

# WIND POWER PROJECT IN GUJARAT



India's Largest Carbon Credit Developer & Supplier

Document Prepared By EKI Energy Services Limited

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## 1 PROJECT DETAILS

### 1.1 Summary Description of the Implementation Status of the Project

Mytrah Energy (India) Limited (formerly Caparo Energy (India) Limited<sup>1</sup>) is entering into the renewable energy sector with an objective to build wind power assets in India. Mytrah Energy (India) Limited has completed 25.20 MW wind power project at in Rajkot District and Surendranagar District of Gujarat State. The project activity comprises of 12 Wind Electric Generators (WEGs) with a capacity of 2.1 MW each. The S88 model WTGs installed as project activity was provided by Suzlon Energy Limited (SEL).

The objective of the proposed CDM project is to generate electricity from environmentally benign sources of energy in the Indian state of Gujarat in order to use renewable and clean electricity to contribute towards combating global warming. The project will lead to reduced greenhouse gas emissions as it displaces electricity from the Northern Eastern Western North-Eastern (NEWNE) grid dominated by fossil fuel based electricity generation plants.

The project activity help to reduce the supply demand gap in the state and also helps in contributing to the sustainable development by using wind energy as the source of power generation and reduction of GHG Emissions. In the project site, there are other wind projects owned by other customers connected to the same substation. There is an apportioning procedure which is approved by the state nodal agency for apportioning the electricity to each and every customer.

The project activity is a zero emissions wind based power generation project connected to NEWNE grid. The project is to export around 50662.584 MWh to NEWNE Grid every year. Hence, the baseline for the project as per Version 12.3.0 of ACM 0002 is defined as “Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources” approved in EB65. The project harnesses renewable resources in the region, thereby displacing non-renewable natural resources and leading to sustainable economic development of the locality. Suzlon Energy Limited (SEL) is the WEG supplier and the operations and maintenance contractor for the project. The electricity generated from the wind farm is being supplied to common local substation through local transmission lines duly metered and measured by Gujarat Urja Vikas Nigam Limited (GUVNL) on a monthly basis at the substation of the wind farm.

The total VCUs generated achieved during this monitoring period is 211,372 tCO<sub>2e</sub>.

### 1.2 Sectoral Scope and Project Type

The project activity falls under

**Sectoral Scope:** 01 - Energy industries (renewable / nonrenewable sources)

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

**Methodology:** The methodology applied for the project is ACM 0002 of version 12.3.0

### 1.3 Project Proponent

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<sup>1</sup> <http://www.mytrah.com/>

Organization name	Mytrah Energy (India) Limited
Contact person	Ms. Mangal jyoti
Title	Deputy Manager
Address	1 <sup>st</sup> Floor, 8001, 8th Floor, Q-City, Nanakramguda, Gachibowli Hyderabad 500032, Telangana, INDIA
Telephone	-
Email	-

#### 1.4 Other Entities Involved in the Project

Organization name	EKI Energy Services Limited
Role in the project	Project Consultant
Contact person	Mr. Prakash Kr. Sahu
Title	Project Manager
Address	Office No. 201, EnKing Embassy, Plot No. 48, Scheme No. 78, Part II, Vijay Nagar INDORE – 452010, India.
Telephone	+91 99 31 158 863
Email	<a href="mailto:prakash@enkingint.org">prakash@enkingint.org</a>

#### 1.5 Project Start Date

The start date considered for the project activity is 06/08/2011 i.e. the first commissioning date WTG.

#### 1.6 Project Crediting Period

CDM crediting period: from 26/12/2012 to 25/12/2022 (10 years fixed)

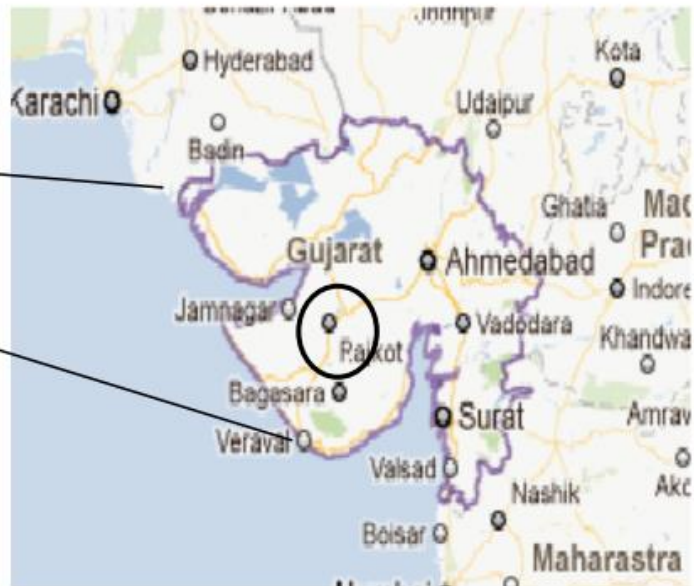
The VCS crediting period will be followed from 06/08/2011 to 05/08/2021 (10 years fixed)

#### 1.7 Project Location

The wind power project is located in Rajkot and Surendranagar district, Gujarat, India. The geo-coordinates of the project location is as follows:

Sr. No	Location No.	Village and Tehsil	District	Latitude	Longitude	Model	H
1	JSD 038	Bhadla	Rajkot	22° 11' 41.9"	71° 05' 44.4"	S88	80 m
2	JSD 041	Dahisara	Rajkot	22° 11' 41.4"	71° 08' 7.5"	S88	80 m

3	JSD 042	Dahisara	Rajkot	22° 11' 31.3"	71° 08' 28.3"	S88	80 m
4	MAH013	Bhojpari	Surendran a	22° 17' 48.5"	71° 10' 15.8"	S88	80 m
5	MAH014	Bhojpari	Surendran a	22° 17' 1.3"	71° 10' 19.1"	S88	80 m
6	MAH015	Bhojpari	Surendran a	22° 16' 46.2"	71° 10' 21.3"	S88	80 m
7	MAH016	Chobari	Surendran a	22° 15' 39.8"	71° 11' 42.3"	S88	80 m
8	MAH018	Chobari	Surendran a	22° 15' 29.2"	71° 11' 27.5"	S88	80 m
9	MAH021	Tajpar	Surendran a	22° 14' 53.6"	71° 10' 39.8"	S88	80 m
10	MAH022	Sakhpar	Surendran a	22° 14' 56.6"	71° 11' 13"	S88	80 m
11	MAH041	Bhojpari	Surendran a	22° 17' 27.5"	71° 10' 9.9"	S88	80 m
12	MDW 021	Kabran	Surendran a	22° 17' 48.0"	71° 08' 24.1"	S88	80 m



**1.8 Title and Reference of Methodology**

Title: Consolidated baseline methodology for grid-connected electricity generation from renewable sources.

Methodology: Version 12.3.0 of ACM 0002<sup>2</sup>.

<sup>2</sup> <http://cdm.unfccc.int/methodologies/DB/C505BVV9P8VSNNV3LTK1BP3OR24Y5L>

The methodology also refers to the latest approved versions of the following tools:

- Tool to calculate the emission factor for an electricity system (Version 02.2.1, Approved in EB 63);
- Tool for the demonstration and assessment of additionality;
- Combined tool to identify the baseline scenario and demonstrate additionality;
- Tool to calculate project or leakage CO<sub>2</sub> emissions from fossil fuel combustion

The tools used in the PDD are as follows:

“Tool to calculate emission factor for an electricity system” – Version 02.2.1, Approved in EB 63<sup>3</sup>

“Tool for the demonstration and assessment of additionality” – Version 6.0.0, Approved in EB 65<sup>4</sup>.

“Guidance on assessment of investment analysis”- Version 5.0 approved in EB 62<sup>5</sup>.

## 1.9 Other Programs

Include the following information, as applicable:

- Emission Trading Programs and Other Binding Limits: The PP has not applied this project in any Emission Trading Programs and other Binding Limits.
- Other Forms of Environmental Credit: The PP has not applied this project in any other form of environmental credits.
- Participation under Other GHG Programs: The PP has participated under CDM mechanism of UNFCCC. The UN reference id 8823<sup>6</sup> of program with this project activity. The PP would not consider the credit from any other mechanism for the current monitoring plan. The undertaking is provided to confirm that there is no any double accounting for current monitoring period.

## 1.10 Sustainable Development

### Contribution to sustainable development:

Ministry of Environment and Forests, has stipulated economic, social, environment and technological well-being as the four indicators of sustainable development. The project contributes to sustainable development using the following ways.

- **Social well-being**: The project would help in generating employment opportunities during the construction and operation phases. The project activity will lead to development in infrastructure in the region like development of roads and also may promote business with improved power generation.
- **Economic well-being**: The project is a clean technology investment in the region, which would not have been taken place in the absence of the VCS benefits the project activity will also help to reduce the demand supply gap in the state.

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<sup>3</sup> <http://cdm.unfccc.int/methodologies/PAMethodologies/tools/am-tool-07-v2.2.1.pdf>

<sup>4</sup> <http://cdm.unfccc.int/methodologies/PAMethodologies/tools/am-tool-07-v2.2.1.pdf>

<sup>5</sup> [http://cdm.unfccc.int/Reference/Guidclarif/reg/reg\\_guid03.pdf](http://cdm.unfccc.int/Reference/Guidclarif/reg/reg_guid03.pdf)

<sup>6</sup> <http://cdm.unfccc.int/Projects/DB/SGS-UKL1355741006.12/view>

The project activity will generate power using zero emissions solar based power generation

which helps to reduce GHG emissions and specific pollutants like SO<sub>x</sub>, NO<sub>x</sub>, and SPM associated with the conventional thermal power generation facilities.

- **Technological well-being:** The successful operation of project activity would lead to promotion of solar based power generation and would encourage other entrepreneurs to participate in similar projects

**Environmental well-being:** The project activity being a renewable source of energy, it reduces the dependence on fossil fuels and conserves natural resources which are on the verge of depletion. Due to its zero emission the project activity also helps in avoiding significant amount of GHG emissions.

## 2 IMPLEMENTATION STATUS

### 2.1 Implementation Status of the Project Activity

The project is of 25.20 MW wind power at in Rajkot District and Surendranagar District of Gujarat State. It comprises of 12 Wind Electric Generators (WEGs) with a capacity of 2.1 MW each. The S88 model WTGs installed as project activity will be provided by Suzlon Energy Limited (SEL). The technology of electricity generation from renewable wind resource is environment friendly as it does not use any fossil fuel. The power (electricity) thus produced by the project activity would be transmitted to the state electricity grid, thereby displacing equivalent amount of power in the grid which is dominated by emission intensive thermal power plants. It is estimated the proposed project would approximately generate 50662.584 MWh of electricity per annum. The project activity is therefore displace an equivalent amount of electricity, which would have otherwise been generated by fossil fuel dominant grid.

The project activity help to reduce the supply demand gap in the state and also helps in contributing to the sustainable development by using wind energy as the source of power generation and reduction of GHG Emissions. In the project site, there are other wind projects owned by other customers connected to the same substation. There is an apportioning procedure which is approved by the state nodal agency for apportioning the electricity to each and every customer.

The technical specification of the WTG is as follows:

MODEL	S88 - 2.1MW
<b>Operating Data</b>	
Rated power	2.1MW
Cut-in wind speed	4 m/s
Rated wind speed	14 m/s
Cut-out wind speed	25 m/s
50 years gust wind speed	59.5 m.s
Hub height	79m (Foundation top equal to ground level)
Wind Class	IEC - IIA
Rotational Speed	15 to 17.6 rpm
<b>Rotor</b>	
Pitch system	Pitch regulated, electrical

Diameter	88 m
Swept area	6082 m <sup>2</sup>
Blade material type	Epoxy bounded fibre glass
<b>Generator</b>	
Type	Asynchronous slip ring type induction
Rated power	2100 kW
Rated voltage	690/600 V
Frequency	50/60 Hz
Protection	IP 54, IP23 for slip ring unit
Cooling system	Air cooled
Insulation	Class H
Slip control	Unique Flexi-Slip providing slip up to 16.67%
<b>Braking System</b>	
Aerodynamic brake	3 independent systems with blade pitching
Mechanical brake	Hydraulic fail-safe disc brake system
<b>Gearbox</b>	
Type	3 stages (One planetary & Two helical)
Ratio	1:98.8 / 1:118.1
Nominal load	2200 kW
<b>Yaw System</b>	
Type	Driven by 3 electrical driven planetary drives
Bearings	Polyamide slide
<b>Tower</b>	
Type	Tubular Tower (4 sections)
Corrosion protection	Epoxy/ PU coated

No events or situations happened during the reported monitoring period that can alter the applicability of the applied methodology.

The Commissioning dates of each WTGs are mentioned below:

Sr. No	Location No.	Village and Tehsil	Date of Commissioning
1	JSD 038	Bhadla	01/10/2011
2	JSD 041	Dahisara	28/09/2011
3	JSD 042	Dahisara	28/09/2011
4	MAH013	Bhojpari	10/08/2011
5	MAH014	Bhojpari	06/08/2011
6	MAH015	Bhojpari	06/08/2011
7	MAH016	Chobari	12/08/2011
8	MAH018	Chobari	31/08/2011
9	MAH021	Tajpar	31/08/2011
10	MAH022	Sakhpar	31/08/2011

11	MAH041	Bhojpari	06/08/2011
12	MDW 021	Kabran	06/08/2011

## 2.2 Deviations

### 2.2.1 Methodology Deviations

There is no request for deviation applied during this monitoring period

### 2.2.2 Project Description Deviations

#### Deviation 1-

The CDM registered PDD mentioned three parameter like net electricity supplied to grid, electricity export by project and electricity import by project and net electricity is difference of export and import. Since PP have only one parameter data available i.e data of net electricity supplied to grid through share certificate issued by state electricity board. Hence only single parameter of net electricity supplied to grid is considered for this project activity. This does not have any impact on emission reductions.

## 2.3 Grouped Project

This project activity is not a grouped project activity.

## 2.4 Safeguards

### 2.4.1 No Net Harm

The project does not involve any potential negative environmental and socio economic impacts and hence this criteria is not applicable to this project activity.

### 2.4.2 Local Stakeholder Consultation

The stakeholders identified for the project were: the occupants of the surrounding villages and the local communities, employees, contractors. Local population is considered to be a major stakeholder with respect to the project activity. Comments were received from the village people. The stakeholder meeting was organized at the project site in Bhojapara village in Surendranagar District of Gujarat State on 07<sup>th</sup> May 2011.

The relevant stakeholders identified were sent personal invitation on 30 April 2011, stating the purpose, date, time and venue of the meeting. The comments were invited and recorded in questionnaire duly filled by every participating stakeholder. Representative of the project proponent explained the purpose of the meeting and detailed all questions in the questionnaire in the local language. He further explained about the advantages of the wind energy generation and explained how the project would help in reducing demand supply gap of electricity in an environmentally friendly manner.

The villagers wished to know the impact of WEGs on the environment in the region. Further to the discussion, Representative of SEL, explained about the eco-friendly wind power technology which will have no harmful effect on the environment. Finally the comments were received from the stakeholder.

According to the feedback received from the stakeholders, due to the erection of wind farms the socioeconomic situation in the area and the village people's living standard has been improved. It has not only provided employment but also significantly contributed to the infrastructure development likes roads. In general, all stakeholders related to the project activity had a positive opinion on the project activity.

Local Stakeholder consultation had been carried out during CDM registration of this project activity. There were no comments that required follow up action from PP. The PP also placed an grievance register onsite in where the stakeholder can put down his/her complain and the same if found genuine will be addressed immediately.

### 3 DATA AND PARAMETERS

#### 3.1 Data and Parameters Available at Validation

Data / Parameter	EF <sub>grid,OMsimple,y</sub>
Data unit	tCO <sub>2</sub> /MWh
Description	Operating margin CO <sub>2</sub> emission factor of NEWNE grid
Source of data	Central Electricity Authority:CO <sub>2</sub> Emission Database CEA CO <sub>2</sub> Baseline database Version 07 <sup>7</sup>
Value applied	0.9842
Justification of choice of data or description of measurement methods and procedures applied	The operating margin emission factor data has been deduced from CO <sub>2</sub> database. CEA CO <sub>2</sub> Baseline database Version 07
Purpose of the data	Calculation of baseline emissions
Comments	The operating margin emission factor is a 3-year generation-weighted average data, based on the most recent data available on CEA database at the time of submission of the CDM-PDD to the DOE for validation

Data / Parameter	EF <sub>grid,BM,y</sub>
Data unit	tCO <sub>2</sub> /MWh
Description	Operating margin CO <sub>2</sub> emission factor of NEWNE grid
Source of data	Central Electricity Authority:CO <sub>2</sub> Emission Database CEA CO <sub>2</sub> Baseline database Version 07

<sup>7</sup> [http://www.cea.nic.in/reports/planning/cdm\\_co2/cdm\\_co2.htm](http://www.cea.nic.in/reports/planning/cdm_co2/cdm_co2.htm)

Value applied	0.8588
Justification of choice of data or description of measurement methods and procedures applied	The operating margin emission factor data has been deduced from CO <sub>2</sub> database. CEA CO <sub>2</sub> Baseline database Version 07
Purpose of the data	Calculation of baseline emissions
Comments	The build Margin would be calculated ex-ante and fixed during the crediting period. For ex-ante calculation the most recent data available has been used and the build margin thus calculated is 0.8588

Data / Parameter	EF <sub>grid,CM,y</sub>
Data unit	tCO <sub>2</sub> /MWh
Description	Operating margin CO <sub>2</sub> emission factor of NEWNE grid
Source of data	Central Electricity Authority:CO <sub>2</sub> Emission Database CEA CO <sub>2</sub> Baseline database Version 07
Value applied	0.9528
Justification of choice of data or description of measurement methods and procedures applied	Calculated as per the procedures in “Tool to calculate the emission factor for an electricity system” based on CEA data.
Purpose of the data	Calculation of baseline emissions
Comments	The Combined Margin would be calculated ex-ante and fixed during the crediting period.

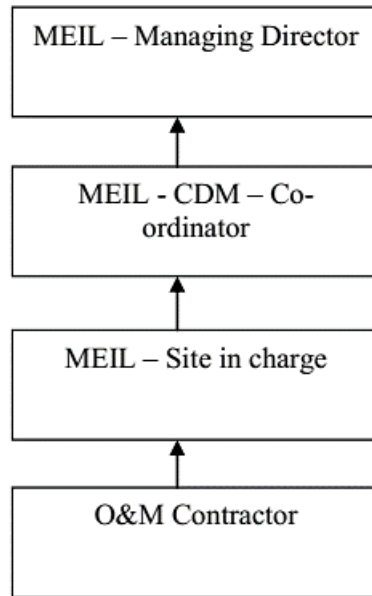
### 3.2 Data and Parameters Monitored

Data / Parameter	EG <sub>PJ,y</sub>
Data unit	MWh
Description	Quantity of net electricity exported to the grid during the year y.
Source of data	Certificate for share of electricity generated by Wind Farm.
Description of measurement methods and procedures to be applied	Authorized state agency (GETCO) releases a monthly Share Certificate for the net energy exports. This certificate is used for determining the emission reductions and also for the billing and payment of net sale of electricity from the project. <b>Calibration Frequency:</b> Energy meters is calibrated atleast once in 3 years. <b>Responsibility:</b> Project Manager of MEIL will be responsible for maintain the records.

Frequency of monitoring/recording	Continuous measuring and at least monthly recording
Value monitored	221,843.329 MWh (with application error factor due to delay in calibration)
Monitoring equipment	The machines of the project activity and machines of other project developers are connected to the Substation The common metering point comprises one main meter & check meter (jointly certified by GUVNL i.e. GETCO and the service provider i.e. Suzlon/ its representative every month) and one ABT meter (ABT meter readings are not certified jointly, although GUVNL, GEDA and GETCO consider this reading as the total energy for billing purpose and used for the calculation of sharing of the energy of the individual developers).
QA/QC procedures to be applied	All the meters of accuracy class 0.2s are under the purview of GETCO and will be calibrated by GETCO every 3 years as per section 7.2 (iv) of the PPA .The net electricity exported can be cross checked with the sales receipts. Also, the generation from each WEG in the wind farm is recorded by an energy meter installed near each machine. The energy meter provides monthly generation data from individual WEG and also records the power consumed by the individual WEG (as explained below). Thus, to cross check; the net electricity supplied to the grid by the project activity WEGs must be lesser than summation of net electricity generated by WEGs of project activity, as measured at the individual energy meter and controller (LCS) of each WEG due to the accounted transmission losses.
Purpose of the data	Calculation of baseline emissions
Calculation method	The ABT meter reading reflects the net electricity supplied by the wind farm (both export and import), including the project activity. The net electricity supplied by individual wind turbines is determined by a process of sharing the net electricity recorded at the ABT meter in proportion of the electricity generation recorded by the energy meters at the individual wind turbines. The Sharing of energy is done as per PPA by GETCO.
Comments	The data will be archived for two years after the end of the last crediting period or till the last issuance of CERs for the project activity, whichever is later. The ABT meter readings at the substation are recorded by GETCO representative every month. These ABT meters are fully under the jurisdiction of GETCO. The readings of net electricity supplied to the grid by each customer are made available on the website of SLDC-Gujarat (GETCO)

### 3.3 Monitoring Plan

The organisational structure of this project activity is as follows.



The Operation & Maintenance of the project is executed by Suzlon Energy Limited. The individual turbine electricity generation is recorded by the LCS meter (controller) at the individual wind turbine. Also, Every WEG has an individual energy meter connected to it. This meter can measure both import and export of electricity by the individual WEGs. This meter is under the purview of GETCO and is calibrated by GETCO officials at least once in 3 years. Every month officials from Suzlon measures the electricity export and import from each WEG and issue the monthly generation report to the project proponent, which is also endorsed by the GEDA. There are 2 feeders to which all the 12 WEGs of MEIL are connected. These two feeders also contain WEGs of other customers. The two feeder meters are connected to a single Main and Check Meter at the substation. The Main meter can measure both electricity import and electricity export. Every month Joint Meter Reading is taken at the Main Meter, by GETCO officials in the presence of officials from Suzlon. There is an Availability Based tariff meter installed at the substation. The reading of ABT meter are not certified jointly although GUVNL/GEDA, SLDC consider this reading as the total energy for billing purpose.

#### **Working model for sharing of energy (considered by GETCO)**

The model evolved by the state utility (GEDA) and the generating company and the steps involved in this are as follows.

1. Each WTG have separate metering point which is read jointly by the representative of the company and the state utility personals (Gujarat Energy Development Agency). Both import and export of electricity by each WTG will be measured by these meters. This is certified by both the representatives.
2. Considering the total No of WTG in the Project by various investors and the energy recorded in the each WTG meter is consolidated and considered as net energy generated from the Wind farm.
3. For calculating the net electricity supplied by the project to the grid the following formula may be considered for understanding.

$$\text{Share of PP's Net Electricity supplied to grid} = (C \times Y) / (C + C_1 + C_2 + \dots + C_n)$$

Where:

- C = Net generation by 12 WTGs owned by Mytrah Energy (India) Limited  
C+C1+C2+C3.....Cn= Total energy generated from the Wind farm from different companies including Mytrah Energy (India) Limited.  
Y = The Meter reading by GETCO at the S/s metering point (ABT)

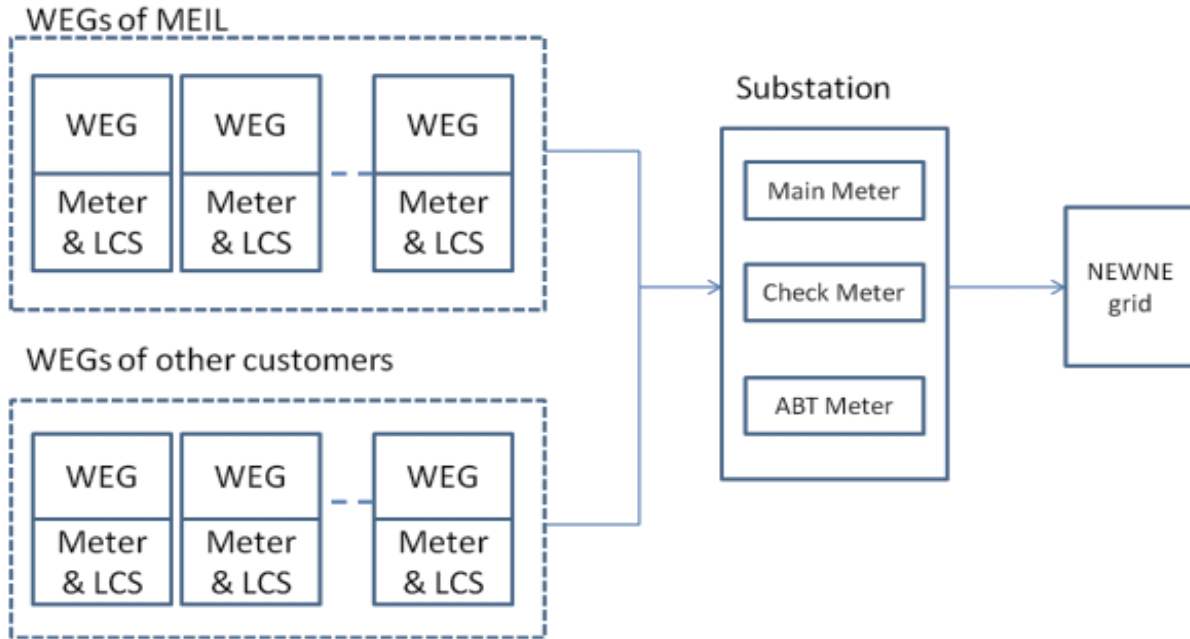
All the above calculations are in accordance with the PPA.

Using the above sharing approach, The SLDC-GETCO provides the certificate of generation through their web site. This is considered for raising invoice accordingly payment is being received from GUVNL. This Certificate of Share forms the basis of billing and also emission reduction calculation. The value of net electricity delivered can be cross checked with the monthly invoices.

In case the ABT Meter is not functioning there is a Main and Check Meter located at the substation which also calculates electricity import and export by all customers (whole wind farm). In case the meter located at the individual WEGs fail, the controller readings (LCS) of each WEG that are recorded by the Central monitoring System of Suzlon, shall be used for measuring electricity generation by individual WEGs. All the data items monitored under the monitoring plan will be kept for 2 years after the end of crediting period or till the last issuance of CERs for this project activity whichever occurs later.

NOTE: The net electricity supplied to the grid by the project activity is a calculated value which is arrived by using the value of electricity generation by project WEGs, non-project WEGs at individual energy meters and the cumulative value of electricity import and export of the entire number of WEGs connected to substation (i.e. including project and non-project WEGs) as measured at the pooling substation. Since the measurement of electricity generation of non-project WEGs at energy meter is non- feasible for PP and The main meter & check meter reading at the substation and ABT meter are under the jurisdiction of GETCO only and are not shared with the individual project developers, hence, these parameter have not been included as the monitoring parameters in section B.7.1 of PDD.

The monitoring arrangement, metering system under project boundary has been illustrated in schematic diagram below:



#### 4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

##### 4.1 Baseline Emissions

According to the approved methodology ACM0002 (Version 12.3.0) Emission Reductions are calculated as:

$$ER_y = BE_y - PE_y$$

Where,

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

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

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

The baseline emissions are to be calculated as follows:

$$BE_y = EG_{PJ,y} * EF_{grid,CM,y}$$

Where,

$BE_y$  = Baseline emissions in year y (tCO<sub>2</sub>)

$EG_{PJ,y}$  = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh)

$EF_{grid,CM,y}$  = Combined margin CO<sub>2</sub> emission factor for grid connected power generation in year y calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (tCO<sub>2</sub>/MWh)

$$EG_{PJ,y} = EG_{facility,y}$$

Where,

$EG_{PJ,y}$  = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh/yr)

$EG_{facility,y}$  = Quantity of net electricity generation supplied by the project plant/unit to the grid in year y (MWh)

According to the methodology, Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y$$

As the project activity is wind power project, project emissions are zero and the resulting emission reduction is as follows.

$$ER_y = BE_y$$

Baseline emission factor (Combined Margin) is found to be 0.9528 tCO<sub>2</sub>e.

$$BE_y = EG_{PJ,y} \times EF_{grid,CM,y}$$

$$BE_y = 221,843 \times 0.9528$$

$$BE_y = \mathbf{211,372 \text{ tCO}_2\text{e}}$$

#### 4.2 Project Emissions

The project activity involves in harnessing wind power. So the emissions from the project are zero.

#### 4.3 Leakage

No leakage emissions have been considered and hence the leakage emission is zero.

So the emission reductions is equal to baseline emissions  $ER_y = BE_y$ .

Therefore,

$$BE_y = EG_{PJ,y} \times EF_{grid,CM,y}$$

$$BE_y = 221,843 \times 0.9528$$

$$BE_y = \mathbf{211,372 \text{ tCO}_2\text{e}}$$

#### 4.4 Net GHG Emission Reductions and Removals

Year	Baseline emissions or removals (tCO <sub>2</sub> e)	Project emissions or removals (tCO <sub>2</sub> e)	Leakage emissions (tCO <sub>2</sub> e)	Net GHG emission reductions or removals (tCO <sub>2</sub> e)
2014	49595	0	0	49595
2015	51626	0	0	51626
2016	48746	0	0	48746
2017	46287	0	0	46287
2018	15118	0	0	15118
<b>Total</b>	<b>211,372</b>	<b>0</b>	<b>0</b>	<b>211,372</b>

The actual VER is -0.79% lower than the estimated VER. This variation is due to the low wind flow pattern, grid availability and other parameters which are not in the control of PP.

## APPENDIX 1: CALIBRATION DETAILS

Location No	Name of Feeder	EB Meter No.	Calibration Date	Due Date
MDW-21	Feeder-1	GJU62221	14-04-17	14-04-20
MAH-13	Feeder-1	GJU62216	14-04-17	14-04-20
MAH-14	Feeder-1	GJU62223	14-04-17	14-04-20
MAH-15	Feeder-1	GJU62222	14-04-17	14-04-20
MAH-41	Feeder-1	GJU62220	14-04-17	14-04-20
MAH-16	Feeder-2	GJU62219	14-04-17	14-04-20
MAH-18	Feeder-2	GJU62225	14-04-17	14-04-20
MAH-22	Feeder-2	GJU62218	14-04-17	14-04-20
MAH-21	Feeder-2	GJU62217	14-04-17	14-04-20
JSD-41	Feeder-2	GJU62227	14-04-17	14-04-20
JSD-42	Feeder-2	GJU62226	14-04-17	14-04-20
JSD38	Feeder-2	MSP 11001	14-04-17	14-04-20

## APPENDIX 2: BREAKDOWN DETAILS

Date	Loc. No	Duration	Description
10.01.2014	MDW-21	24	CT Failure
11.02.2014	MAH-13	24	CT Failure
14.04.2014	MAH-14	23.6	Preventive Action : Failure Rectification
17.05.2014	MAH-14	24	Major Breakdown
18.06.2017	MAH-14	24	error_converter_signal_DC_link_max
18.08.2014	MAH-15	24	Preventive Action : Failure Rectification
19.09.2014	MAH-14	24	error_converter_signal_DC_link_max
25.09.2014	MAH-41	24	Preventive Action : Failure Rectification
30.09.2014	MAH-16	24	error_converter_generator_contactor
30.04.2015	MAH-18	24	error_converter_generator_contactor
30.04.2015	MAH-22	23.97	error_converter_generator_contactor
30.04.2015	MAH-21	23.86	error_converter_generator_contactor
30.04.2015	JSD-41	24	error_converter_generator_contactor
30.04.2015	JSD-42	24	error_converter_generator_contactor
16.05.2015	JSD-38	23.73	error_pitch_converter_ok_2
19.05.2015	MAH-21	24	Preventive Action : Visual Inspection
21.05.2015	MAH-21	24	Preventive Action : Visual Inspection
23.05.2015	MAH-21	24	error_converter_generator_contactor
24.05.2015	MAH-21	24	error_converter_generator_contactor
31.05.2015	MAH-21	24	error_converter_generator_contactor
01.06.2015	MAH-21	24	error_converter_generator_contactor
02.06.2016	MAH-21	24	error_converter_generator_contactor

03.06.2016	MAH-21	24	error_converter_generator_contactor
05.06.2016	MAH-21	24	error_converter_generator_contactor
07.06.2016	MAH-21	24	error_converter_generator_contactor
08.06.2016	MAH-21	24	error_converter_signal_DC_link_max
12.06.2016	MAH-22	24	Preventive Action : Failure Rectification
14.06.2016	MAH-21	23.53	error_converter_generator_contactor
14.06.2016	MAH-13	24	error_safety_system_safety_system_ok_from_pitch
15.06.2016	MAH-21	24	error_safety_system_safety_system_ok_from_pitch
15.06.2016	MAH-13	24	error_safety_system_safety_system_ok_from_pitch
15.06.2016	MAH-22	24	error_safety_system_safety_system_ok_from_pitch
16.06.2016	MAH-21	24	error_converter_generator_contactor
16.06.2016	MAH-13	24	error_safety_system_safety_system_ok_from_pitch
16.06.2016	MAH-22	23.9	error_safety_system_safety_system_ok_from_pitch
17.06.2016	MAH-13	24	error_safety_system_safety_system_ok_from_pitch
17.06.2016	MAH-22	23.9	error_safety_system_safety_system_ok_from_pitch
18.06.2016	MAH-21	24	error_safety_system_safety_system_ok_from_pitch
18.06.2017	MAH-13	24	error_safety_system_safety_system_ok_from_pitch
20.06.2017	MAH-21	24	error_safety_system_safety_system_ok_from_pitch
20.06.2017	MAH-13	24	error_safety_system_safety_system_ok_from_pitch
21.06.2017	MAH-21	24	error_safety_system_safety_system_ok_from_pitch
21.06.2017	MAH-13	24	error_safety_system_safety_system_ok_from_pitch
22.06.2017	MAH-21	24	error_safety_system_safety_system_ok_from_pitch
22.06.2017	MAH-13	24	error_safety_system_safety_system_ok_from_pitch
26.06.2017	MAH-21	24	error_safety_system_safety_system_ok_from_pitch
26.06.2017	MAH-13	23.92	error_safety_system_safety_system_ok_from_pitch
27.06.2017	MAH-13	23.57	error_safety_system_safety_system_ok_from_pitch
27.06.2017	MAH-13	24	error_safety_system_safety_system_ok_from_pitch
30.06.2017	MAH-13	24	Preventive Action : Failure Rectification
01.07.2017	MAH-13	24	Preventive Action : Failure Rectification
03.07.2017	MAH-13	24	Preventive Action : Failure Rectification
03.07.2017	MAH-41	24	Preventive Action : Failure Rectification
29.07.2017	MAH-13	24	error_converter_signal_chopper_overcurrent
15.09.2017	MAH-16	23.81	error_safety_system_safety_system_ok_from_pitch
13.10.2017	MAH-16	23.65	error_profi_node_20_diag
13.10.2017	MDW-21	23.67	error_converter_signal_phase_voltage_peak
13.10.2017	MAH-13	23.65	error_pitch_power_supply_1
13.10.2017	JSD-41	23.65	error_profi_node_20_diag
13.10.2017	MAH-22	23.68	error_pitch_position_end_switch_1
13.10.2017	MAH-15	23.9	error_profi_node_41_diag
14.10.2017	MAH-16	23.65	error_profi_node_20_diag