4%	0.0%	0.0%	0.0%
West	0.2%	0.0%	0.5%	0.6%	0.2%	6.8%
North-East	0.0%	0.0%	0.0%	0.0%	27.0%	0%
