



2.5 MW BUNDLED WIND POWER PROJECT IN MAHARASHTRA (INDIA)



Document Prepared By EKI Energy Services Limited

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Project Title	2.5 MW Bundled Wind Power Project in Maharashtra (India)
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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

The Wind Power Project of 2.5 MW installed capacity enabling generation of electricity by state-of-art 1.25 MW Wind Turbine Generators (WTGs) in the State of Maharashtra was installed by Raj Infrastructure Development (India) Pvt. Ltd. (Pune) and Raj Promoters & Civil Engineers. Pvt. Ltd, Pune. However, the bundled CDM project activity has been proposed by Raj Infrastructure Development (India) Pvt. Ltd.

The bundled project activity consists of 2 sub-bundles described as below:

Sub-Bundles	No. x Capacity	Name of Promoter	WTG Manufacturer	Date of Commissioning	Location
I	1 no. x 1.25 MW	Raj Infrastructure Development (India) Pvt. Ltd.	SUZLON	13 August, 2006	WTG No. – J 129 Gut No. – 90 Compartment No. –141 Sr. No. – 64039789 Village – Chhadvel Taluka – Sakri District – Dhule
II	1 no. x 1.25 MW	Raj Promoters & Civil Engineers. Pvt. Ltd.	SUZLON	30 September, 2006	WTG No. – J 116 Gut No. – 16 Compartment No. –442 Sr. No. – 64039585 Village – Isharde Taluka – Sakri District – Dhule

Purpose of the project activity:

The main purpose of the project activity is to generate electrical energy through sustainable means using wind power resources, to utilize the generated output for selling it to the state electricity utility and to contribute to climate change mitigation efforts.

Apart from generation of renewable electricity, the project has also been conceived for the following:

- To enhance the propagation of commercialisation of wind turbines in theregion.
- To contribute to the sustainable development of the region, socially, environmentally and economically.
- ToreducetheprevalentregulatoryrisksforthisprojectthroughrevenuesfromtheCD

M.

The actual emission reductions achieved for this monitoring period is 18,410 tCO₂e.

1.2 Sectoral Scope and Project Type

Sectoral Scope: 1

Project Type: Energy industries (renewable - / non-renewable sources)

This is not a grouped project activity

1.3 Project Proponent

Organization name	M/s Raj Infrastructures Development, (India) Pvt. Ltd.
Contact person	Rajendra Hiremath
Title	2.5 MW Bundled Wind Power Project in Maharashtra (India)
Address	410, Pride silicon plaza, Senapati Bapat Road, Pune - 411016
Telephone	+91 9822046604
Email	drhiremathraju@rediffmail.com

1.4 Other Entities Involved in the Project

Organization name	EKI Energy Services Limited
Role in the Project	MD CEO
Contact person	Mr. Manish Dabkara
Title	Project Manager
Address	Office No 201, Plot No 48, Scheme 78, Vijay Nagar Part- II, Indore 452010, India
Telephone	+91-731-4289086
Email	manish@enkingint.org

1.5 Project Start Date

Project start date is 13-August-2006 (Commissioning date of first WTG in bundled project activity).

1.6 Project Crediting Period

Crediting period for this project is from 25-April-2007 to 24-April-2017 that is fixed for 10 Years 00 Month.

1.7 Project Location

City/Town:

Sub-Bundles	I	II
Site/Village	Isharde (1 x 1.25 MW)	Chhadvel (1 x 1.25 MW)
Taluka	Sakri	Sakri
District	Dhule	Dhule

State: Maharashtra

Country: India

Unique identification of Project Activity		
Sub-Bundles	I	II
Site/Village	Isharde (1 x 1.25 MW)	Chhadvel (1 x 1.25 MW)
WTG Location No.	J 116	J 129
Gut No.	16	90
Compartment No.	442	141
Sr. No.	64039585	64039789
Latitude	17.6167, (DMS) – 17°37'0" N	17.6167, (DMS) – 17°37'0" N
Longitude	77.9500, (DMS) – 77°57'0" E	77.9500, (DMS) – 77°57'0" E



Figure 01- Location Map

1.8 Title and Reference of Methodology

Project Type: I – Renewable Energy Projects

Project Category: D – Grid connected renewable electricity generation (Version 13: EB 36)¹

Reference: Appendix B of the simplified modalities and procedures for small-scale CDM project activities i.e, 'indicative simplified baseline and monitoring methodologies for selected small- scale CDM project activity categories –Version 10'.

This methodology also refers to:

- Tool to calculate the emission factor for an electricity system (Version 1.1, EB 35)²
Additionality tool for small scale project activities (Attachment A to Appendix B, Version 06: 30 September 2005³.

¹https://cdm.unfccc.int/filestorage/C/D/M/CDMWF_AM_PHPV5WESACMBTJ2YY54GAJYSIEI3HD/AMS_I.D_rev_ver13.pdf?t=d058cjZtazhvfdCDvu8UWvxHY-KYWNcTz7J3

²<https://cdm.unfccc.int/methodologies/PAMethodologies/tools/am-tool-07-v1.1.pdf>

1.9 Participation under other GHG Programs

Project has been registered with UNFCCC under Clean Development Mechanism program, Registration reference number is 2543. For the monitoring period 12-June-2009 to 30-June-2010 and 01-July-2010 to 01-July-2011 there are 3,314 and 3,005 GHG credits are claimed respectively under Clean Development Mechanism and for the current monitoring period there is no GHG credits claimed under the CDM.

The crediting period start date had been approved/accepted and freezed in accordance with previous standards and guidelines. As per the previous verification the first verification is in VCS from 25/04/2007 to 31/05/2009 after that the 2nd verification is done in CDM from 12/06/2009 to 01/07/2011.

Hence the crediting period start date is not matching with the start date.

The Project is not rejected by any other GHG programs.

1.10 Other Forms of Credit

India is Non-annex1 country and there is no compliance with an emission trading program or to meet binding limits on GHG emissions for this project activity. The project is registered under CDM with registration ID 2543. Project Proponent has submitted undertaking that they will not claim same GHG emission reductions of the project from CDM and VCS. PP would not use net GHG emission reductions by the projects for compliance with emission trading program to meet binding limits on GHG emissions. PP has also submitted an undertaking stating that they will not take REC benefits for the same Emission Reductions.

Project has been registered with UNFCCC under Clean Development Mechanism program. Registration reference number is 2543. Project Proponent has submitted undertaking for not availing other forms of environmental credit for the same monitoring period under consideration. Project Participant is not taking REC benefits for the same emission reductions.

1.11 Sustainable Development Contributions

Contribution of project activity to sustainable development:

Government of India has stipulated following indicators for sustainable development in the interim approval guidelines¹ for CDM projects.

- **Social well-being**

The proposed project activity leads to alleviation of poverty by establishing direct and indirect employment benefits accruing out of ancillary units for manufacturing towers for erecting the WTGs and for maintenance during operation of the project activity. The infrastructure in and around the project area will also improve due to project activities. This includes development of road network and improvement of the quality of electricity in terms of its availability and frequency as the generated electricity is fed into a deficit grid.

³https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-21-v1.pdf/history_view

- **Economic well-being**

The project contributes to the economic sustainability around the plant site, which is promotion of decentralization of economic power, leading to diversification of the national energy supply, which is dominated by conventional fuel based generating units. The generated electricity is fed into the Western Regional Grid thereby improving the grid frequency and availability of electricity to the local consumers which will provide new opportunities for industries and economic activities to be setup in the area thereby resulting in greater local employment, ultimately leading to overall development.

- **Environmental well-being**

The project utilizes wind energy for generating electricity which otherwise would have been generated through alternate fuels (most likely - fossil fuel) based power plants, thereby contributing to the reduction in specific emissions (emissions of pollutant/unit of energy generated) including GHG emissions. As wind power projects produce no end products in the form of solid waste (ash etc.), they address the problem of solid waste disposal encountered by most other sources of power. Being a renewable resource, using wind energy to generate electricity contributes to resource conservation. Thus the project causes no negative impact on the surrounding environment contributing to environmental well-being.

- **Technological well-being**

The project activity leads to the promotion of renewable energy generation by wind, demonstrating the success of wind turbine generators in the region, 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.

In view of the above, the project participant considers that the project activity profoundly contributes to the sustainable development.

Table 1: Sustainable Development Contributions

Row number	SDG Target	SDG Indicator	Net Impact on SDG Indicator	Current Project Contributions	Contributions Over Project Lifetime
Sequential row number	SDG Target number	Number and text of SDG indicator or, if no official SDG indicator is applicable, user-defined indicator	Indicate the project's contribution to the SDG Indicator (implemented activities to increase or decrease)	Brief description of the quantifiable impact of the project's activities related to the SDG indicator, during the monitoring period.	Brief description of the cumulative quantifiable impact of the project's activities related to the SDG indicator, over the project lifetime.
1)	NA				

This Section is not applicable.

2 SAFEGUARDS

2.1 No Net Harm

Renewable energy projects are not mandated in India by any enforced law or other regulatory framework. However, for guidance on voluntary wind energy based electricity generation, there are policies introduced/incentives declared by the state governments. These policies have been considered for the project activity and are available at <http://www.windpowerindia.com/govtinc.html>

Wind power is one of the cleanest sources of renewable energy, with no associated emissions and waste products. In India, as per the provisions under the EIA Notification of 1994, wind power projects do not require an Environmental Impact Assessment.

The project activity does not involve any major construction activity. It primarily requires the installation of Wind Turbine Generators.

The report on “Developmental Impacts and Sustainable Governance Aspects of Renewable Energy Projects” prepared by MNRE dated September 2013. This report clearly mentioned that wind power project activity operations do not result in direct air pollution, noise pollution.

Thus there are no any significant impacts due to implementation of project activity on air, water, soil quality and ambience are envisaged due to the project activity.

2.2 Local Stakeholder Consultation

The project promoter identified local communities, farmers, and villagers, as the stakeholders with an interest in the CDM activities. The meeting was conducted separately for both the sites. Accordingly, issued letters to all the respective stakeholders requesting to attend meeting or depute representatives at respective venues:

Sub-Bundles	Promoter	WTG Location	Venue	Date and Time
I	Raj Promoters & Civil Engineers. Pvt. Ltd.	WTG No. – J 116 Gut No. – 16 Compartment No. – 442 Sr. No. – 64039585 Village – Isharde Taluka – Sakri District – Dhule	Village- Vasant Nagar District- Dhule	05/12/2007, 11:30 AM

II	Raj Infrastructure Development (India) Pvt. Ltd.	WTG No. – J 129 Gut No. – 90 Compartment No. – 141 Sr. No. – 64039789 Village – Chhadvel Taluka – Sakri District – Dhule	Village-Bramhanvel District- Dhule	05/12/2007, 11:30 AM
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The agenda of the meeting was fixed as follows:

- Welcome.
- Description of the project.
- Queries and responses from the proponent and the stakeholders.
- Vote of thanks.

The stakeholder's view is Raj Group in its own small way is contributing positively to local economy & development.

Stakeholders had no objections from installations of WTGs instead they have openly said that wind power projects helped to them by-

- Additional revenue generated through land/lease to outsiders like contractors & their employees.
- Job opportunities for day-to-day maintenance and security of WTGs
- Development of roads.
- No any adverse impact on rains, agriculture.

The stakeholders have given positive feedback and thus no measures were required to be taken

The Grievances received during the current Monitoring Period has been mentioned below:

S.No.	WTG number	Comment/Grievance Received	Date	Action Taken	Date	Result
1.	J-129	Improper water management at site leads to shortage of drinking water	04-March-2013	Designated RO were installed only for sole water in drinking purpose	07-March-2013	Issue resolved

		Improper garden management at the site	04-August-2015	A gardener was hired to take care of the gardenProper	06-August-2015	Issue resolved
		Shortage of additional help	11-April-2016	Additional helper boy was hired to ensure the proper help given to the employees.	12-April-2016	Issue resolved
2.	J-116	No proper street lighting facility on the way to the site	13-January-2014	street lighting were constructed on the side ways of the road	20-January-2014	Issue resolved
		Roads to the Site are illegitimate	07-November-2016	Proper roads were made to the site	30-November-2016	Issue resolved

2.3 AFOLU-Specific Safeguards

Not applicable to this as this is not an AFOLU project activity.

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

Type : I – Renewable Energy Projects
Project Category : AMS I.D. – Grid connected renewable electricity generation (Version 13: EB 36)

Technology Used:

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 wind turbines, it is converted into mechanical energy and rotates the wind blades. When the wind blades rotate, the shaft connected to the generator also rotates, thereby producing electricity.

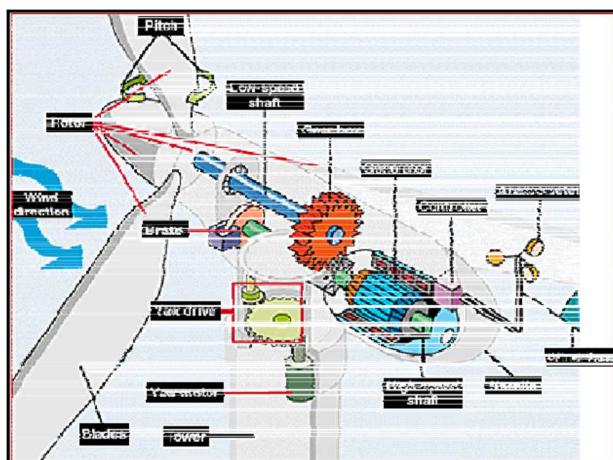


Figure 02: Major Mechanical Parts of a Wind Turbine

The technology is a clean technology since there are no GHG emissions associated with the electricity generation. The project installs Suzlon make WTGs of individual capacity 1.25 MW (2 machines).

Salient Features 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 ²
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 gearbox, 1 planetary & 2 helical.
20.	Gear box manufacturer	Winergy
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	Polyamide slide bearing
Safety system		
26.	Aerodynamic brake	3 times independent pitch regulation
27.	Mechanical brake	Spring power disc brake, hydraulically released, fail safe. Microprocessor Controlled, indicating.
28.	Control unit	Actual operating conditions, UPS back-up system
39.	Tower	Tubular
31.	Design standards	GL/IEC

Note: This project does not involve any technology transfer. It is an indigenous technology implemented for project activity.

3.2 Deviations

3.2.1 Methodology Deviations

No methodology deviation is applied during the monitoring period.

3.2.2 Project Description Deviations

Deviation 1: The following parameters have now been removed as these parameters are not contributing for the calculation of emission reductions:

- Total Electricity Generated from the other wind turbines attached to the common MSEDCL meter at the sub-station
- Electricity supplied to the grid from SEL wind farm from all wind turbines (including project activity) attached to the common MSEDCL meter at the substation and metered jointly by SEL representative and MSEDCL
- Electricity drawn from the grid by SEL wind farm for all wind turbines (including project activity) attached to the common MSEDCL meter at the substation and metered jointly by SEL representative and MSEDCL

Hence the above project parameters have now been removed.

Deviation 2: In case the dates of monitoring period do not match with meter reading cycle, an apportioning procedure has now been incorporated in section 4.3 “Monitoring plan” of the monitoring report. Earlier it was not defined in the monitoring plan of registered PD. The Deviation doesn’t alter the project design, monitoring approach, and emission reduction calculations. The nature of deviation is permanent.

Deviation 3: The VCS first verification choose the monitoring end date of 31-May-2009, due to the ease of data monitoring and calculation. The second verification (in CDM) started with 12-June-2009 i.e. the registration date. There is an unverified period from 1-June-2009 to 11-June-2009, and PP will not verify the 11 days generation as it was left unintentionally. With this deviation, PP declares that mentioned period will not be verified in future. Therefore, there is no negative issuance during the gap period.

The Deviation doesn’t alter the project design, monitoring approach, and emission reduction calculations. The nature of deviation is permanent.

3.3 Grouped Projects

Not applicable as it is not a grouped project

4 DATA AND PARAMETERS

4.1 Data and Parameters Available at Validation

Data / Parameter	EF _{grid, CM, y}
Data unit	tCO ₂ / GWh
Description	CO ₂ Combined Margin emission factor for the Western

	Region Grid
Source of data	CO ₂ Baseline Database –Version 3, 15 December 2007 by Central Electricity Authority. http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm
Value applied	$EF_{grid,CM,y} = EF_{grid,OM,y} \times 0.75 + EF_{grid,BM,y} \times 0.25$ $= 1003 \times 0.75 + 594 \times 0.25$ $= 752.25 + 148.5$ $= 901 \text{ tCO}_2/\text{GWh}$
Justification of choice of data or description of measurement methods and procedures applied	Estimated as per 'Tool to calculate the emission factor for an electricity system - Version 1' using values of OM and BM values as shown above.
Purpose of Data	To calculate the emission reductions.
Comments	This is an ex-ante parameter and fixed at the time of registration for the entire crediting period.

Data / Parameter	$EF_{OM, y}$												
Data unit	tCO ₂ / GWh												
Description	CO ₂ Operating Margin emission factor for the Western Region Grid (Three years average has been taken)												
Source of data	CO ₂ Baseline Database –Version 3, 15 December 2007 by Central Electricity Authority. http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm												
Value applied	<table border="1"> <thead> <tr> <th colspan="2">Simple Operating Margin Emission Factor (Western Region) in tCO₂/GWh</th> </tr> <tr> <th>Year</th><th>Simple OM</th></tr> </thead> <tbody> <tr> <td>2004-2005</td><td>1013</td></tr> <tr> <td>2005-2006</td><td>1004</td></tr> <tr> <td>2006-2007</td><td>994</td></tr> <tr> <td>Average of 3 years</td><td>1003</td></tr> </tbody> </table>	Simple Operating Margin Emission Factor (Western Region) in tCO ₂ /GWh		Year	Simple OM	2004-2005	1013	2005-2006	1004	2006-2007	994	Average of 3 years	1003
Simple Operating Margin Emission Factor (Western Region) in tCO ₂ /GWh													
Year	Simple OM												
2004-2005	1013												
2005-2006	1004												
2006-2007	994												
Average of 3 years	1003												
Justification of choice of data or description of	The Central Electricity Authority, Ministry of Power, Government of India prepares the data.												

measurement methods and procedures applied	
Purpose of Data	To calculate the emission reductions.
Comments	This database is an official publication of Government of India for the purpose of CDM baselines. It is based on most recent data available to the Central Electricity Authority and hence authentic. Promoter has opted for <i>ex ante</i> method to calculate operating margin and hence it will remain fixed throughout the 10 years of crediting period and hence need not be monitored every year.

Data / Parameter	EF_{BM, y}				
Data unit	tCO ₂ / GWh				
Description	CO ₂ Build Margin emission factor for the Western Region Grid 2006- 2007				
Source of data	CO ₂ Baseline Database –Version 3, 15 December 2007 by Central Electricity Authority. http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm				
Value applied	<u>Build Margin emission factor (Western Region) int CO₂/G Wh</u> <table><tr><th>Year</th><th>BM</th></tr><tr><td>2006-2007</td><td>594</td></tr></table>	Year	BM	2006-2007	594
Year	BM				
2006-2007	594				
Justification of choice of data or description of measurement methods and procedures applied	The Central Electricity Authority, Ministry of Power, Government of India prepares the data.				
Purpose of Data	To calculate the emission reductions.				
Comments	This database is an official publication of Government of India for the purpose of CDM baselines. It is based on most recent data available to the Central Electricity Authority and hence authentic. Promoter has opted for <i>ex ante</i> method to calculate build margin and hence it will remain fixed throughout the 10 years of crediting period and hence need not be monitored every year.				

4.2 Data and Parameters Monitored

Data / Parameter	EG_y
Data unit	MWh

Description	Net electricity supplied to the grid by the Project
Source of data	As available in the project proponent records
Description of measurement methods and procedures to be applied	Calculated based on the measured data
Frequency of monitoring/recording	Monthly recording
Value monitored	20,433
Monitoring equipment	Energy Meters
QA/QC procedures to be applied	The quantity of net electricity supplied will be cross-verified from the invoice raised on MSEDCL by the project proponent. Also refer section 4.3 of the monitoring period.
Purpose of the data	To calculate the emission reductions
Calculation method	Net electricity supplied to grid will be calculated based on the measured values of “export” and “import” on the MSEDCL meter, where joint reading is taken by SEL representative and MSEDCL officials. Since this meter is common to project activity and other wind turbines that are not under this project activity, the apportioning of net electricity would be done based on electricity generated from individual wind turbines. Refer Section 4.3 of the monitoring report for the details of apportioning methodology followed by SEL and accepted by MSEDCL.
Comments	The data will be archived for crediting period + 2 years.

Data / Parameter	$\sum_{n=0}^n EG_{n,y}$
Data unit	MWh
Description	Total Electricity Generated from two wind turbines of Raj group
Source of data	Metered at windmill site metering station. $EG_{n,y}$ will be a summation of values taken from individual meters of the

	two wind turbines
Description of measurement methods and procedures to be applied	Measured
Frequency of monitoring/recording	Monthly recording
Value monitored	20,533
Monitoring equipment	Energy Meters
QA/QC procedures to be applied	Refer section 4.3 of the monitoring period.
Purpose of the data	To calculate the emission reductions
Calculation method	This value will be used for apportioning of the net electricity supplied to the Western Regional Grid by the CDM project activity, as metered in “joint meter” of MSEDCL.
Comments	The data will be archived for crediting period + 2 years.

Data / Parameter	EG_{JMR, Raj, export}
Data unit	MWh
Description	Electricity supplied to the grid from the project activity
Source of data	Calculated from EG _{JMR, export} which is a metered value
Description of measurement methods and procedures to be applied	This value will not be directly used for estimation of emission reduction.
Frequency of monitoring/recording	Monthly recording
Value monitored	20,533
Monitoring equipment	Energy Meters
QA/QC procedures to be applied	Refer section 4.3 of the monitoring period.
Purpose of the data	To calculate the Baseline Emissions

Calculation method	This value will be apportioned to the project activity based on the values of $\sum_{0}^n EG_{n,y}$ and $\sum_{0}^n EG_{m,y}$ as per the formula in Section 4.3
Comments	The data will be archived for crediting period + 2 years.

Data / Parameter	EG_{JMR, Raj, import}
Data unit	MWh
Description	Electricity drawn from the grid by the project activity
Source of data	Calculated from EG _{JMR, export} which is a metered value
Description of measurement methods and procedures to be applied	Measured
Frequency of monitoring/recording	Monthly recording
Value monitored	100.00
Monitoring equipment	Energy Meters
QA/QC procedures to be applied	Refer section 4.3 of the monitoring period.
Purpose of the data	To calculate the Baseline Emissions
Calculation method	This value will be apportioned to the project activity based on the values $\sum_{0}^n EG_{n,v}$ and $\sum_{0}^n EG_{m,v}$ as per the formula in Section 4.3
Comments	The data will be archived for crediting period + 2 years.

4.3 Monitoring Plan

The applied small-scale methodology, AMS-I-D, requires monitoring of the electricity supplied to the grid.

Project proponent has signed an 'Operation and Maintenance' contract with the supplier, Suzlon Energy Ltd. to operate the wind mills for a period of ten years from the date of commissioning of each Wind Turbine Generator. The performance of the mills, safety in

operation and scheduled/breakdown maintenances are organized and monitored by the contractor. SEL will monitor the generation of the WTG daily on a regular basis and will maintain a log book recording daily generation details for each WTG comprising the project, as metered at the wind farm. SEL will also provide daily generation data through website.

A power purchase agreement has been signed with MSEDCL. Raj Group installed Real Time TOD Meters with online reading features at the Metering Point (the Main Meter). The metering equipment is duly approved, tested and sealed by MSEDCL. The metering equipment (consisting of the Main Meter and the Check Meter) is identical in make and technical standards and is of 0.2% accuracy class and calibration. They comply with the requirements of the Electricity Rules. The meter readings at the Metering Point are undertaken jointly by the representatives of the State Grid/ MSEDCL and the representative of SEL in the first week of every month. The meter readings are jointly certified by representatives of the State Grid/ MSEDCL and SEL. However, it is the reading of the Main meter that is considered for billing purpose. In case of error/failure in the main meter, the check meter reading is taken and the main meter is immediately calibrated /replaced by MSEDCL.

The MSEDCL carries out the calibration, periodical testing, sealing and maintenance of meters in the presence of SEL representative. The frequency of meter testing is annual. All meters are tested only at the Metering Point. The technicality involved in the operation of the Panel Meter i.e. the meter that is located at the base of the WTG is mentioned below.

The controller used for the WTG is 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 is 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 is having no display and needs special protocol to view energy readings as this relay is communicating digital signal through special communication protocol. In case of any problem related to the panel meter, the WTG will automatically get shut down and the meter will be replaced by a new meter immediately.

The generated electricity is measured through a twostep procedure wherein the first metering is carried out at the controller of the machine with on-board meter. The monitoring of all these wind turbines is done from a 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 Ltd, are always present

on site to monitor various parameters of power generation and deal with any problems related to generation, transmission or maintenance. $EG_{n,y}$ is the electricity generated from an individual wind turbine measured through its controller meter. The summation of total Electricity Generated from two wind turbines of the project proponent from individual wind turbine meters in MWh is

n

presented as $\sum EG_{n,y}$, and the summation of total Electricity Generated from the other wind turbines

n

attached to the common MSEDCL meter at the sub-station in MWh is presented as $\sum EG_m$,

y

0

A ratio based on these two sets of measured values would use for apportioning the net electricity supplied to the Western Regional Grid by the project activity.

The second metering is carried out at grid interconnection point (substation) wherein the Joint Meter Reading (JMR) is carried out on 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 Regional Grid. There is a single meter which gives both the export and import values, this metered reading would give value net of line losses and auxiliary consumption.

In case of mismatch between billing cycle and the monitoring period, the apportioning will be done based on the generation ratio obtained from the daily generation reports provided by the technology supplier.

The formula used to calculate the net power generated for the intervening period will be as follows:

Net Electricity generated for the Intervening period = Total power generated for the complete month as per JMR * Generation Ratio

Generation Ratio: Controller reading for the intervening period/Controller reading for the complete month.

The Accounts department of Raj Group receives the data from both the sources and keeps track of project activity which reduces the carbon emission reductions. The project performance is communicated to the higher management by the accounts department.

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

Baseline Emission Calculation:

For all other systems, the baseline (BE electricity, y) is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in kg CO₂equ/kWh). Hence baseline emissions of the project activity the project have been calculated by using following equation:

$$BE_{\text{electricity, y}} = EG_y \times EF_{\text{grid, CM, y}}$$

Where,

EG_y = Net quantity of electricity supplied to the manufacturing facility by the project during the year y in MWh, and $EF_{\text{grid, CM, y}}$ = Grid emission coefficient for the electricity displaced due to the project activity during the year y (tCO₂/MWh).

By using the above equation, Baseline Calculation for the Monitoring Period of 02/07/2011 to 24/04/2017 (Inclusive Both Days) is as follows:

$$BE_{\text{electricity, y}} = EG_y \times EF_{\text{grid, CM, y}}$$

$$BE_{\text{electricity, y}} = 20,433 \text{ MWh} \times 0.901 \text{ tCO}_2\text{e/MWh}$$

$$BE_{\text{electricity, y}} = 18,410 \text{ tCO}_2\text{e}$$

5.2 Project Emissions

Since the project activity involves generation of power through wind, there is no project emissions associated with the project activity.

Hence, $PE_y = 0$

5.3 Leakage

Leakage is not applicable, as the conditions prescribed for leakage in para 12 of the methodology AMS I.D. version 13 is not applicable for the present case.

Hence, $LE_y = 0$

5.4 Net GHG Emission Reductions and Removals

Year	Baseline emissions or removals	Project emissions or removals (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Net GHG emission reductions or removals
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	(tCO ₂ e)			(tCO ₂ e)
02-July-2011 to 31-december-2011	1,328	0	0	1,328
01-January-2012 to 31-December-2012	3,712	0	0	3,712
01-January-2013 to 31-December-2013	3,570	0	0	3,570
01-January-2014 to 31-December-2014	3,223	0	0	3,223
01-January-2015 to 31-December-2015	2,946	0	0	2,946
01-January-2016 to 31-December-2016	3,040	0	0	3,040
01-January-2017 to 24-April-2017	588	0	0	588
Total	18,410	0	0	18,410

The actual VER is about 20% lower than the estimated VER. This variation is majorly due to the variations in wind flow pattern, grid availability and other parameters which are not in the control of PP. The above variations is conservative.

APPENDIX 1: CALIBRATION DETAILS

Meter Serial No.		Date of Calibration	Due Date of Calibration	Accuracy Class	Calibration Frequency
WTG J129	WTG J116				
04725791 (Main Meter)	04890562 (Main Meter)	26/04/2011	25/04/2012	0.2%	Yearly
04763795 (Check Meter)	04863441 (Check Meter)	24/04/2012	23/04/2013	0.2%	Yearly
		28/03/2013	27/03/2014	0.2%	Yearly
		05/03/2014	04/03/2015	0.2%	Yearly
02814591 (Main Meter)	04890562 (Main Meter)	16/02/2015	15/02/2016	0.2%	Yearly
02814592 (Check Meter)	04863441 (Check Meter)	13/02/2016	12/02/2017	0.2%	Yearly
		09/02/2017	08/02/2018	0.2%	Yearly
02814591	02831466(Main	23/01/2018	22/01/2019	0.2%	Yearly

(Main Meter) 02814592 (Check Meter)	Meter) 02831467 (Check Meter)	20/01/2019	19/01/2020	0.2%	Yearly
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APPENDIX 2: MAJOR BREAKDOWN DETAILS

Generation Date	Customer name	State	WTG Number	Breakdown remark	Breakdown Hours
10-August-2011	M/s Raj Infrastructure Development, (India) Pvt. Ltd.	Maharashtra	J-129	CLS Generator Lubrication Stop	9:00
27-December-2011	M/s Raj Infrastructure Development, (India) Pvt. Ltd.	Maharashtra	J-129	Mech Gear Oil Filter Choked Stop	17:00
05-May-2012	M/s Raj Infrastructure Development, (India) Pvt. Ltd.	Maharashtra	J-129	CLS Generator Lubrication Stop	12:00
12-October-2012	M/s Raj Infrastructure Development, (India) Pvt. Ltd.	Maharashtra	J-116	CLS Pitch Slew Ring Lubrication Stop	14:00
27-November-2012	M/s Raj Infrastructure Development, (India) Pvt. Ltd.	Maharashtra	J-116	Pitch Resolver Encoder Stop	18:00
10-January-2013	M/s Raj Infrastructure Development, (India) Pvt. Ltd.	Maharashtra	J-129	Rep Pitch Frequency Pitch2 Stop	10:00
16-March-2013	M/s Raj Infrastructure Development, (India) Pvt. Ltd.	Maharashtra	J-129	CLS Generator Lubrication Stop	9:00
09-May-2013	M/s Raj Infrastructure Development, (India) Pvt. Ltd.	Maharashtra	J-116	Mech Gear Oil Filter Choked Stop	17:00
22-November-2013	M/s Raj Infrastructure Development, (India) Pvt. Ltd.	Maharashtra	J-129	Rep Pitch Freq Conv Pitch1 Stop	10:00

30-November-2013	M/s Raj Infrastructure Development, (India) Pvt. Ltd.	Maharashtra	J-129	Forcefull Stoppage	6:00
28-December-2013	M/s Raj Infrastructure Development, (India) Pvt. Ltd.	Maharashtra	J-116	Forcefull Stoppage	12:00
01-March-2014	M/s Raj Infrastructure Development, (India) Pvt. Ltd.	Maharashtra	J-116	Elec Saftey Chain Stop	10:00
06-June-2014	M/s Raj Infrastructure Development, (India) Pvt. Ltd.	Maharashtra	J-129	Elec Saftey Chain Stop	12:00
09-Semptember-2014	M/s Raj Infrastructure Development, (India) Pvt. Ltd.	Maharashtra	J-129	INTL_Line Breakdown due to E/F	10:00
08-October-2014	M/s Raj Infrastructure Development, (India) Pvt. Ltd.	Maharashtra	J-116	INTL_Line Breakdown due to E/F	6:00
02-December-2014	M/s Raj Infrastructure Development, (India) Pvt. Ltd.	Maharashtra	J-116	Forcefull Stoppage	Month
02-January-2015	M/s Raj Infrastructure Development, (India) Pvt. Ltd.	Maharashtra	J-116	Forcefull Stoppage	Month
25-April-2015	M/s Raj Infrastructure Development, (India) Pvt. Ltd.	Maharashtra	J-116	Mech Gear Oil Filter Choked Stop	10:00
17-June-2015	M/s Raj Infrastructure Development, (India) Pvt. Ltd.	Maharashtra	J-129	Rep Pitch Freq Conv Pitch1 Stop	9:00
19-September-2015	M/s Raj Infrastructure Development, (India) Pvt. Ltd.	Maharashtra	J-129	Forcefull Stoppage	17:00
15-October-2015	M/s Raj Infrastructure Development, (India) Pvt. Ltd.	Maharashtra	J-116	Forcefull Stoppage	10:00
10-November-2015	M/s Raj Infrastructure Development, (India) Pvt. Ltd.	Maharashtra	J-116	Elec Saftey Chain Stop	6:00
02-June-2016	M/s Raj Infrastructure Development, (India) Pvt. Ltd.	Maharashtra	J-129	Elec Saftey Chain Stop	10:00
06-July-2016	M/s Raj Infrastructure Development, (India) Pvt. Ltd.	Maharashtra	J-129	INTL_Line Breakdown due to E/F	12:00
09-September-2016	M/s Raj Infrastructure Development, (India) Pvt. Ltd.	Maharashtra	J-129	CLS Generator Lubrication Stop	8:00
22-October-2016	M/s Raj Infrastructure Development, (India) Pvt. Ltd.	Maharashtra	J-129	Mech Gear Oil Filter Choked Stop	14:00
02-Febrary-2017	M/s Raj Infrastructure Development, (India) Pvt. Ltd.	Maharashtra	J-116	Forcefull Stoppage	Month