



**MONITORING REPORT FORM (CDM-MR)  
Version 01 - in effect as of: 09/06/2010**

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**MONITORING REPORT**

Version 01

Date: 21/07/2010

**15 MW Wind Energy Project in Maharashtra**

Reference number: 1778

First Monitoring Period

24/10/2008 TO 30/06/2010 (Inclusive Both Days)

**SECTION A. General description of the project activity****A.1. Brief description of the project activity:****Purpose of the project activity and the measures taken to reduce greenhouse gas emissions:**

The main purpose of the project activity is the implementation and operation of 15 MW wind farms to generate electricity in high wind speed areas of Maharashtra. M/s D. J. Malpani (DJM) is the promoter of these wind farms. The implemented project activity, sells electricity generated from its WTGs to the Maharashtra State Electricity Distribution Company Ltd. (MSEDCL) which falls under NEWNE network of India. This avoids generation of same amount of electricity in fossil fuel dominated thermal plants. Thus the project activity avoids equivalent CO<sub>2</sub> emissions that would have happened in absence of project activity. The project activity also contributes to the regional sustainable development as stated in the PDD.

**Brief description of the installed technology and equipments:**

The project activity consists of 12 wind electric generators (WEGs) installed in three phases at various locations<sup>1</sup> within Maharashtra. The generated electricity from WEGs is fed to state electric utility namely Maharashtra State Electricity Distribution Company Limited (MSEDCL) and transmitted through state electric grid<sup>2</sup>. The details of the windmill e.g. employed technology, model, rated capacity is provided in table A.1.1: Commissioning dates, capacity, location number, supplier and model number, location for the project activity. The description of technology is provided under A.4 “Technical description of the project”.

**Relevant dates for the project activity**

The project activity involves the installation twelve WTGs of 1.25 MW capacity each. The details of technology, capacity and the date of commissioning of different units are given in table A.1.1,

<sup>1</sup> Refer columns WEG Location No. and Village, District of table A.1.1

<sup>2</sup> PPA signed between PP and MSEDCL



Table A.1.1: Commissioning dates, capacity, location number, supplier and model number, location for the project activity

Phase	WEG Location No. <sup>3</sup>	Installed Capacity (MW) <sup>4</sup>	Technology	Village, District <sup>5</sup>	Substation <sup>6</sup>	Date of Commissioning <sup>7</sup>
Phase - I	K 400	1.25	SUZLON, S70	Mandal, Nandurbar	Jamde	31/12/2005
Phase - I	K 401	1.25	SUZLON, S70	Mandal, Nandurbar	Jamde	31/12/2005
Phase - I	K 402	1.25	SUZLON, S70	Akhatwade Nandurbar	Jamde	06/02/2006
Phase - I	K 407	1.25	SUZLON, S70	Mandal, Nandurbar	Jamde	06/03/2006
Phase - I	K 412	1.25	SUZLON, S70	Mandal, Nandurbar	Jamde	31/12/2005
Phase - I	K 413	1.25	SUZLON, S70	Mandal, Nandurbar	Jamde	26/03/2006
Phase - II	K 254	1.25	SUZLON, S70	Dhavlivilhar, Dhulia	Valve	31/03/2006
Phase - II	K 118	1.25	SUZLON, S70	Titane, Dhulia	Jamde	29/03/2006
Phase - III	J 114	1.25	SUZLON, S70	Isharde, Dhulia	Jamde	13/08/2006
Phase - III	J 115	1.25	SUZLON, S70	Isharde, Dhulia	Jamde	24/08/2006
Phase - III	J 127	1.25	SUZLON, S70	Isharde, Dhulia	Jamde	13/08/2006
Phase - III	J 128	1.25	SUZLON, S70	Isharde, Dhulia	Jamde	16/08/2006
<b>Total</b>	<b>12</b>	<b>5 MW</b>				

**Total emission reductions achieved in this monitoring period**

The electricity generation from the project activity will contribute to GHG reductions of 34,383 tCO<sub>2</sub>e over the Monitoring Period of 24/10/2008 to 30/06/2010 (Inclusive Both Days). For detailed calculations please refer section E.

**A.2. Project Participants**

As per Annex-I of registered PDD<sup>8</sup>

Organization:	M/s D. J. Malpani
Street/P.O.Box:	Kasera Dumala
Building:	Malpani Estate
City:	Sangamner, Dist- Ahmednagar
State/Region:	Maharashtra
Postfix/ZIP:	422605
Country:	India
Telephone:	+91 2425 225035
Fax:	+91 2425 225035
E-Mail:	<a href="mailto:malpani@malpani.com">malpani@malpani.com</a>
URL:	
Represented by:	
Title:	Purchase Manager

<sup>3</sup> Commissioning certificate issued by MSEDCL

<sup>4</sup> Commissioning certificate issued by MSEDCL

<sup>5</sup> Commissioning certificate issued by MSEDCL

<sup>6</sup> JMR issued by MSEDCL to PP

<sup>7</sup> Commissioning certificate issued by MSEDCL

<sup>8</sup> <http://cdm.unfccc.int/Projects/DB/BVQI1207584460.66/view>



Salutation:	Mr
Last Name:	Khinvasara
Middle Name:	--
First Name:	Prafulla
Department:	Purchase
Mobile:	+91 9822322145
Direct Fax:	--
Direct tel:	--
Personal E-Mail:	<a href="mailto:prafulla@malpani.com">prafulla@malpani.com</a>

Annex-1 party is not yet identified.

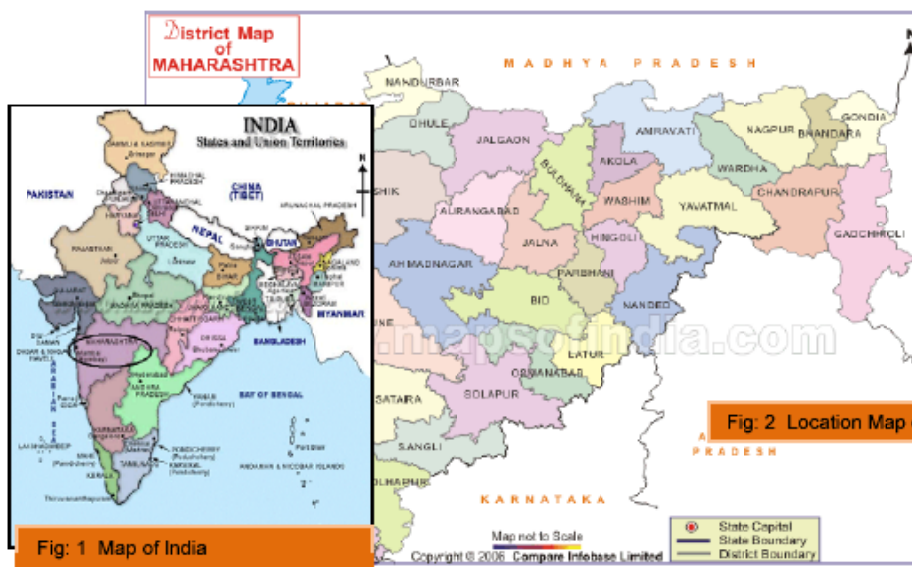
### A.3. Location of the project activity:

Complete information of the location of the project activity: town, city, country and GPS coordinates is provided under the below table.

PHASE	WINDMILL LOCATION NO. <sup>9</sup>	ADDRESSES <sup>10</sup>	LATITUDE	LONGITUDE
Phase - I	K 400	Gut No. 168/4/P, Village- Mandal, Taluka- Nandurbar, Dist.: Nandurbar	21°16'15.9" N	74°19'49.6" E
Phase - I	K 401	Gut No. 161/1A/1, Village- Mandal, Taluka- Nandurbar, Dist.: Nandurbar	21°16'07.4" N	74°19'30.5" E
Phase - I	K 402	Gut No. 46/P, Village- Akhatwade, Taluka- Nandurbar, Dist.: Nandurbar	21°16'12.6" N	74°14'27.6" E
Phase - I	K 407	Gut No. 370/1/P, Village- Mandal, Taluka- Nandurbar, Dist.: Nandurbar	21°16'57.4" N	74° 19'07.2" E
Phase - I	K 412	Gut No. 375/1/P, Village- Mandal, Taluka- Nandurbar, Dist.: Nandurbar	21°17'08.1" N	74°19'27.7" E
Phase - I	K 413	Gut No. 378/1B/P, Village- Mandal, Taluka- Nandurbar, Dist.: Nandurbar	21°17'21.9" N	74°19'29.2" E
Phase - II	K 254	Gut No. 74/1A/P, Village- Dhavlivihar, Taluka- Sakri, Dist.: Dhulia	21°11'06.1" N	74°14'56.2" E
Phase - II	K 118	Gut No. 43/1, Village- Titane, Taluka- Sakri, Dist.: Dhulia	21°11'33.2" N	74°17'10.3" E
Phase - III	J 114	R. S. No. 16, Village- Isharde, Taluka- Sakri, Dist.: Dhulia	21°13'54.1" N	74°18'21.2" E
Phase - III	J 115	R. S. No. 16, Village- Isharde, Taluka- Sakri, Dist.: Dhulia	21°13'39.6" N	74°18'19.1" E
Phase - III	J 127	R. S. No. 16, Village- Isharde, Taluka- Sakri, Dist.: Dhulia	21°14'17.5" N	74°17'29.0" E
Phase - III	J 128	R. S. No. 16, Village- Isharde, Taluka- Sakri, Dist.: Dhulia	21°14'06.5" N	74°17'09.6" E

<sup>9</sup> Commissioning certificate issued by MSEDCL

<sup>10</sup> Commissioning certificate issued by MSEDCL



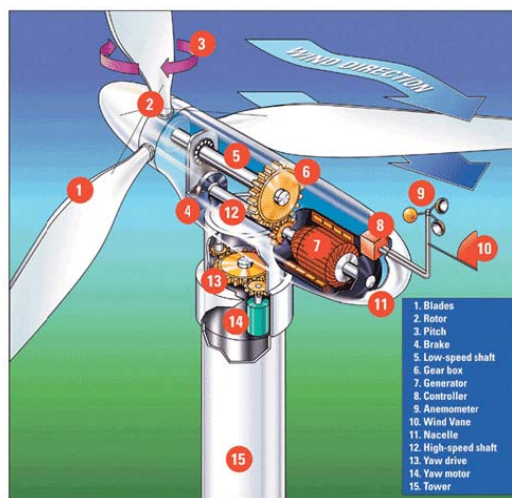
#### A.4. Technical description of the project

##### Description of the technology applied in the project activity and detailed technical process, including diagrams<sup>11</sup>:

All the machines are S70 make and have been developed by Suzlon Energy Ltd. (SUZLON) in association with its collaborators using state of the art technology. The primary driver for the development of the turbines was Suzlon's commitment to make wind energy more accessible - in terms of technology, yield and cost.

In wind energy generation, kinetic energy of wind is converted into mechanical energy and subsequently into electrical energy. Wind has considerable amount of kinetic energy when blowing at high speeds. This kinetic energy when passes through the blades of the WEG is converted into mechanical energy and rotates the wind blades. When the wind blades rotate, the connected generator also rotates, thereby producing electricity. The technology is a clean technology since there are no GHG emissions associated with the electricity generation.

<sup>11</sup> Registered PDD, section A.4.2 and the technical specifications provided by SUZLON



The important parts of a windmill are:

i. Main Tower

This is a very tall structure with a door and inside ladder at the bottom. The door is used to enter into the tower for operation and maintenance.

ii. Blades

The WEGs are provided with three blades. The blades are self supporting in nature made up of Fiber Reinforced Polyester. The blades are mounted on the hub.

iii. Nacelle

The Nacelle is the one which contains all the major parts of a WEG. The nacelle is made up of thick rugged steel and mounted on a heavy slewing ring. Under normal operating conditions, the nacelle would be facing the upstream wind direction.

iv. Hub

The Hub is an intermediate assembly between the wing and the main shaft of the wind turbine. Inside the hub, a system to actuate the aerodynamic brake is fitted. The hub is covered with nose cone.

v. Main Shaft

The shaft is to connect the gear box and the hub. Solid high carbon steel bars or cylinders are used as main shaft. The shaft is supported by two bearings.

vi. Gear Box, Bearing and Housing

The gearbox is used to increase the speed ratio so that the rotor speed is increased to the rated generator speed. Oil cooling is employed to control the heating of the gearbox. Gearboxes are mounted over dampers to minimize vibration. The main bearings are placed inside housing.

vii. Brake

Brake is employed in the WEGs to stop the wind turbine mainly for maintenance check. Brakes are also applied during over speed conditions of the wind turbine. The brakes are placed on the high speed shaft.



## viii. Generator

The generator uses induction type of generator. The generators are provided with monitoring sensors in each phase winding to prevent damage to the generators.

**Technical Details of 1.25 MW (S 70) WTG**

Sr. No.	Particulars	Specifications
1.	Rotor diameter	69.1 m
2.	Hub height	74 m
3.	Installed electrical output	1250 kW
4.	Cut-in wind speed	3 m/s
5.	Rated wind speed	12 m/s
6.	Cut-out wind speed	20 m/s
7.	Rotor swept area	3750 m <sup>2</sup>
8.	Rotational speed	13.2/19.8
9.	Rotor material	GRP
10.	Regulation	Pitch
11.	Generator	Asynchronous Generator, 4/6 poles
12.	Rated output	250/1250 kW
13.	Rotational speed	1010/1515 rpm
14.	Operating voltage	690 V
15.	Frequency	50 Hz
16.	Protection	IP 56
17.	Insulation class	H
18.	Cooling system	Air cooled
19.	Gear box	3 stage gear box, 1 planetary and 2 helical
20.	Manufacturer	Winenergy
21.	Gear ratio	77.848
22.	Nominal load	1390 kW
23.	Type of cooling	Oil cooling system
24.	Yaw drive system	4 active electrical yaw motors
25.	Yaw bearing	Polymide slide bearing
26.	Safety system	
26.1	Aerodynamic brake	3 times independent pitch regulation
26.2	Mechanical brake	Spring power disc brake, hydraulically released, fail safe.
27.	Control unit	Microprocessor controlled, indicating actual operating conditions, UPS back up system
28.	Tower	Tubular
29.	Design standards	GL/IEC

**A.5. Title, reference and version of the baseline and monitoring methodology applied to the project activity:**

As defined under Appendix B of the simplified modalities and procedures for small-scale CDM project activities, the project activity falls under following project types and categories:

**Project Type:** I – Renewable Energy Projects  
**Project Category:** I.D. – Grid connected renewable electricity generation (Version 11)<sup>12</sup>  
**Reference:** Appendix B of the simplified M&P for small scale CDM project activities

Methodology AMS I.D. also refers to:-

**Revision to the approved consolidated baseline methodology ACM0002 “Consolidated baseline methodology for grid-connected electricity generation from renewable sources”<sup>13</sup>**

And

**Revision to the approved consolidated monitoring methodology ACM0002 “Consolidated monitoring methodology for zero-emissions grid-connected electricity generation from renewable sources”**

Scope no: 1

Sectoral Scope Energy Industries: (Renewable/non-renewable)

**A.6. Registration date of the project activity:**

Registration Date: 24/10/2008<sup>14</sup>

**A.7. Crediting period of the project activity and related information (start date and choice of crediting period):**

Crediting period from 24/10/2008 to 23/10/2018 (*Fixed*)<sup>15</sup>  
Choice of crediting period: *Fixed* for 10 Years 0 Month

**A.8. Name of responsible person(s)/entity(ies):**

Please refer section A.3.

<sup>12</sup> [http://cdm.unfccc.int/UserManagement/FileStorage/CDMWF\\_AM\\_UYF1PQNDY5FZ4VH4HZ28FYAP13SI9W](http://cdm.unfccc.int/UserManagement/FileStorage/CDMWF_AM_UYF1PQNDY5FZ4VH4HZ28FYAP13SI9W)

<sup>13</sup> [http://cdm.unfccc.int/UserManagement/FileStorage/CDMWF\\_AM\\_BW759ID58ST5YEEV6WUCN5744MN763](http://cdm.unfccc.int/UserManagement/FileStorage/CDMWF_AM_BW759ID58ST5YEEV6WUCN5744MN763)

<sup>14</sup> <http://cdm.unfccc.int/Projects/DB/BVQI1207584460.66/view>

<sup>15</sup> <http://cdm.unfccc.int/Projects/DB/BVQI1207584460.66/view>

**SECTION B. Implementation of the project activity****B.1. Implementation status of the project activity**

The project activity was already commissioned before the registration at UNFCCC in three phases (**Phase I**-6 machines in Nandurbar in the year 2005-2006; **Phase II**- 2 machines in Sakri in 2006; and finally **Phase III**-4 machines in Sakri also in 2006) with total installed capacity 15 MW.

The detailed status of implementation i.e. start date as well as capacity for each site of the project activity is provided under Table A.1.1: Commissioning dates, capacity, location number, supplier and model number, location for the project activity.

**B.2. Revision of the monitoring plan**

Yes, revision of the monitoring plan has been completed on date 08/07/2010<sup>16</sup>.

**B.3. Request for deviation applied to this monitoring period**

Not applicable

**B.4. Notification or request of approval of changes**

Not applicable for the First Periodic Verification.

The project was commissioned before the registration and thereafter there are no changes in the installed components of the project activity i.e. WEGs. Therefore the project activity corresponds with the description provided under registered PDD<sup>17</sup> (Version: 2, dated: 09/01/2008), Validation report<sup>18</sup> (REPORT NO. INDIA-VAL/119.49/2007, dated: 23/01/2008) and revised monitoring plan<sup>19</sup>.

**SECTION C. Description of the monitoring system**

The project activity essentially involves generation of electricity from wind, the employed WEG can only convert wind energy into electrical energy and cannot use any other input fuel for electricity generation. Thus no special ways and means are required to monitor leakage from the project activity.

<sup>16</sup> As per email confirmation received from UNFCCC regarding acceptance of revision in monitoring plan (forwarded by DOE)

<sup>17</sup> <http://cdm.unfccc.int/UserManagement/FileStorage/HPUZIS4HCJVLJRJ32KQRIKITGR2Z69E>

<sup>18</sup> <http://cdm.unfccc.int/UserManagement/FileStorage/R7603LLGVDNE1CSRQVHCKC5SHUV5ML8>

<sup>19</sup> Submitted to UNFCCC by the DOE during Request for Revision in Monitoring Plan



In line with the registered PDD and the PPA between the PP and MSEDCL:

- The proposed project activity uses evacuation facilities for sale to grid and the evacuation facility is essentially maintained by the state power utility (MSEDCL).
- The electricity generation measurements are required by the utility and the investors to assess electricity sales revenue and / or wheeling charges.
- The project activity has therefore envisaged two independent measurements of generated electricity from the wind turbines.
- 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 (MSEDCL). Meters for sale to utility are connected to the feeder.
- The joint measurement will be carried out once in a month in presence of both parties (the developer's representative and officials of the state power utility). Both parties will sign the recorded reading.
- 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 (meter reading) on the last day of every calendar month will be kept as a record both in electronic as well as printed (paper) form.

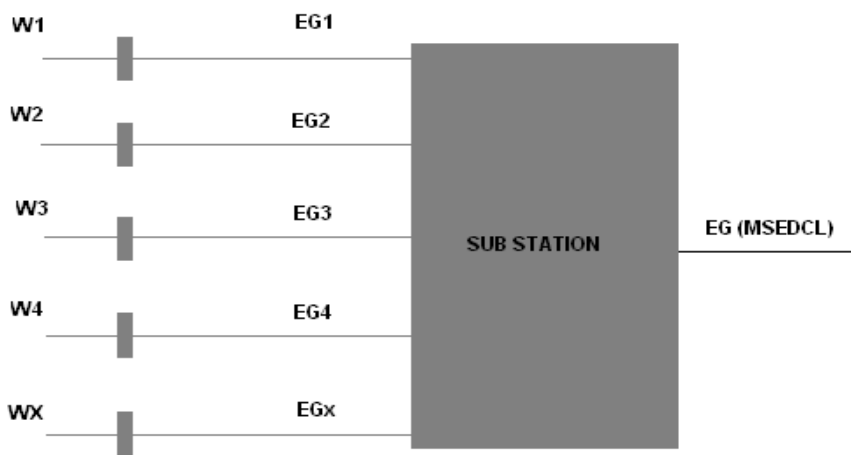
**\*Trivector Meter** - is a device that measures the amount of electrical energy supplied to the utility. It is called as tri-vector meter because it measures energy consumption of the three phase lines R, Y, B which are 120 phase difference from each other. It measures the consumption in terms of the active energy, reactive energy, apparent energy, power factor

#### **Description of calibration of WEG Controller**

SCS Controller is a micro-processor based intelligent controller which has been specially designed for control of wind turbines. It uses a Woodward Multi function Relay that has three current inputs from CT and three direct voltage inputs (690 Volts). The analog values of current/voltage are converted into digital signal internally using A/D Converters at very high sampling rate. A software program reads these values and displays instantaneous parameters such as voltage, current, power factor, kVAh, kVARh and kWh. These instantaneous values are then time integrated and displayed/stored. Woodward relay does not have a display and needs special protocol to view energy readings as this relay communicates digital signal through special communication protocol hence, it is not possible to calibrate. Moreover, turbine can not run without this relay hence it can not be removed for calibration during operation.

#### **Description of billing calculation from net meter to individual meters**

Each substation is connected to a number of wind turbines. The generation reading is collectively displayed by the substation meter. The net generation of each of the wind turbines is then calculated in the following manner:



The generated electricity is measured through inbuilt control panel meter of the WTGs. The monitoring of electricity generation from all these wind turbines is done at common monitoring station as a part of central monitoring system. The system consists of a state-of-the-art controlling and monitoring and well trained staff personnel of O&M contractor, Suzlon Energy Limited, are always present on site to monitor various parameters of power generation and deal with any problems related to generation, transmission or maintenance. The Electricity Generated from the wind turbine/s (either individual or group) of the project proponent in MWh is presented as

$$\sum_{i=1}^n EG_{n,y}$$

And the summation of total Electricity Generated from all the wind turbines at the given site and connected to common bulk meter in MWh as measured at inbuilt control panel meters of the WTGs is presented as:

$$\sum_{i=1}^m EG_{m,y}$$

A ratio based on these two set of measured values is used for apportioning the net electricity supplied to the western regional grid (Now integrated in to NEWNE Grid) by the project activity. The second metering is carried out at grid interconnection point (sub station) wherein the Joint Meter Reading (JMR) is carried out, usually in the first week of every month, in presence of the representatives of the project proponent & the state electricity utility (MSEDCL). This JMR is used for calculation of the amount of electricity supplied to the grid against which the utility makes the payment to the project proponent. The JMR gives both the “export” ( $EG_{JMR,export}$ ) and “import” ( $EG_{JMR,import}$ ) of the electricity to/ from the western grid (Now integrated in to NEWNE Grid).. There are common bulk meter which monitors both the export and import of electricity to the grid.

The apportioning of electricity generated from the various wind turbines is done by MSEDCL based on the values of generation for WTG’s provided by the O & M contractor and Total net electricity supplied to the grid measured at the substation by common bulk meters (main and check meter) as per below enumeration:



$$EG_y = \left[ \frac{\sum_0^n EG_{n,y}}{\sum_0^m EG_{m,y}} \right] \times EG_{MSEDCL}$$

Where

$EG_y$	Net Electricity exported to the grid by the Project Activity.
$\sum_0^n EG_{n,y}$	Electricity generation by WTG/s owned by DJM (either individual or group)
$EG_{MSEDCL}$	Total net electricity supplied to the grid measured at the substation by common bulk meters (main and check meter).
$\sum_0^m EG_{m,y}$	Total electricity generation by all the WTGs connected to the common bulk meters

For this project the feeder connections are as follows:

WTG Location No.	WTG Connected on 220 KV/33KV Feeder	Detail of Feeder Change <sup>20</sup>
K 400	Jamde 15	Gangapur 09
K 401	Jamde 08	Gangapur 09
K 402	Jamde 15	Gangapur 09
K 407	Jamde 08	Gangapur 09
K 412	Jamde 15	Gangapur 08
K 413	Jamde 15	Gangapur 08
K 254	Valve I	-
K 118	Jamde 04	-
J 114	Jamde 03	-
J 115	Jamde 03	-
J 127	Jamde 03	-
J 128	Jamde 03	-

Recording of generation at the joint meter (JMR) is usually from 1st of one month to 1st or 2nd of next month.

#### Routine Maintenance Services:

The project proponents have signed an “Operation and Maintenance” agreement with the supplier of the wind turbines for the operation of the wind farm. The O & M management structure is as follows:

<sup>20</sup> The Feeder was changed from Jamde 08 and Jamde 15 to Gangapur 08 and Gangapur 09 in June 2009.



Routine Maintenance Labour Work involves making available suitable manpower for operation and maintenance of the equipment and covers periodic preventive maintenance, cleaning and upkeep of the equipment including –

- a) Tower Torquing
- b) Blade Cleaning
- c) Nacelle Torquing and Cleaning
- d) Transformer Oil Filtration
- e) Control Panel & LT Panel Maintenance
- f) Site and Transformer Yard Maintenance

**Security Services:** This service includes watch & ward and security of the wind farm and the equipment.

**Management Services:**

- a) Data logging in for power generation, grid availability, machine availability.
- b) Preparation and submission of monthly performance report in agreed format.
- c) Taking monthly meter reading jointly with utility of power generated at wind farm and supplied to grid from the meter/s maintained by utility for the purpose and co-ordinate to obtain necessary power credit report/ certificate.

**Technical Services:**

- a) Visual inspection of the WEG and all parts thereof.
- b) Technical assistance including checking of various technical, safety and operational parameters of the equipment, trouble shooting and relevant technical services.
- c) Annual and monthly training schedules are organized by the manufacturers and suppliers of the wind turbines.

The responsibilities of CDM project team is presented below

Designation	Responsibilities
Project Head	<ul style="list-style-type: none"> <li>▪ Overall performance monitoring</li> <li>▪ Project Execution</li> </ul>
Project Executer and Controller	<ul style="list-style-type: none"> <li>▪ Operation</li> <li>▪ Verification of data</li> <li>▪ Site visit to check authenticity of data and take corrective action, wherever necessary</li> <li>▪ Storage of data</li> </ul>
Site Main Controller	<ul style="list-style-type: none"> <li>▪ Operation, Monitoring and Verification of data</li> <li>▪ Data recording</li> <li>▪ Storage of data</li> </ul>

**Training**

Training of staff operating and maintaining the WTGs is carried out by the WTG manufacturer and supplier (Suzlon). Special emphasis is given to the training of the employees to enable them to develop their skills to meet changing WTG technology and to provide efficient and effective O&M services. There is an initial learning programme as well as continuous learning programmes for all employees.



All newly-hired employees are required to attend an intensive two- to four-week, full-time training programme to familiarize them with business and operations.

Besides the usual training programs for their staff Suzlon conducts specific familiarization capsules for customers, such that they are fully aware of the capabilities of the highly sophisticated WECs of Suzlon.

The training programme focuses mainly on the management, monitoring and maintenance, and safety and reliability aspects of wind power. The objectives include:

1. Understanding the various stages and aspects in the management of Wind Power systems
2. Understanding the importance of monitoring and maintenance of Wind Power systems and hence the various tasks involved in this
3. Understanding the importance of safety and reliability aspects involved with Wind Power and the measures taken.
4. Managing generation and other data for future reference.

#### SECTION D. Data and parameters

<b>D.1. Data and parameters determined at registration and not monitored during the monitoring period, including default values and factors</b>	
<i>(Copy this table for each data and parameter. To report multiple values, a table may be used)</i>	
<b>Data / Parameter:</b>	<b>EF<sub>Grid,v</sub></b>
Data unit:	t CO <sub>2</sub> /MWh
Description:	tons of CO <sub>2</sub> per MWh of electricity produced by the project activity.
Source of data used:	CO <sub>2</sub> Baseline Database for the Indian Power Sector, User Guide, Version 3.0 CEA
Value(s) :	0.8975
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	The value has been provided by Central Electricity Authority for the year 2006-2007
Additional comment:	--

<b>Data / Parameter:</b>	<b>EG<sub>y</sub></b>
Data unit:	MWh
Description:	Net Electricity exported to the grid by the Project Activity.
Measured /Calculated /Default:	Measured and Calculated
Source of data:	Joint meter reading issued by MSEDCL for promoter with the help of O & M contractor by applying logic of apportioning described in section B.7.2 of PDD.
Value(s) of monitored parameter:	38,310.047
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Used for the Baseline Calculation
Monitoring equipment (type, accuracy class,	Please refer Annex I of Monitoring Report.



serial number, calibration frequency, date of last calibration, validity)	
Measuring/ Reading/ Recording frequency:	Monthly
Calculation method (if applicable):	<p>Net Electricity exported to the grid by the Project Activity is calculated based on the monitoring parameter- <math>\sum_0^n EG_{n,y}</math>, <math>EG_{MSEDCL}</math> and <math>\sum_0^m EG_{m,y}</math>.</p> $EG_y = \left[ \frac{\sum_0^n EG_{n,y}}{\sum_0^m EG_{m,y}} \right] \times EG_{MSEDCL}$
QA/QC procedures applied:	<p>The project revenue is based on the net units displaced as calculated by applying apportioning logic on the values that are monitored with the help of metering system involving common bulk meter and inbuilt control panel meter of the WTGs. The common bulk meters constitute main meter and check meter. The accuracy of the main meter and check meter can be verified by comparing with each other. The calibration of the common bulk meters (main &amp; check meter) will be done by state utility normally on annual basis or as per the schedule of MSEDCL.</p>

<b>Data / Parameter:</b>	$\sum_0^n EG_{n,y}$
Data unit:	MWh
Description:	Electricity generation by WTG/s owned by DJM (either individual or group)
Measured /Calculated /Default:	Measured
Source of data:	Monitored through inbuilt control panel meters of the WTGs. The O & M contractor further aggregates (calculates) the monitored readings to arrive at “Total electricity generation by WTGs owned by DJM”.
Value(s) of monitored parameter:	-
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Used for the Baseline Calculation
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Please refer Annex I of Monitoring Report.
Measuring/ Reading/ Recording frequency:	Continuous
Calculation method (if	The electricity generated by the WTGs of DJM is monitored with the



applicable):	help of inbuilt control panel meters installed on all the WTGs. The data is continuously measured at each WTG by inbuilt control panel meter and recorded at CMS maintained by O & M contractor. The aggregated or individual monthly readings of “Total electricity generation by WTGs owned by DJM” is provided by O & M contractor to MSEDCL for apportioning and calculating the net electricity exported by the individual WTG in Joint Meter Reading Report issued by MSEDCL.
QA/QC procedures applied:	As per letter provided by the technology supplier the inbuilt control panel meters can not be calibrated. The meter are of accuracy class of 0.2. Please also refer to detailed description under “Description of calibration of WEG Controller” in section B.7.2 of PDD.

<b>Data / Parameter:</b>	$\sum_0^m EG_{m,y}$
Data unit:	MWh
Description:	Total electricity generation by all the WTGs connected to the common bulk meters
Measured /Calculated /Default:	Measured
Source of data:	Monitored through inbuilt control panel meters of the WTGs. The O & M contractor further aggregates (calculates) the monitored readings to arrive at “Total electricity generation by all the WTGs connected to the common bulk meter”.
Value(s) of monitored parameter:	-
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Used for the Baseline Calculation
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	-
Measuring/ Reading/ Recording frequency:	Monthly
Calculation method (if applicable):	The electricity generated by all the WTGs (including WTGs of DJM) is monitored with the help of inbuilt control panel meters installed on all WTGs (which are connected to common bulk meters i.e. main meter & check meter). The data is continuously measured at each WTG by inbuilt control panel meter and recorded at CMS. The readings are aggregated by the O & M contractor and provided to the MSEDCL for apportioning and calculating the net electricity exported by WTG’s. The reading of “Total electricity generation by all the WTGs connected to the common bulk meter” is monitored by O & M contractor at CMS.
QA/QC procedures applied:	As per letter provided by the technology supplier the inbuilt control panel meters can not be calibrated. Please also refer to detailed description under “Description of calibration of WEG Controller” in



	section B.7.2 of PDD.
<b>Data / Parameter:</b>	EG <sub>MSEDCL</sub>
Data unit:	MWh
Description:	Total net electricity supplied to the grid measured at the substation by common bulk meters (main and check meter).
Measured /Calculated /Default:	Calculated
Source of data:	This parameter is calculated by subtracting imported electricity from the exported electricity to grid and monitored with the help of bulk meters.
Value(s) of monitored parameter:	-
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Used for the Baseline Calculation
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Please refer Annex I of Monitoring Report.
Measuring/ Reading/ Recording frequency:	Monthly
Calculation method (if applicable):	Net export from all the WTGs is calculated by subtracting import from the export. Export and import of electricity is measured at the common bulk meters (i.e. main meter & check meter)The readings at the common bulk meter will be taken on a monthly basis, in presence of the representative of MSEDCL & O & M contractor(PP's representative).
QA/QC procedures applied:	The common bulk meters constitute main meter and check meter. The meter are of accuracy class 0.2. The accuracy of the main meter and check meter can be verified by comparing with each other. The calibration of the common bulk meters (main & check meter) will be done by state utility normally on annual basis or as per the schedule of MSEDCL.

## SECTION E. Emission reductions calculation

### E.1. Baseline emissions calculation

The baseline emission ( $BE_y$  in  $tCO_2$ ) is the product of the baseline emission factor ( $EF_y$  in  $tCO_2/MWh$ ) times the electricity supplied by the project activity to the grid ( $EG_y$  in MWh) minus the baseline electricity supplied to the grid in the case of modified or retrofit facilities ( $EG_{baseline}$  in MWh), as follows:

$$BE_y = (EG_y - EG_{baseline}) * EF_{grid y}$$



Since the following project does not involve any modification or retrofit of the existing generation facility hence  $EG_{\text{baseline}} = 0$

$EF_{\text{grid},y}$  is determined as follows:

The weighted average of the Operating Margin emission factor ( $EF_{\text{OM},y}$ ) and the Build Margin emission factor ( $EF_{\text{BM},y}$ ):

$$EF_{\text{grid},y} = w_{\text{OM}} * EF_{\text{OM},y} + w_{\text{BM}} * EF_{\text{BM},y}$$

where the weights  $w_{\text{OM}}$  and  $w_{\text{BM}}$ , by default, are 50% (i.e.,  $w_{\text{OM}} = w_{\text{BM}} = 0.5$ ), and  $EF_{\text{OM},y}$  and  $EF_{\text{BM},y}$  are calculated as described in Steps 1 and 2 below and are expressed in  $\text{tCO}_2/\text{MWh}$ .

$$EF_{\text{grid},y} = 0.75 \times EF_{\text{OM},y} + 0.25 \times EF_{\text{BM},y}$$

Where

$EF_{\text{OM},y}$  = Operating Margin Emission Factor

$EF_{\text{BM},y}$  = Build Margin Emission Factor

#### 1. Calculation of operating margin emission factor for the region based on simple OM

For calculation of operating margin four options are available:

- a) Simple operating margin;
- b) Simple adjusted operating margin;
- c) Dispatch data analysis operating margin;
- d) Average operating margin.

According to ACM0002 / version 06 dispatch data analysis should be the first choice but for the current project, dispatch data analysis cannot be used because of unavailability of data.

The simple OM method was used as the low-cost/must run resources constitute less than 50% of the total grid generation of Western, Northern and Southern Grid in average of the five most recent years.

The simple OM emission factor ( $EF_{\text{OM, simple}, y}$ ) is calculated as the generation-weighted average emissions per electricity unit ( $\text{tCO}_2/\text{MWh}$  or MU) of all generating sources serving the system, not including low-operating cost and must-run power plants.

$$EF_{\text{OM},y} = \frac{\sum F_{i,j,y} * COEF_{i,j,y}}{\sum GEN_{j,y}}$$

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<sub>2</sub> emission coefficient of fuel i (tCO<sub>2</sub>/ 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 or MU) delivered to the grid by source j.

The CO<sub>2</sub> emission coefficient  $COEF_i$  is obtained as

$$COEF_i = NCV_i * EF_{CO_2,i} * OXID_i$$

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.

$EF_{CO_2,i}$  - is the CO<sub>2</sub> emission factor per unit of energy of the fuel i.

## 2. Calculation of build margin factor for the region (ex ante):

Build margin can be calculated as the generation weighted average emission factor (tCO<sub>2</sub>/MWh or MU) of a sample of power plant *m*, as follows:

$$EF_{BM,y} = \frac{\sum F_{i,m,y} * COEF_{i,m}}{\sum GEN_{m,y}}$$

Where,

$F_{i,m,y}$ ,  $COEF_{i,m}$  are analogous to the variables described for the simple OM method for plants *m*.

## 3. Baseline emission factor (EF<sub>y</sub>):

The baseline emission factor  $EF_y$  is calculated as the weighted average of the operating margin emission factor ( $EF_{OM, simple, y}$ ) and the build margin emission factor ( $EF_{BM, y}$ ), where the weights  $w_{OM}$  and  $w_{BM}$ , by default, are 50% (i.e.,  $w_{OM} = w_{BM} = 0.5$ ), and  $EF_{OM,y}$  and  $EF_{BM,y}$  are calculated as described in Steps 1 and 2 above and are expressed in tCO<sub>2</sub>/MWh or MU.

$$EF_{GRID,Y} = 0.75 * EF_{OM,y} + 0.25 * EF_{BM,y}$$

Baseline Emission Factor Calculation <sup>21</sup>		
Simple Operating Margin		
2004-05	tCO <sub>2</sub> /MWh	1.01
2005-06	tCO <sub>2</sub> /MWh	1.00
2006-07	tCO <sub>2</sub> /MWh	0.99
Average	tCO <sub>2</sub> /MWh	1.00
Build Margin		
2006-07	tCO <sub>2</sub> /MWh	0.59

<sup>21</sup> <http://www.cea.nic.in/planning/c%20and%20e/government%20of%20india%20website.htm> (version03)



Weights		
WOM		0.75
WBM		0.25
$EF_{grid,y} = 0.75 \times EF_{OM,y} + 0.25 \times EF_{BM,y}$ $EF_{grid,y} = 0.75 \times 1.00 + 0.25 \times 0.59$		
Baseline Emission Factor ( $EF_{grid,y}$ )	tCO <sub>2</sub> /MWh	0.8975

### Baseline Emission Calculations

JMRs from the MSEDCL will be the basis of calculation for the PP.

The baseline emission is calculated as:

$$BE_y = EG_y * EF_y$$

Where,

$BE_y$  = Baseline Emissions due to displacement of electricity during the year y (in tons of CO<sub>2</sub>)

$EG_y$  = Net units of electricity due to substituted in the grid during the year y (in MWh)

$EF_y$  = Emission Factor of the grid (in tCO<sub>2</sub>/ MWh) and y is any year within the crediting period of the project activity

### Illustration for Baseline Calculation.

Baseline Calculation for the month of November 2008(Feeder No. J 114) is follows:

Month	Feeder No	Total Generation ( MWh)	Emission Factor of the grid (tCO <sub>2</sub> / MWh)	Baseline Emission (tCO <sub>2</sub> e)
		$EG_y$	$EF_y$	$BE_y$
Nov 2008	J114	32,379	0.8975	29,060.153

Total Baseline Calculation for the Monitoring Period of 24/10/2008 to 30/06/2010 (Inclusive Both Days) as follows:

Period	Total Generation ( MWh)	Emission Factor of the grid (tCO <sub>2</sub> / MWh)	Baseline Emission (tCO <sub>2</sub> e)
	$EG_y$	$EF_y$	$BE_y$
01/11/2008 <sup>22</sup> to 31/12/2008	769.797	0.8975 <sup>23</sup>	690.89
01/01/2009 to 31/12/2009	24,622.632	0.8975	22,098.81
01/01/2010 to 30/06/2010	12,917.618	0.8975	11,593.56
<b>Total</b>	<b>38,310.047</b>		<b>34,383<sup>24</sup></b>

## E.2. Project emissions calculation

### Project Emission

<sup>22</sup> The ER's are claimed in line with the issued JMR. Since there is no JMR available to captive generation from 24/10/2008 to 31/10/2008, the PP is not claiming for any emission reduction. Accordingly the ER claimed from 01/11/2008 to 30/06/2010 (Inclusive both days) based on available JMR's issued by MSEDCL.

<sup>23</sup> CER calculation worksheet.

<sup>24</sup> After rounding down the emission reductions



Being a wind energy project, the project activity does not lead to any form of emission; hence project emission has not been considered in this case.

Hence,  $PE_y = 0$

### E.3. Leakage calculation

#### Leakage Emission

As wind energy projects fall under clean energy sources for electricity generation, the emission from the project is taken as zero.

Hence,  $LE_y = 0$

### E.4. Emission reductions calculation / table

#### Emission Reduction Due to Project Activity

The emission reduction  $ER_y$  by the project activity during a given year  $y$  is the difference between the baseline emissions through substitution of electricity generation with fossil fuels ( $BE_y$ ) and project emissions ( $PE_y$ )

$$ER_y = BE_y - PE_y - LE_y$$

Where:

$ER_y$  = Emission reductions in year  $y$  (t CO<sub>2</sub>/y)

$BE_y$  = Baseline Emissions in year  $y$  (t CO<sub>2</sub>/y)

$PE_y$  = Project emissions in year  $y$  (t CO<sub>2</sub>/y)

$LE_y$  = Leakage emissions in year  $y$  (t CO<sub>2</sub>/y)

**Illustration for emission reduction calculation.**

**Emission Reduction Calculation for the month of November 2008 (Feeder No. J 114) is follows:**

Month	Feeder No.	Baseline Emissions (tCO <sub>2</sub> e)	Project Emission	Leakage (tCO <sub>2</sub> e)	Emission Reduction (tCO <sub>2</sub> e)
Nov 2008	J 114	29,060.153	0	0	29,060.153

**Total Emission Reduction Calculation for the Monitoring Period of 24/10/2008 to 30/06/2010 (Inclusive Both Days) as follows:**

Period	Total Baseline Emissions (tCO <sub>2</sub> e)	Total Project Emission	Total Leakage (tCO <sub>2</sub> e)	Total Emission Reduction (tCO <sub>2</sub> e)



01/11/2008 <sup>25</sup> to 31/12/2008	690.89	0	0	690.89
01/01/2009 to 31/12/2009	22,098.81	0	0	22,098.81
01/01/2010 to 30/06/2010	11,593.56	0	0	11,593.56
<b>Total</b>	<b>34,383</b>	<b>0</b>	<b>0</b>	<b>34,383</b>
<b>Total (after rounding down)</b>				<b>34,383</b>

It is also observed that the MSEDCL has consistently applied the apportioning logic to derive the joint meter readings. The registered monitoring plan captures all the monitoring parameters to replicate the apportioning logic since the % error was observed  $\approx 0\%$ .

#### E.5. Comparison of actual emission reductions with estimates in the CDM-PDD

Comparison of the actual emission reduction with estimate in the CDM-PDD for the said monitoring period i.e. 24/10/2008 to 30/06/2010 (Inclusive Both Days) has been carried out in the following table

Item	Values applied in ex-ante calculation of the registered CDM-PDD	Actual values reached during the monitoring period
<b>Emission reductions (tCO<sub>2</sub>e)</b>	<b>(tonnes CO<sub>2</sub>/year)</b>	<b>(tonnes CO<sub>2</sub>/year)</b>
2008 (01/11/2008 <sup>26</sup> to 31/12/2008)	25,848	690.89
2009 (01/01/2009 to 31/12/2009)	25,848	22,098.81
2010 (01/01/2010 to 30/06/2010)	12,924	11,593.56

#### E.6. Remarks on difference from estimated value in the PDD

Not Applicable please refer section E.5

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#### History of the document

Version	Date	Nature of revision
01	EB 54, Annex 34 28 May 2010	Initial adoption.
<b>Decision Class:</b> Regulatory <b>Document Type:</b> Guideline, Form <b>Business Function:</b> Issuance		

<sup>25</sup> The ER's are claimed in line with the issued JMR. Since there is no JMR available to captive generation from 24/10/2008 to 31/10/2008, the PP is not claiming for any emission reduction. Accordingly the ER claimed from 01/11/2008 to 30/06/2010 (Inclusive both days) based on available JMR's issued by MSEDCL.

<sup>26</sup> The ER's are claimed in line with the issued JMR. Since there is no JMR available to captive generation from 24/10/2008 to 31/10/2008, the PP is not claiming for any emission reduction. Accordingly the ER claimed from 01/11/2008 to 30/06/2010 (Inclusive both days) based on available JMR's issued by MSEDCL.

**Annex I**

WTG Location No.	WTG Connected on 220 KV/33KV Feeder	Meter Details			Date of Calibration
		Type	Accuracy Class	Serial No. (Main Meter)	
K 400	Jamade 15	Electronic Trivector Meter	0.2	04725784	27/05/2008 08/07/2009
	Gangapur 09 <sup>27</sup>	Electronic Trivector Meter	0.2	04961775 <sup>28</sup>	04/05/2009
K401	Jamade 08	Electronic Trivector Meter	0.2	04738079	27/05/2008 08/07/2009
	Gangapur 09 <sup>29</sup>	Electronic Trivector Meter	0.2	04961775 <sup>30</sup>	04/05/2009
K402	Jamade 15	Electronic Trivector Meter	0.2	04725784	27/05/2008 08/07/2009
	Gangapur 09 <sup>31</sup>	Electronic Trivector Meter	0.2	04961775 <sup>32</sup>	04/05/2009
K407	Jamade 08	Electronic Trivector Meter	0.2	04738079	27/05/2008 08/07/2009
	Gangapur 09 <sup>33</sup>	Electronic Trivector Meter	0.2	04961775 <sup>34</sup>	04/05/2009
K412	Jamade 15	Electronic Trivector Meter	0.2	04725784	27/05/2008 08/07/2009
	Gangapur 08 <sup>35</sup>	Electronic Trivector Meter	0.2	04961738 <sup>36</sup>	04/05/2009
K413	Jamade 15	Electronic Trivector Meter	0.2	04725784	27/05/2008 08/07/2009
	Gangapur 08 <sup>37</sup>	Electronic Trivector Meter	0.2	04961738 <sup>38</sup>	04/05/2009

<sup>27</sup> Feeder was changed from Jamde 15 to Gangapur 09 in June 2009<sup>28</sup> Meter were changed in June 2009<sup>29</sup> Feeder was changed from Jamde 08 to Gangapur 09 in June 2009<sup>30</sup> Meter were changed in June 2009<sup>31</sup> Feeder was changed from Jamde 15 to Gangapur 09 in June 2009<sup>32</sup> Meter were changed in June 2009<sup>33</sup> Feeder was changed from Jamde 08 to Gangapur 09 in June 2009<sup>34</sup> Meter were changed in June 2009<sup>35</sup> Feeder was changed from Jamde 15 to Gangapur 09 in June 2009<sup>36</sup> Meter were changed in June 2009<sup>37</sup> Feeder was changed from Jamde 15 to Gangapur 09 in June 2009<sup>38</sup> Meter were changed in June 2009



K118	Jamde 04	Electronic Trivector Meter	0.2	04862460	27/05/2008 08/07/2009
K254	Valve I	Electronic Trivector Meter	0.2	04725793	27/05/2008 08/07/2009
J114	Jamde 03	Electronic Trivector Meter	0.2	04862465	27/05/2008 08/07/2009
J128	Jamde 03	Electronic Trivector Meter	0.2	04862465	27/05/2008 08/07/2009
J127	Jamde 03	Electronic Trivector Meter	0.2	04862465	27/05/2008 08/07/2009
J115	Jamde 03	Main Meter	0.2	04862465	27/05/2008 08/07/2009