## B.7 Application of a monitoring methodology and description of the monitoring plan:

### B.7.1 Data and parameters monitored:

*(Copy this table for each data and parameter)*

| **Data / Parameter:** | **EGy** |
|---|---|
| Data unit: | MWh |
| Description: | Net Electricity export to the grid by the project activity. |
| Source of data to be used: | 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 |
| Value of data | |
| Description of measurement methods and procedures to be applied: | Net Electricity exported to the grid by the Project Activity is calculated based on the monitoring parameter- $\sum_{0}^{n} EG_{n,y}$ , $EG_{MSEDCL}$ and $\sum_{0}^{m} EG_{m,y}$ .<br>$EGy = \left[ \frac{\sum_{0}^{n} EG_{n,y}}{\sum_{0}^{m} EG_{m,y}} \right] \times EG_{MSEDCL}$ |
| QA/QC procedures to be applied: | 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 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 & check meter) will be done by state utility normally on annual basis or as per the schedule of MSEDCL. |
| Any comment: | This data will be archived in paper form up-to two years after the completion of crediting period or last issuance whichever is later. |

| **Data / Parameter:** | $\sum_{0}^{n} EG_{n,y}$ |
|---|---|
| Data unit: | MWh |
| Description: | Electricity generation by WTG/s owned by SPD (either individual or group) |
| Source of data to be used: | 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 SPD". |
| Value of data | - |
| Description of measurement methods and procedures to be applied: | The electricity generated by the WTGs of SPD is monitored with the 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 SPD" 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. |

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| QA/QC procedures to be applied: | As per letter provided by the technology supplier the inbuilt control panel meters can not be calibrated. The meter are of accuracy class 0.2. Please also refer to detailed description under "Description of calibration of WEG Controller" in section B.7.2. |
| Any comment: | This data will be archived in paper form up-to two years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data / Parameter:** | $\sum_{0}^{m} EG_{m,y}$ |
| Data unit: | MWh |
| Description: | Total electricity generation by all the WTGs connected to the common bulk meters |
| Source of data to be used: | 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 of data | - |
| Description of measurement methods and procedures to be applied: | The electricity generated by all the WTGs (including WTGs of SPD) 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 meters" is monitored by O & M contractor at CMS. |
| QA/QC procedures to be 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. |
| Any comment: | This data will be archived in paper form up-to two years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data / Parameter:** | $EG_{MSEDCL}$ |
| Data unit: | MWh |
| Description: | Total net electricity supplied to the grid measured at the substation by common bulk meters (main and check meter). |
| Source of data to be used: | This parameter is calculated by subtracting imported electricity from the exported electricity to grid and monitored with the help of bulk meters. |
| Value of data | - |
| Description of measurement methods and procedures to be applied: | 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 to be 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 annul |

| | |
|---|---|
| | basis or as per the schedule of MSEDCL. |
| Any comment: | This data will be archived in paper form up-to two years after the completion of crediting period or last issuance whichever is later. |

| **Parameter:** | **$EF_{Grid, y}$** |
|---|---|
| Data unit: | tonnes of $CO_2$ eq /MWh |
| Description: | Weighted average grid emission factor |
| Source of data to be used: | The value has been provided by Central Electricity Authority |
| Value of data | 0.86 |
| Description of measurement methods and procedures to be applied: | The data will be taken from the latest CEA database available. |
| QA/QC procedures to be applied: | The value has been taken from official statistics published by Central Electricity Authority , which is a official data available in public domain. |
| Any comment: | This data will be archived up-to two years after the completion of crediting period or last issuance whichever is later. |

### B.7.2 Description of the monitoring plan:

As emission reductions from the project is determined by the number of units exported to the grid. It is mandatory to have a monitoring system in place and ensure that the project activity produces and exports the rated power at the stipulated norms. The sole objective of having monitoring system is to have a constant watch on the emission reductions.

The delivered energy will be metered by Suzlon and MSEDCL at the high voltage side of the step up transformers. Metering will be done either for two /three / more wind turbines depending on the location of wind turbines and service connection number. Metering equipments will be electronic trivector meters*. The metering equipments will be maintained in accordance with electricity standards and will have the capability of recording daily and monthly readings. Records of joint meter reading will be maintained at site and a copy will be maintained at the head office. All the meters will be tested for accuracy every calendar year with reference to a portable standard meter. As the instruments will be calibrated and marked at regular intervals, the accuracy of measurement can be assured at all times. Necessary records of calibration will be maintained by both MSEDCL and project proponents.

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.

- The proposed project activity requires 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). Machines 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.
- Metering equipment - Metering is carried out through electronic **trivector meters***of accuracy class 0.2% required for the project. The main meter shall be installed and owned by MSEDCL, whereas the project participant owns the check meters. The metering equipments are maintained in accordance with electricity standards.
- 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 through a wireless Radio Frequency (RF) network (PLC). The generation data of individual machine can be monitored as a real-time entity at CMS. The snapshot of generation on the last day of every calendar month will be kept as a record both in electronic as well as printed (paper) form.

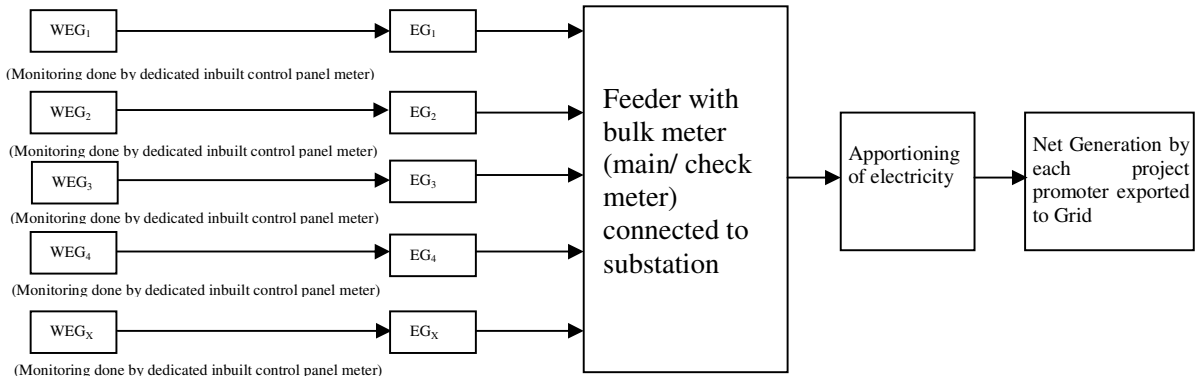
***Trivector Meter** - is a device that measures the amount of electrical energy supplied to the utility. It is called as tri-vector meter because it measures energy consumption of the three phase lines R, Y, B which are 120 phase difference from each other. It measures the consumption in terms of the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

**Description of calibration of WEG Controller**

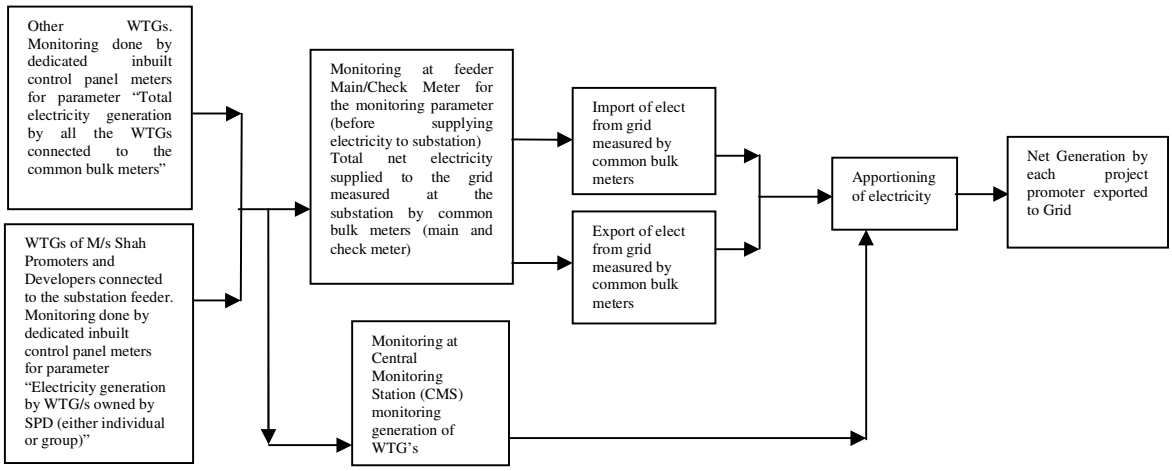
SCS Controller is a micro-processor based intelligent controller which has been specially designed for control of wind turbines. It uses a Woodward Multi function Relay that has three current inputs from CT and three direct voltage inputs (690 Volts). The analog values of current/voltage are converted 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:



Monitoring Arrangement:




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

$$\sum_{0}^{n} EG_{n,y}$$

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;

$$\sum_{0}^{m} EG_{m,y}$$

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 meter (main and check meter) as below enumeration: .

$$EGy = \left[ \frac{\sum_{0}^{n} EG_{n,y}}{\sum_{0}^{m} EG_{m,y}} \right] X \; EG_{MSEDCL}$$

Where

| | |
|---|---|
| **EGy** | Net Electricity exported to the grid by the Project Activity, |
| $\sum_{0}^{n} EG_{n,y}$ | Electricity generation by WTG/s owned by SPD (either individual or group) included in this project activity at the controller. |
| $EG_{MSEDCL}$ | Total net electricity supplied to the grid measured at the substation by common bulk meter (main and check meter). |
| $\sum_{0}^{m} EG_{m,y}$ | Total electricity generation by all the WTGs connected to the common bulk meters |

MSEDCL carries out the calibration, periodical testing, sealing and maintenance of meters in the presence of SPD representative. The frequency of meter testing is annual. All meters are tested only at the Metering Point. The meters are tested and maintained as per the Metering Code for Maharashtra. Additionally, each wind turbine is equipped with an integrated electronic meter. The electricity generated is recorded by the O & M staff of the EPC contractor on 24 hour basis.

The Accounts department of SPD 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.

For this project, the feeder connections are as follows:

**Site I : Village –Jamade, Dhule**

| WEG Location No. | Substation | Feeder Number[1] |
|---|---|---|
| J-17 | Jamade | 13 |
| J-21 | Jamade | 14 |
| J-22 | Jamade | 14 |
| J-23 | Jamade | 14 |

**Site II : Village –Nagaj, Sangli**

| WTG Location No. | Substation | Feeder Number[1] |
|---|---|---|
| N-4 | Ghatnandre | 9 |
| N-5 | Ghatnandre | 9 |
| N-6 | Ghatnandre | 9 |
| N-7 | Ghatnandre | 9 |
| N-8 | Ghatnandre | 10 |
| N-9 | Ghatnandre | 10 |

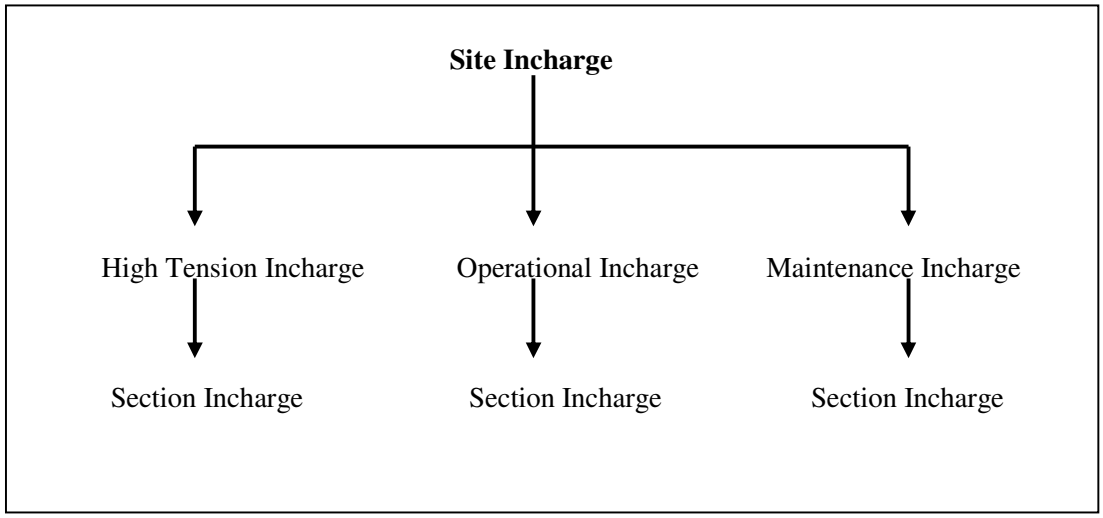
[1] JMR is issued based on apportioning logic applied at feeder level

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

The project participant has signed an operation and maintenance agreement with the supplier of the wind turbines i.e. Suzlon. The agreement is for a period of 10 years. The performance of the turbines, safety in operation and scheduled /breakdown maintenances is responsibility of Suzlon and is organized and monitored by them. So the authority and responsibility of project management lies with the O & M contractor.

ISO 9001:2000 standard has been adopted by Suzlon, who is responsible for monitoring, calibration and O & M of the project. Training is an essential part of the ISO system. To comply with the ISO standard, training has to be provided to personnel according to their responsibility with in organization.

The organizational hierarchy of Suzlon for O& M management is as follows




**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:

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 and 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 WEGs 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. The project activity essentially involves generation of electricity from wind. The employed WEGs can only convert wind energy into electrical energy and cannot use any other input fuel for electricity generation. As the operation of WEGs is emission free and no emissions will be produced during the lifetime of the WEGs.

Although it is being anticipated that there would be no unintended emissions/leakages from this project, however, if any such condition arises, and leakage effect is found due to the project, such leakage will be accounted accordingly as mentioned in the chosen applied baseline methodology.

SPD has appointed a full time project in-charge to manage the overall project activity. The project in-charge supervises the functioning of the wind farm in close coordination with the officials & technical personnel of Suzlon.

## Annex 4

## MONITORING INFORMATION

The project is a renewable energy project generating electricity (Type ID) – the monitoring methodology and baseline are selected here as suggested in the document 'Simplified Modalities and Procedures for Small-Scale CDM project activities'

**Data to be monitored**

| | |
|---|---|
| Monitoring methods and procedures | Monitoring of Generation with the help of inbuilt panel meters;<br><br>This generation data will be measured continuously with the help of inbuilt control panel meters located at individual WEGs The Technicians of the CDM team will record the generation data at CMS.<br><br>Monitoring of Net export of electricity to grid from WTG's connected to Common Bulk Meters:<br><br>The reading from MSEDCL meter will be recorded every month by MSEDCL personnel in the presence of site Engineer. The MSEDCL will apply the apportioning logic and issues the JMR which provided the "Net export of electricity by each WTG" or "Net export of electricity by each project promoter" accordingly the PP raises invoices The monitoring records will be maintained at the PP's end for the entire crediting period plus two years. |
| QA/QC procedures | The common bulk meter will be calibrated by MSEDCL as per their schedule usually once every year. The monthly generation data from the WTG's connected to common bulk meter will be compared with the readings of common bulk meter by the Site Engineer.<br><br>In case the deviation in MSEDCL's recorded data is beyond the allowable limits, the PP will request MSEDCL to calibrate/rectify the meter at the earliest. For the period of error, data would be adjusted as described under "Data uncertainties and adjustments". The site Engineer will be Responsible to undertake the calibration from the MSEDCL . |
| Reporting | The Site Engineers (SE) will review the generation data measured at inbuilt control panel meters at CMS on a daily basis and record the data in computer. On a daily basis, a compilation of the electricity generation data from each WEG will be uploaded in the O&M Contractor's website. This website data will be accessible by the Head - Wind Power Projects (WPP) at the respective project promoter's administration office. The Head – WPP will then take a print of the daily report from the website and file it. He will prepare a monthly consolidated report of the electricity generation data. |
| Data archiving | Once the monthly reports are approved, it would be archived in paper at the respective administrative office by the Head-WPP. Electronic copy of monthly reports would be archived by the PP. Generation data from |

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|---|---|
| | the CMS at the site would be archived by the Site Engineer. |

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| Data uncertainties and adjustments | For this parameter, data uncertainties are likely during the following scenarios:<br>• During error in meter<br>• When meter is dismantled for O&M or calibration<br>• When data is not recorded or records are lost<br>Error in the common bulk meter will be usually identified during cross-checking the monthly electricity generation reports. If an error is found in the MSEDCL meter, the generation data measured at inbuilt control panel meter minus average transformer losses would be used to calculate the net export from the WTG and used for emission reduction determination for the error period. When the common bulk meter will be dismantled for O&M or Calibration, pre-calibrated standby meters may be used by the MSEDCL meter for that period which would be noted When data or records are lost, the emission reductions would be calculated based on MSEDCL's monthly generation report. |

**Procedures for internal audit and management review:**

An internal audit of the project activity would be done on a half yearly basis by a special audit team. The audit team would comprise competitive persons. The team would audit the project for the following aspects among other things:

- Are the monitoring of CDM parameters done in line with the CDM PDD and CDM Manual?
- Is the documentation of monitored CDM parameters done properly?
- Are equipments calibrated and maintained as scheduled?
- Is the quantity of CERs generated inline with that projected in the CDM PDD, if not, what are the reasons for deviation?
- Are necessary corrective actions being taken to address deviations?
- Check the authenticity of data monitored and recorded by random cross-checking with other sources.

The audit team will submit their observations to the Head- Wind Power Projects for his review and necessary action.

**Procedures for maintenance of monitoring equipments:**

- The Site Engineer will conduct a physical inspection of all the common bulk meters once a month
- Any maintenance requirements would be immediately attended
- The common bulk meters will undergo a preventive maintenance and calibration once in a year or as per the schedule of MSEDCL.
- The responsibility of calibration and maintenance of common bulk meters will be with the Site Engineer
- Maintenance history card would be maintained for all common bulk meters

**Internal audit and GHG compliance at the suppliers end:**

Since the promoters have signed an O&M contract with the suppliers of the wind turbines i.e. Suzlon, internal audits regarding GHG compliance is carried out by the suppliers.

The Suzlon Quality Management system is constantly reviewed by DNV, one of the leading global registrars of Quality Management systems. GHG compliance of the project activity is associated with the ISO 9001 system and project performance reviews will be conducted and verified on a regular basis.