**PROJECT DESIGN DOCUMENT FORM
FOR CDM PROJECT ACTIVITIES (F-CDM-PDD)
Version 04.1**

# PROJECT DESIGN DOCUMENT (PDD)

| | |
|---|---|
| **Title of the project activity** | Renewable Energy Wind Power Project in Rajasthan |
| **Version number of the PDD** | 11.0 |
| **Completion date of the PDD** | 08/07/2014 |
| **Project participant(s)** | Vish Wind Infrastructure LLP |
| **Host Party(ies)** | India |
| **Sectoral scope and selected methodology(ies)** | Sectoral Scope: 1, Energy industries (renewable/ non-renewable<br>Sources<br>ACM0002, Version 12.3.0 |
| **Estimated amount of annual average GHG emission reductions** | 48,988 |

**SECTION A. Description of project activity**

**A.1. Purpose and general description of project activity**

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Vish Wind Infrastructure LLP ("VWIL") is developing 29.6 MW wind farm in the state of Rajasthan in India. The project consists of 37 machines of Wind World (name of Enercon (India) Ltd. has been changed to Wind World (India) Ltd. effective from 01/01/2013, hereafter Enercon will be refereed as Wind World) make E-53 type WEGs of 800KW capacity each. Annually, the project is expected to generate and supply 53.103 GWh of electricity to Rajasthan regional electricity grid which is part of the NEWNE (Northern, Eastern, Western and North-Eastern) grid in India. The clean and green electricity supplied by the project will aide in sustainable growth in the region. VWIL is the project owner and project participant for the project activity. The project activity is the first renewable energy project developed by VWIL in the state of Rajasthan in India.

**Objective of the Project**

The purpose of the project activity is to utilize renewable wind energy for generation of electricity. The project activity replaces anthropogenic emissions of greenhouse gases (GHG's) into the atmosphere, which is estimated to be approximately 48,988 $tCO_2e$ per year, by displacing the equivalent amount of electricity generation through the operation of existing fuel mix in the grid comprising mainly fossil fuel based power plants and future capacity expansions connected to the grid.

Project activity is the installation of green field energy production using wind as a source of power generation. In the absence of the project activity the equivalent amount of electricity would have been generated from the connected/ new power plants in the NEWNE[1], which are/ will be predominantly based on fossil fuels. Whereas the operation of Wind Energy Convertors (WEG's) is emission free and no emissions occur during the lifetime of the project activity. As per the applicable methodology the baseline scenario for the project activity is the grid based electricity system, which is also the pre-project scenario.

**Nature of Project**

The Project harnesses renewable resources in the region, thereby displacing non-renewable natural resources and thus leading to sustainable economic and environmental benefits. Wind World (India) Limited (hereafter referred as "WWIL") is the equipment supplier and the operations and maintenance contractor for the Project. The Project is owned by VWIL. The generated electricity will be supplied to Electricity Distribution Company (DISCOM) under a long-term power purchase agreement (PPA) for a period of 20 years. PP has no prior experience in renewable energy project. This is the first investment of PP in renewable energy sector in the state of Rajasthan.

**Contribution to sustainable development**

The National CDM Authority (NCDMA) is the Designated National Authority (DNA) for the Government of India (GoI) in the Ministry of Environment and Forests (MoEF). It has stipulated four indicators for sustainable development in the interim approval guidelines for Clean Development Mechanism (CDM) projects from India[2]. The contributions of this project activity towards these indicators are provided below:

[1] http://www.cea.nic.in/installed_capacity.html

[2] http://www.cdmindia.gov.in/approval_process.php

1. **Social well being:**

- The project activity will lead to the development of supporting infrastructure such as road network etc., in the wind park location, the access to which is also provided to the local population.
- The project activity will lead to alleviation of poverty by establishing direct and indirect benefits through employment generation and improved economic activities by strengthening of local grid of the state electricity utility.
- Use of a renewable source of energy reduces the dependence on imported fossil fuels and associated price variation thereby leading to increased energy security.

2. **Environmental well being:**

- The project activity employs renewable energy source for electricity generation instead of fossil fuel based electricity generation which would have emitted gaseous, liquid and/or solid effluents/wastes.
- 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 and contributes to environmental well-being.

3. **Economic well being:**

- The project activity requires temporary and permanent, skilled and semi-skilled manpower at the wind park; this will create additional employment opportunities.
- The generated electricity will be fed into the NEWNE regional grid through local grid, thereby improving the grid frequency and availability of electricity to the local consumers (villagers & sub-urban habitants). This 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.

4. **Technological well being:**

- Increased interest in wind energy projects will further push R&D efforts by technology providers to develop more efficient and better machinery in future.

In addition to this, the project proponent will contribute 2% of the CDM revenue realized from the candidate CDM project for sustainable development including society / community development. PP is aware about the Indian DNA guideline on commitment of 2% of the CDM revenues towards sustainable development and a formal undertaking is being submitted separately to the DNA.

**A.2. Location of project activity**

**A.2.1. Host Party(ies)**

>> India

**A.2.2. Region/State/Province etc.**

>>

North-Western Region/Rajasthan State

**A.2.3. City/Town/Community etc.**

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The Project is spread across Ugawa, Korwa & Kita villages of Jaisalmer District and Salodi & Jelu Villages of Jodhpur district in the Rajasthan state of India.

### A.2.4. Physical/Geographical location

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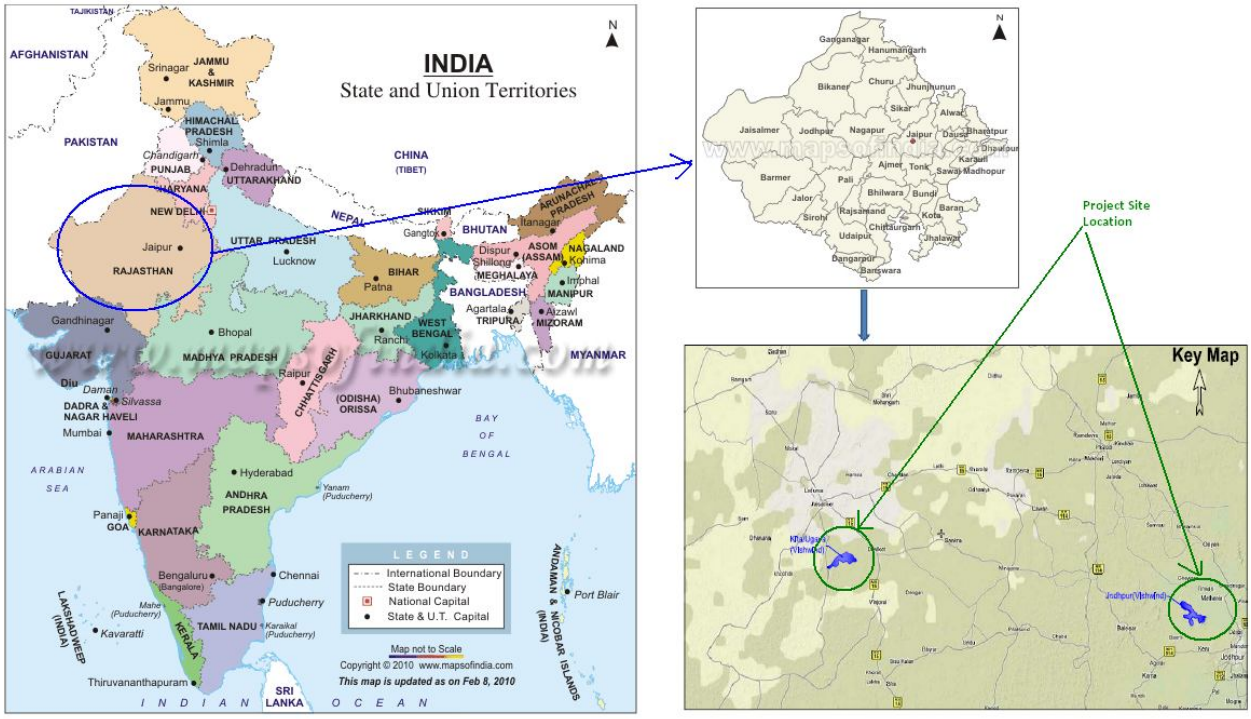
The Project is located in Jaisalmer & Jodhpur district in the Indian State of Rajasthan. The nearest railway station for project activity located at Ugawa, Korwa & Kita villages (District-Jaisalmer) is Jaisalmer approximately at a distance of 50 Kms from site, while the nearest railway station for project activity located at Salodi & Jelu villages (District-Jodhpur) is Jodhpur approximately at a distance of 50 Kms. The nearest airport is Jodhpur from site. The wind turbines extend between Latitude N26°25′ 25.2” to Latitude N 26°41′ 58.8” and Longitude E 70°56'13.0” to Longitude E72°50'44.5”. The latitude and longitude of each WEGs is provided in Annex1:

The location of the project site is shown in below picture:




### A.3. Technologies and/or measures

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The project activity involves 37-wind energy converters (WEGs) of Wind World make (800 KW E-53) with internal electrical lines connecting the project activity with local evacuation facility. The WEGs generate 3-phase power at 400V, which is stepped up to 33 KV. The project activity can operate in the frequency range of 47.5–51.5 Hz and in the voltage range of 400 V ± 12.5%. The average life time of the WEG is around 20 years as per the industry standards. The other salient features of the state-of-art-technology are:

| | |
|---|---|
| Turbine model | WWIL E- 53 |
| Rated power | 800 KW |
| Rotor diameter | 53 m |

| | |
|---|---|
| Hub height | 75 m |
| Turbine Type | Gearless horizontal axis wind turbine with variable rotor speed |
| Power regulation | Independent electromechanical pitch system for each blade. |
| Cut in windspeed | 2.5 *m/s* |
| Rated wind speed | 12 *m/s* |
| Cut out Windspeed | 28-34 m/s |
| Extreme Wind Speed | 59.5 *m/s* |
| Rated rotational speed | 32 rpm |
| Operating range rot. speed | 12-29 rpm |
| Orientation | Upwind |
| No of Blades | 3 |
| Blade Material | Glass Fiber reinforced Epoxy |
| Gear box type | Gear less |
| Generator type | Synchronous generator |
| Braking | Aerodynamic |
| Output Voltage | 400 V |
| Yaw System | Active yawing with 4 electric yaw drives with brake motor and friction bearing |
| Tower | 74 m concrete |

Wind World (India) Limited has secured and facilitated the technology transfer for wind based renewable energy generation from Enercon GmbH, has established a manufacturing plant at Daman in India, where along with other components the "Synchronous Generators" using "Vacuum Impregnation" technology are manufactured.

**Scenario existing prior to the start of the implementation of the project activity:**

Project activity installs the wind farm at a barren land. Project activity is the installations of green field energy production with the installation of 37 WEGs of WWIL make E 53 of 800 KW each totalling 29.6MW project capacity.

In the absence of the project activity the equivalent amount of electricity would have been generated from the connected/ new power plants in the NEWNE grid, which are/ will be predominantly based on fossil fuels[3], hence baseline scenario of the project activity is the grid based electricity system, which is also the pre-project scenario. Since the project activity involves power generation from wind, it does not emit any emissions in the atmosphere.
Project activity will harness wind as a source of energy production which is environmentally safe and sound technology. There is no GHG emission through project activity. The WEGs confirms to the relevant code of safety and standards mandatory for setting up wind projects. The standard includes Wind Turbine

[3] http://www.cea.nic.in/installed_capacity.html

Safety and Design, Noise level and Mechanical Load. Therefore the technology implemented can be depicted as environmentally safe and sound one.

The power production through WEG's depends on several factors i.e. wind speed and grid availability. Grid availability as well as wind speed varies, based on different external factors. VWIL has conducted a third party study through Ravi-Enteck for estimating the PLF of the site, as per the report of 'site validation and generation estimation' the PLF of the Jaisalmer site is 20.48% and for Jodhpur site it is 20.45%. Being conservative the maximum of both the PLF values that is 20.48% has been used in the financial analysis in additionality demonstration.

**A.4. Parties and project participants**

| Party involved (host) indicates a host Party | Private and/or public entity(ies) project participants (as applicable) | Indicate if the Party involved wishes to be considered as project participant (Yes/No) |
|---|---|---|
| Government of India (Host) | Vish Wind Infrastructure LLP (Private entity) | No |

The contact details of the entities are provided in Appendix– 1.

**A.5. Public funding of project activity**

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There is no public funding from Annex 1 countries and no diversion of Official Development Assistance (ODA) is involved in the project activity.

**SECTION B. Application of selected approved baseline and monitoring methodology**

**B.1. Reference of methodology**

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**Title:** Consolidated baseline and monitoring methodology for "Grid-connected electricity generation from renewable sources"

**Reference:** Approved consolidated baseline methodology ACM0002 (Version 12.3.0, EB 66)

ACM0002 draws upon the following tools which have been used in the PDD:

- Tool to calculate the emission factor for an electricity system – Version 02.2.0
- Tool for the demonstration and assessment of additionality – Version 5.2

Further information with regards to the methodology / tools can be obtained at:
http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

**B.2. Applicability of methodology**

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The project activity is wind based renewable energy source, zero emission power project connected to the Rajasthan state grid, which forms part of the NEWNE grid. The project activity will displace fossil fuel based electricity generation that would have otherwise been provided by the operation and expansion of the fossil fuel based power plants in NEWNE grid.

The approved consolidated baseline and monitoring methodology ACM0002 Version 12.3.0 is the choice of the baseline and monitoring methodology and it is applicable because:

| Para No. | Applicability Conditions as per ACM 0002 | Applicability to this Project Activity |
|---|---|---|
| 1. | The project activity is the installation capacity addition, retrofit or replacement of a power plant/unit of one of the following types:<br>• Hydro power plant/unit (either with a run-of-river reservoir or an accumulation reservoir)<br>• Wind power plant/unit,<br>• Geothermal power plant/unit,<br>• Solar power plant/unit,<br>• Wave power plant/unit<br>• Tidal power plant/unit. | The project activity is the installation of new grid connected renewable power generation from wind. |
| 2. | In the case of capacity additions, retrofits or replacements: the existing plant started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity expansion or retrofit of the plant has been undertaken between the start of this minimum historical reference period and the implementation of the project activity; | This condition is not relevant, as the project activity does not involve capacity additions, retrofits or replacements. |
| 3. | In case of hydro power plants:<br>• The project activity is implemented in an existing reservoir, with no change in the volume of reservoir.<br>• The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 $W/m^2$.<br>• The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the project emissions section, is greater than 4 $W/m^2$. | This condition is not relevant, as the project activity is not the installation of a hydro power plant. |
| 4. | The methodology is not applicable to the following:<br>• Project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site;<br>• Biomass fired power plants;<br>• Hydro power plants that result in new | The project activity does not involve any of the given criteria hence methodology is applicable for the project activity. |

| | | |
|---|---|---|
| | reservoirs or in the increase in existing reservoirs where the power density of the power plant is less than 4 W/$m^2$. | |
| 5. | In the case of retrofits, replacements, or capacity additions, this methodology is only applicable if the most plausible baseline scenario, as a result of the identification of baseline scenario, is "the continuation of the current situation, i.e. to use the power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance". | The project activity is a new wind power plant. No replacement, modification or retrofit measures are implemented here. Hence, this criterion is also not relevant to the project activity. |

The description provided in table above shows that the project activity satisfies the applicable conditions of the methodology, ACM0002.

**B.3. Project boundary**

According to the applicable methodology, spatial extent of this project activity includes the project site and all the power plants connected physically to the electricity system that the CDM power project is connected to. The project activity is connected to the network of state transmission utility which falls in NEWNE grid. Thus the project boundary includes all the power plants physically connected to the NEWNE grid.

Project boundary includes all the 37 WEGs of VWIL along with the other customer WEGs connected to the sub-station. Project boundary includes main and backup meters for energy monitoring. Project activity is connected through total 4 sub-stations (2 EB (Electricity Board) sub-stations & 2 WWIL Pooling sub-stations) as follows:-

**1) 16 MW of Project activity installed in Jodhpur District:-**

Metering is done at 132 kV billing metering point (one main & one check meter) connected at 132kV EB sub-station (PS-8 Narwa). There is one backup metering point (one main & one check meter) connected at Salodi - 132kV WWIL pooling sub-station. Project activity is connected to WWIL pooling sub-station (132kV, Salodi) through 33 KV line. Further a 132kV transmission line (EHV line) connects the WWIL pooling sub-station to state utility sub-station (132kV, PS-8) where energy monitoring is done.

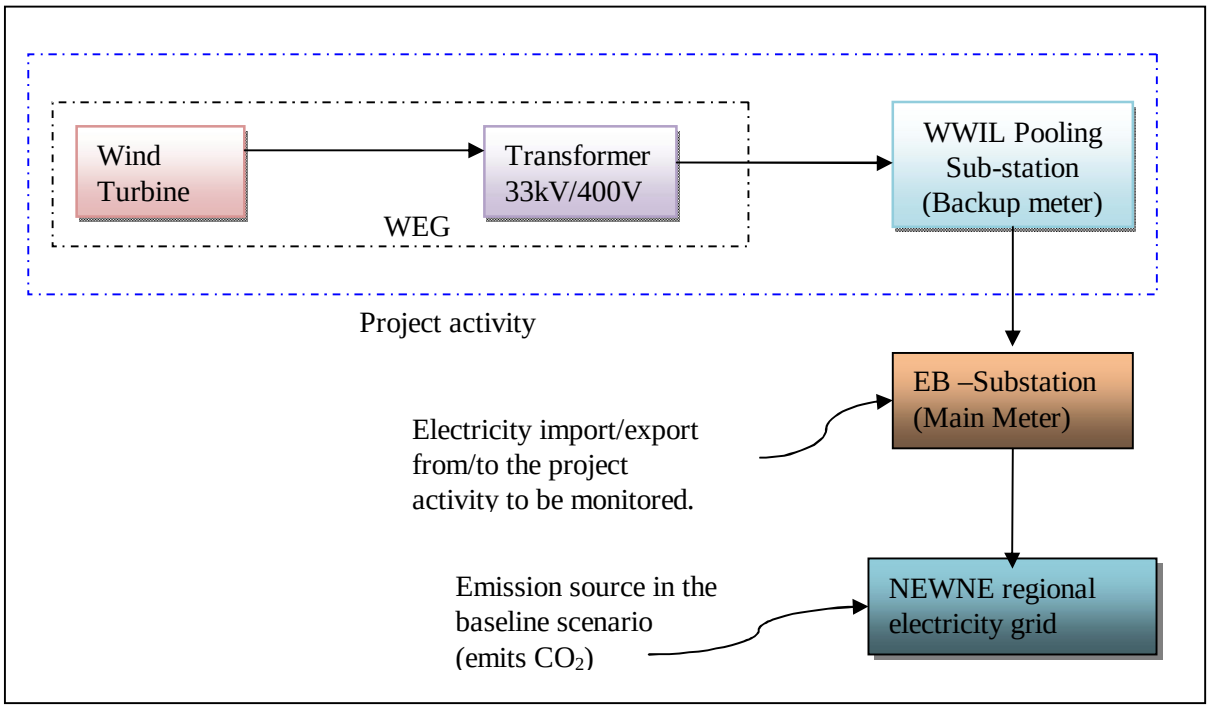
**2) 13.6 MW of Project activity installed in Jaisalmer District:-**

Metering is done at 220 kV billing metering point (one main meter) connected at 220kV EB sub-station (Akal[4]). There is one backup metering point (one main meter) connected at Bhu – 220 kV sub-station (WWIL pooling sub-station). Project activity is connected to WWIL pooling sub-station (220kV, Bhu) through 33 KV line. Further a 220kV transmission line (EHV line) connects the WWIL pooling sub-station to state utility sub-station (220kV, Akal) where energy monitoring is done.

[4] The connection point of the project activity to a particular substation is decided by state utility and hence, the same
might change in future. However the procedure for allocation of apportioning of electricity generated will remain same.

From state utility substation (EB Sub-station) electricity is transmitted to NEWNE grid though transmission lines. A schematic of project boundary diagram is shown below.

**Flow diagram of the project boundary:**




Represents project activity

Represents 1 unit of WEG (there are 37 such units in the project activity)

Represents project boundary

The baseline study of NEWNE grid shows that the main sources of GHG emissions in the baseline are $CO_2$ emissions from the conventional power generating systems, the other emissions are that of $CH_4$ and $N_2O$ but both emissions were conservative and are excluded for simplification of the project. The project activity is the emission free electricity generation from renewable sources and hence emits no gases in the atmosphere.

Following table indicates the sources and gases included in the project boundary:

| Source | | GHGs | Included? | Justification/Explanation |
|---|---|---|---|---|
| **Baseline scenario** | Grid-connected electricity generation | $CO_2$ | Yes | In the baseline scenario the electricity would have been sourced from the NEWNE grid which in turn would be connected to fossil fuel fired power plants which emit $CO_2$. |
| | | $CH_4$ | No | No methane generation is expected to be emitted. |
| | | $N_2O$ | No | No nitrous oxide generation is expected to be emitted. |
| **Project scenario** | Greenfield wind energy conversion system | $CO_2$ | No | The project activity does not emit any emissions. |
| | | $CH_4$ | No | No methane generation is expected to be emitted. |
| | | $N_2O$ | No | No nitrous oxide generation is expected to be emitted. |

**B.4. Establishment and description of baseline scenario**

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According to the applied methodology ACM 0002, if the project activity is the installation of a new grid-connected renewable power plant/ unit, the baseline scenario is the following:

*Electricity delivered to the grid by the project would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the "Tool to calculate the emission factor of an electricity system".*

As the Project does not modify or retrofit an existing generation facility, the baseline scenario is the emissions generated by the operation of grid-connected power plants and by the addition of new generation sources. This is estimated by multiplying the Combined Margin with electricity delivered to the grid by the Project.

The details of India grid system is described in the table below:

| S.No. | Electricity Grid (Present) | Electricity Grid (Earlier) | Geographical Areas Covered |
|---|---|---|---|
| 1. | NEWNE Grid | Northern | Chandigarh, Delhi, Haryana, Himachal Pradesh, Jammu and Kashmir, Punjab, Rajasthan, Uttar Pradesh, Uttarakhand |
| | | Western | Chhattisgarh, Gujarat, Daman & Diu, Dadar & Nagar Haveli, Madhya Pradesh, Maharashtra, Goa |
| | | Eastern | Bihar, Jharkhand, Orissa, West Bengal, Sikkim, Andaman-Nicobar |
| | | North-Eastern | Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura |
| 2. | Southern Grid | Southern | Andhra Pradesh, Karnataka, Kerala, Tamilnadu, Pondicherry, Lakshadweep |

Rajasthan state falls under NEWNE grid. The power sector in India including the Northern region largely comprises thermal power stations[5]; as can be seen from the table below[6]:

| Sector | Hydro | Thermal | | | | Nuclear | Renewable | Total |
|---|---|---|---|---|---|---|---|---|
| | | Coal | Gas | Diesel | Total | | | |
| State | 27055.76 | 42537.50 | 3672.12 | 602.61 | 46812.23 | 0.00 | 2247.68 | 76115.67 |
| Central | 8592.00 | 29620.00 | 6638.99 | 0.00 | 36258.99 | 4120.00 | 0.00 | 48970.99 |
| Private | 1230.00 | 5491.38 | 4565.50 | 597.14 | 10654.0 | 0.00 | 10994.73 | 22878.75 |

[5] http://www.cea.nic.in/

[6] http://www.cea.nic.in/installed_capacity.html

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 2 | | | |
| All India | 36877.76 | 77648.88 | 14876.61 | 1199.75 | 93725.24 | 4120.00 | 13242.41 | 147965.41 |

It is evident from the above table that the installed capacity in India is predominantly thermal power plants; thermal power generation is GHG intensive and is a major source of $CO_2$ emissions. In the absence of the project activity equivalent amount of electricity would have been generated from the existing grid connected power plants and planned capacity additions which are also largely fossil fuel based. Thus generation from the project displaces the electricity generated from existing and planned power plant capacities in the NEWNE grid whose emission intensities are represented by the Combined Margin Emission Factor of the NEWNE Grid. The Emission Reductions from the project activity is estimated to be 48,988 $tCO_2e$ annually.

The baseline emissions and emission reductions from the project activity are estimated by multiplying the amount of electricity exported by the project activity to the NEWNE grid with the emission factor of the NEWNE grid calculated as the combined margin (CM) of the operating margin (OM) and build margin (BM) emission factors.

| **Variable** | **Data Source** |
|---|---|
| $EG_{PJ,y}$ = 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) | Records maintained by project proponents |
| **Parameter** | **Data Source** |
| $\boldsymbol{EF_{grid,OM,y}}$ = Operating Margin Emission Factor ($tCO_2$/MWh) | CEA Database for $CO_2$ emission factor, version 5 |
| $EF_{grid,BM,\ y}$ = Build Margin Emission Factor ($tCO_2$/MWh) | CEA Database for $CO_2$ emission factor, version 5 |
| EFy – Grid Emission Factor | Calculated as the weighted average of the operating margin and build margin |

**B.5. Demonstration of additionality**

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**CDM Consideration:**

The project activity has been conceived as a CDM project since its inception. The project start date is 10th July 2010 which is the date of issuing purchase order for the project activity. The PP has intimated UNFCCC about the project activity initiative within six months of the start date on 16th October 2010 and received the acknowledgement from UNFCCC on the same day. The acknowledgement from UNFCCC and intimation by Project participant shall be provided to the DOE for verification. The PP published invitation of local stakeholder meeting on dated 12th October 2010 and stakeholder meeting was conducted on 25th & 27th October 2010 at Jaisalmer & Jodhpur project site respectively. PP engaged the DOE on 15th-Oct-10 for Project validation activity and PDD preparation was completed on 15-Dec-10.

Chronology of events for project activity is as follows:-

| S. No. | Activity | Date |
|---|---|---|
| 1 | Supplier Offer | 25 June 2010 |
| 2 | Board Resolution | 09 July 2010 |
| 3 | Purchase Order | 10 July 2010 |

| | | |
|---|---|---|
| 4 | Authorization to EIL for CDM consultancy services | 20 July 2010 |
| 5 | Commissioning date | Sep 2010 |
| 6 | Engagement with DoE | 15 Oct 2010 |
| 7 | Intimation to UNFCCC | 16 Oct 2010 |
| 8 | Intimation to DNA | 30 Oct 2010 |
| 9 | Stakeholder Meeting | 25 & 27 Oct 2010 |
| 10 | PDD Webhosting for global stakeholder comments | 05 Jan 2011 |

**Demonstration of Additionality for the project activity:**

The latest Additionality tool i.e. Tool for the demonstration and assessment of Additionality version 5.2 approved by CDM Executive Board is used to demonstrate project Additionality.

**Step 1: Identification of alternatives to the project activity consistent with current laws and regulations**

As per ACM0002, the baseline alternative for the project activity is generation of equivalent amount of electricity by operation of grid-connected power plants and by addition of new generation sources. Accordingly, the realistic and credible alternatives to the project activity are:

(a) The Project is undertaken without registering it as a CDM activity.

(b) Equivalent amount of electricity being generated through operation of grid-connected power plants and addition of new generation sources

**Outcome of Step 1a:** Alternatives (a) and (b) above have been identified as realistic and credible alternative scenario(s) to the project activity

**Sub-step 1b: Consistency with mandatory laws and regulations:**

There are no legal and regulatory requirements that prevent Alternatives (a) and (b) from occurring.

**Outcome of Step 1b:** Identified realistic and credible alternative scenario(s) to the project activity that are in compliance with mandatory legislation and regulations taking into account the enforcement in the region or country and EB decisions on national and/or sectoral policies and regulations.

**Proceed to Step 2 (Investment analysis) or Step 3 (Barrier analysis). (Project participants may also select to complete both steps 2 and 3.)**

**Step 2: Investment Analysis**

**Sub step 2(a): Determine Appropriate Analysis Method**

The project activity generates revenue by selling electricity to State electricity Board/ DISCOM, thus simple cost analysis (option I) cannot be applied to the proposed CDM project activity.

The alternative to the project activity is continuation of current situation, i.e. no project activity and equivalent amount of energy would have been produced by the grid electricity system. This alternative will not require capital investment; hence investment comparison analysis (option II) cannot be applied.

In this case the benchmark analysis (option III) is most appropriate.

### Sub step 2(b): Option III- Apply benchmark analysis

The Project Proponent proposes to use **Option III – Benchmark Analysis** and the financial indicator is identified as *post-tax* equity IRR.

The guidance to investment analysis issued in EB 51, Annex 58 (paragraph 12) states that in cases where a benchmark approach is used the applied benchmark shall be appropriate to the type of IRR calculated. Required/expected returns on equity (Cost of Equity) are appropriate benchmarks for equity IRR.

As per ACM 0002 version 12.3.0 the additionality of the project shall be conducted using " tool for demonstration and assessment of additionality" version 5.2. The tool for demonstration and assessment of additionality [para-5, sub step 2(b)] states that, in cases where the project has more than one potential developer, the benchmark shall be based on parameters that are standard in the market, considering the specific characteristics of the project type. Accordingly, the cost of Equity applicable to the project type has been considered as the benchmark to be compared against equity IRR.

The benchmark Cost of equity for the project is calculated as **16.40%**. The detailed calculation of the assumptions is provided in Annex 2.

### Sub-step 2c: Calculation and comparison of financial indicators (only applicable to Options II and III):

Key assumptions used for calculating post-tax Equity IRR are set out below:

| Assumptions for Financial Model | | | |
|---|---|---|---|
| Capacity of Machines in kW | 800 | | Enercon Offer |
| Number of Machines | 37 | | Enercon Offer |
| Project Capacity in MW | 29.60 | | Enercon Offer |
| Expected project commissioning date | 30-Sep-10 | | Enercon Offer |
| Project Cost per MW (Rs. In Millions) | 59.34 | | Calculated |
| | | | |
| **Operations** | | | |
| PLF | 20.48% | | Third party PLF |
| Insurance Charges @ % of capital cost | 0.12% | | Normative |
| Operation & Maintanance Cost base year @ % of capital cost | 1.30% | | Enercon's offer |
| % of escalation per annum on O & M Charges | 6.0% | | Enercon's offer |
| Service Tax on O&M expenses | 10.3% | | Income Tax Act (Financial |

| | | | |
|---|---|---|---|
| | | | Year 2010-11) |
| | | | |
| **Tariff** | | | |
| Base year Tariff for 20 years - Rs./Kwh | 3.87 | | RERC Tariff Order dated 31.3.10 |
| | | | |
| **Project Cost** | **Rs Million** | | |
| Land and Infrastructure, Generator & Electrical Equipments, Mechanical Equipments, Civil Works, Instrumentation & Control, Other Project Cost, Pre operative Expenses, etc. | | | |
| **Total Project Cost** | **1,756.39** | | Enercon Offer |
| | | | |
| **Means of Finance** | | **Rs Million** | |
| Own Source | 100% | 1,756.39 | The project is 100% equity project |
| Term Loan | 0% | - | |
| Total Source | | 1,756.39 | |
| | | | |
| **Income Tax Depreciation Rate (Written Down Value basis)** | | | |
| Depreciation as per IT Act | 80% | | |
| Additional depreciation | 20% | | |
| **Total depreciation on Wind Energy Generators** | **100%** | | Income Tax Act |
| | | | |
| **Book Depreciation Rate (Straight Line Method basis)** | | | |
| On all assets | 4.50% | | Straight line Method Adopted |
| Book Depreciation up to (% of asset value) | 90% | | |
| | | | |
| **Income Tax** | | | |
| Income Tax rate | 30.90% | | Income Tax Act (Financial Year 2010-11) |
| | | | |
| | | | |
| **Working capital** | | | |
| Receivables (no of days) | 30 | | Billing Cycle |
| O & m expenses (no of days) | 90 | | Enercon's Offer |

The post tax equity IRR for the Project without CDM revenues is 7.25 % i.e. less than the benchmark.

### Sub-step 2d: Sensitivity analysis (only applicable to Options II and III):

**Sensitivity Analysis**

The investment in wind power project shall be tested based on the following parameters:

- Capital Cost
- Tariff
- Plant Load Factor
- O&M cost
- Debt Equity Ratio

**Capital Cost**

In accordance with the investment guidance, the additionality for the project activity is demonstrated at the time of decision making. The project proponent has considered it appropriate to conduct the sensitivity at the variation of +/- 10% of the project cost.

| | 10% decrease in Capital Cost | Base Capital Cost | 10% Increase In Capital Cost |
|---|---|---|---|
| Post tax Equity IRR | 9.24% | 7.25% | 5.58% |

Further as per the purchase order placed by VWIL the total project cost is INR 1628.00 million which is 7.30% below than the project cost used at the time of decision making, which comes under the 10% sensitivity analysis done and the IRR at actual project cost is 8.66% which is below than the benchmark.

The equity IRR crosses the benchmark after 28.9% reduction in base capital cost or at the capital cost of INR 1248.79Million, which is not a realistic assumption.

**Tariff**

Rajasthan state electricity commission has fixed the tariff for the period of 20 years (Lifetime) for the wind power projects. The tariff for the entire life of the project activity is fixed a Rs. 3.87 per Unit. Therefore it is not appropriate to conduct sensitivity on tariff.

Though being conservative PP has done 10% sensitivity on tariff and an increase of 10% in tariff, the IRR for project activity is 8.80% which is below than the benchmark.

Further equity IRR crosses the benchmark at a tariff of INR 6.48 per unit, which is unrealistic condition.

**Plant Load Factor**

Plant Load Factor is the key variable encompassing variation in wind profile, variation in off-take (including grid availability) including machine downtime.

As per EB 48, annex 11, Plant load factor validated by independent third party source can be used for investment analysis. PP has appointed third party for the assessment of PLF for both Jaisalmer & Jodhpur site. The third party submitted two separate PLF assessment reports, one for Jaisalmer & another for

Jodhpur site. The plant load factor (PLF) for the Jaisalmer site is 20.45% and for the Jodhpur site is 20.48% based on third party assessment report. Being conservative PP has taken the higher of both the PLF values for investment analysis i.e. 20.48%. We have conducted sensitivity at the variation of 10% from the base case PLF of 20.48%. Sensitivity is summarized in below table:

| | **PLF @ 18.43% (10% Decrease over PLF estimated by Third Party)** | **PLF 20.48% (PLF estimated by Third Party)** | **PLF @ 22.53% (10% Increase over PLF estimated by Third Party)** |
|---|---|---|---|
| Post tax Equity IRR | 5.59% | 7.25% | 8.80% |

The sensitivity analysis clearly shows even with a higher PLF, the project is not able to generate sufficient returns. It can therefore be concluded that the project is financially not viable without CDM benefits.
Further equity IRR crosses the benchmark at a PLF of 34.2%, which is unrealistic condition.

**O&M Cost**

In the financial analysis of the project activity we have taken the O&M cost as per the offer letter provided by the WEG supplier. Since the O& M agreement is yet to be signed with O&M contractor the actual O&M cost is not available to PP. Hence being conservative, PP have done sensitivity on ±50% in O&M and 5% escalation in O&M yearly.

By varying the O&M cost by ±50% the equity IRR has following value:

| | **(-50% decrease in base value & at 5% escalation) 0.65%** | **O&M cost base Value @ 1.30 % of capital cost & 6% escalation per year** | **(+50% increase in base value & at 5% escalation) 1.95%** |
|---|---|---|---|
| Post tax Equity IRR | 8.74% | 7.25% | 6.09% |

From the above sensitivity analysis it is clear that a decrease of 50% in O&M, IRR for the project activity is 8.74% which is below than the benchmark.

**Debt Equity Ratio**

This is the first investment of the VWIL in wind power projects. The project was envisaged as 100% equity finance and equity IRR for at the base case of 100% equity comes 7.25%. However post investment decision the PP has taken loan of Rs. 578.8 Million which is 36% of total project cost (total project cost as per the purchase order placed by PP). Therefore the sensitivity analysis has been conducted on the same debt equity ratio of 36: 64 in the investment analysis sheet. In the sensitivity analysis PP has considered 10.9% interest rate and 12 months moratorium period at which loan has been sanctioned and IRR of project activity comes out 6.50% which is well below than the benchmark.

**Outcome of Step 2:** As can be seen, the equity IRR of the project activity remains well below the benchmark even under the sensitivity analysis. Therefore it can be concluded that the proposed CDM project activity is unlikely to be the most financially/economically attractive.

### Step 3: Barrier analysis

Not Opted for.

### Step 4: Common practice analysis

### Sub-step 4a: Analyze other activities similar to the proposed project activity:

The description of common practice test (Step 4 of Additionality tool) requires analysis of other similar activities that are operational. Similar activities are defined as those that rely on a broadly similar technology, are of a similar scale, and take place in a comparable environment with respect to regulatory framework, investment climate, access to technology, access to financing etc.

The project activity is a 29.6 MW wind power project set up by VWIL industry in Rajasthan to generate and supply electricity to the Rajasthan state grid. The project is a large scale CDM activity. The applicable tariff for the project has been determined by the Rajasthan Electricity Regulatory Commission.

For common practice analysis only the state of Rajasthan is being considered as a reason of common practice analysis since in India the regulatory framework is different for different states and tariff policy and other regulations are state specific and are governed by state electricity regulatory commission.

It may be noted that common practice analysis is required to be carried out only in case of large scale CDM projects i.e. projects of more than 15 MW capacity. Further, the common practice guidance also states that projects of similar scale only need to be considered. Accordingly, for carrying out the common practice analysis the PP have considered following two criteria to define similar scale projects viz:-

1. Wind power projects that fall under the large scale definition of CDM i.e. that are of 15 MW of higher capacity.

2. The project activity has been set up by a private investor, in such cases; the additionality tool clearly states that the benchmark (Sub step 2 Paragraph 6a) for investment analysis should be increased to account for higher risks in private investments. Thus it is clear that government sector investments cannot be compared with private investments.

3. Further the small scale wind power projects by different investors combined to form a large scale bundled wind power project are not considered for common practice analysis since the investment risk profile of single private investor setting up a large scale project is different from the large scale bundled wind power projects.

Accordingly, all wind power projects of greater than 15 MW capacity set by single private project proponent in the state of Rajasthan, have been analyzed till the date of investment decision. Data for the common practice analysis have been sourced from the Indian Wind Power Directory 9$^{th}$ edition published in September 2009, which was available at the time of investment decision.

Wind projects by individual investors in Rajasthan where the installed capacity is more than 15MW are presented in the table below:

| S.No. | Name of Investor | Total Capacity in Rajasthan (MW) | CDM | CDM Project Title | Sub project Capacity (MW) | UNFCCC Reference number | Web links |
|---|---|---|---|---|---|---|---|
| 1 | Rajasthan State Mines & Mineral Ltd. | 74.8 | Yes | 1) **14.8** MW small-scale grid connected wind power project in Jaisalmer state Rajasthan, India by RSMML | 14.8 | 243 | http://cdm.unfccc.int/Projects/DB/BVQI1139048635.42/view |
| | | | | 2) **22.5** MW grid connected wind farm project by RSMML in Jaisalmer, India. | 22.5 | 1602 | http://cdm.unfccc.int/Projects/DB/BVQI1201770524.09/view |
| | | | | 3) **15** MW Grid connected renewable energy generation by RSMML | 15 | 2613 | http://cdm.unfccc.int/Projects/DB/DNV-CUK1243661243.16/view |
| | | | | 4) **22.5** MW grid connected Wind Energy Project of RSMML" of Rajasthan State Mines and Minerals Limited in Jaisalmer District, Rajasthan State | 22.5 | At validation stage | http://cdm.unfccc.int/Projects/Validation/DB/Y3O8IX2VXOH6L1WCZP48IC1UM74CU3/view.html |
| 2 | Enercon Windfarms Hindustan P. Ltd. | 60.000 | Yes | Enercon Wind Farm (Hindustan) Ltd in Rajasthan | 60 | 1168 | http://cdm.unfccc.int/Projects/DB/SGS-UKL1181742063.57/view |
| 3 | Rajasthan Ren. Energy Corp. Ltd. | 35.2 | Yes | 1) 10.2 MW Grid Connected Wind Farm project by RRECL in Jaisalmer, India. | 10.2 | At validation stage | http://cdm.unfccc.int/UserManagement/FileStorage/62MTX5WDKKBC2WS06RBD0P10SK20TZ |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | 2) 25 MW Grid Connected Wind Farm project by RRECL in Jaisalmer, India. | 25 | At validation stage | http://cdm.unfccc.int/UserManagement/FileStorage/QPGDS3PM9B0B667ZEI1KIU6XYNE8MH |
| 4 | DLF Home Developers | 33.000 | Yes | Wind Power based electricity generation project in India by DLF Home Developers Limited | 33 | At validation stage | http://cdm.unfccc.int/Projects/Validation/DB/34CAG54CUL49MILW9S0SKWCWU38SSX/view.html |
| 5 | Enercon Wind Farms (Rajasthan) Pvt. Ltd. | 24.000 | Yes | Bundled wind energy power projects (2003 policy) in Rajasthan | 24 | At validation stage | http://cdm.unfccc.int/Projects/DB/SGS-UKL1181738388.43/view |
| 6 | Enercon Wind Farm (Jaisalmer) Ltd. | 24.000 | Yes | "Bundled Wind power project in Jaisalmer (Rajasthan in India) managed by Enercon (India) Ltd. " * | 24.6 | 310 | http://cdm.unfccc.int/UserManagement/FileStorage/QHZU5CN321RNIWYQQ8DGK5HHYO9BBC |
| 7 | Hindustan Petroleum Corporation Ltd. | 21.250 | Yes | Bundled grid-connected electricity generation using wind energy by Hindustan Petroleum Corporation Limited. | 21.25 | At validation stage | http://cdm.unfccc.int/UserManagement/FileStorage/3VMQRC5EO6G7AB028WZUPDJ1SK9Y4X |
| 8 | Modern Road Makers Pvt. Ltd. | 20.000 | Yes | MRMPL Wind Power Project | 20 | At validation stage | http://cdm.unfccc.int/Projects/Validation/DB/AERX8YCUI2RBEAK41JC7IF8SN67G1P/view.html |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 9 | K S Oils Ltd. | 15.500 | Yes | 1) 7.5 MW Wind Power project in Jodhpur, Rajasthan | 7.5 | At validation stage | http://cdm.unfccc.int/Projects/Validation/DB/RA6L3V9EWLLXCYTDYOJIEE1QYAKT31/view.html |
| | | | | 2) 8 MW Wind power project by K.S Oils Limited | 8 | At validation stage | http://cdm.unfccc.int/Projects/Validation/DB/9K96F1AVNBCPWHZA103MFZZAEFC345/view.html |
| 10 | IDFC | 20.00 | No | Refer Sub-step 4b for detail description about IDFC project. | | | |

It can be seen that, without exception, all private investors in the state of Rajasthan with installations greater than 15 MW have developed these projects as CDM projects. In addition, all similar activities over 15 MW in size in the state of Rajasthan are CDM projects.

**Sub-steps 4a is satisfied.**

**Sub-step 4b Discuss any similar options that are occurring:**
From sub-step 4a it is clear that all similar projects have been undertaken only as CDM projects. Hence it can be concluded that similar activities are not widely observed or commonly carried out. Thus Sub-step 4b is not applicable.

Out of the above table of investors only IDFC project is not in CDM pipeline. IDFC project cannot be compared with other private project developers since the access to financing with respect to cost of borrowing for the banking institute like IDFC is not comparable to the private investors. The cost of borrowing for the banking institute is deposit rate where as cost of borrowing for the private investor is cost of debt. Therefore the cost of financing for the banking institute is different from the cost of financing for the private investors. The long term fixed deposits for the banks always are at the discount of cost of debt. Therefore access to financing for the private sector is costlier compared to banking institutes.
IDFC is a banking institute with equity stake of more than 20% held by government of India (source: http://www.idfc.com/pdf/shareholding_pattern/dec_31_2009/IDFCC3531122009_Web.pdf). Therefore IDFC project of 20 MW can be eliminated using the explanation provided under point number 2 and 3 above.

Therefore, the project activity is considered to be additional.

**B.6. Emission reductions**
**B.6.1. Explanation of methodological choices**
>>

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

$\mathbf{ER_y = BE_y – PE_y – L_y}$

Where:

| | |
|---|---|
| $BE_y$ | Baseline Emissions in year *y* (t $CO_2$e/yr) |
| $PE_y$ | Project Emissions in year *y* (t $CO_2$e/yr) |
| $L_y$ | Leakage Emissions in year *y* (t $CO_2$e/yr) |

**Estimation of Baseline Emissions:**

Baseline emissions include only $CO_2$ emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. The methodology assumes that in the absence of the project activity, equivalent amount of electricity would have been generated by existing grid-connected power plants and the addition of new grid-connected power plants. 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* ($tCO_2$/yr)

$EG_{PJ,y}$ = 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)

$EF_{grid,CM,y}$ = Combined margin $CO_2$ 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" ($tCO_2$/MWh)

Since the project activity is the installation of a new grid connected renewable power plant the $EG_{PJ,y}$ is calculated as :
$EG_{PJ,y} = EG_{facility,y}$

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/yr)

The proposed project activity is in the state of Rajasthan which falls under NEWNE grid which is not part of Annex –I. Therefore as per the paragraph 12 of the applied methodology baseline emission factor is calculated as combined margin, consisting of a combination of operating margin and build margin factors according to the procedures prescribed in the latest tool "Tool to calculate the emission factor for an electricity system – Version 02.2.0 (EB-61, Annex12)"for calculating the emission factor for an electricity system. The steps of calculation are as follows:

**STEP 1: Identifying the relevant electricity systems:**

The Indian electricity system is divided into two regional grids, viz. (1) Northern, Eastern, Western, North-Eastern and (2) Southern grid. Each grid covers several states. As the regional grids are interconnected,

there is inter-state and inter-regional exchange. A small power exchange also takes place with neighboring countries like Bhutan and Nepal.

According to "Tool to calculate the emission factor for an electricity system" version 02.2.0, If a connected electricity system is located partially or totally in Annex-I countries, then the emission factor of that connected electricity system should be considered zero.
The above applicability criteria is not applicable for the project activity since the project activity will supply the electricity to the NEWNE grid of host country India, which is a not a part of Annex- I country hence the "Tool to calculate the emission factor for an electricity system" is applicable for the project activity. Power generation and supply within the regional grid is managed by Regional Load Dispatch Centre (RLDC). The Regional Power Committees (RPCs) provide a common platform for discussion and solution to the regional problems relating to the grid. Each state in a regional grid meets its demand with its own generation facilities and also with allocation from power plants owned by the Central Sector such as NTPC and NHPC etc. Specific quotas are allocated to each state from the Central Sector power plants. Depending on the demand and generation, there are electricity exports and imports between states in the regional grid. The regional grid thus represents the largest electricity grid where power can be dispatched without significant constraints and thus, represents the "project electricity system" for the project activity. As the project activity is connected to the NEWNE regional electricity grid, the NEWNE grid is the "project electricity system".

**STEP 2: Choose whether to include off-grid power plants in the project electricity system (optional):**

Option I is opted for the project activity i.e. only grid power plants are included in the calculation.

**STEP 3: Select a method to determine the operating margin (OM):**

According to the tool, the calculation of the operating margin emission factor is based on one of the following methods:

(a) Simple OM, or
(b) Simple adjusted OM, or
(c) Dispatch data analysis OM, or
(d) Average OM.

Any of the four methods can be used for calculating OM, The simple adjusted OM and dispatch data analysis OM cannot be currently applied in India due to lack of necessary data however, the simple OM method (option a) can only be used if low cost/must-run resources constitute less than 50% of total grid generation in: 1) average of the five most recent years, or 2) based on long-term averages for hydroelectricity production.

The Share of Low Cost / Must-Run (% of Net Generation) in the generation profile of the different grids in India in the last five years is as follows:

| | **2004-05** | **2005-06** | **2006-07** | **2007-08** | **2008-09** |
|---|---|---|---|---|---|
| NEWNE | 16.84% | 18.0% | 18.5% | 19.0% | 17.3% |
| Southern | 21.61% | 27.0% | 28.3% | 27.1% | 22.8% |
| India | 18.01% | 20.1% | 20.9% | 21.0% | 18.6% |

*Source: CO2 Baseline Database for the Indian Power Sector – Central Electricity Authority*

The above data clearly shows that the percentage of total grid generation by low cost/must run plants (on the basis of average of five most recent years) for the NEWNE regional grid is less than 50 % of the total

generation. Hence the Simple OM method can be used to calculate the Operating Margin Emission factor. The average operating margin method cannot be applied, as low cost/ must run resources in NEWNE grid constitute less than 50% of total grid generation.

The project proponents choose an ex ante option for calculation of the OM with a 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation, without requirement to monitor and recalculate the emissions factor during the crediting period.

**STEP 4: Calculate the operating margin emission factor according to the selected method:**

The simple OM emission factor is calculated as the generation-weighted average $CO_2$ emissions per unit net electricity generation ($tCO_2/MWh$) of all generating power plants serving the system, not including low-cost / must-run power plants / units. It may be calculated:

- Based on the net electricity generation, and a $CO_2$ emission factor of each power unit. (Option A), or
- Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system (option B)

The Central Electricity Authority, Ministry of Power, Government of India has published a database of Carbon Dioxide Emission from the power sector in India based on detailed authenticated information obtained from all operating power stations in the country. This database i.e. The $CO_2$ Baseline Database provides information about the Combined Margin Emission Factors of all the regional electricity grids in India. The Combined Margin in the CEA database is calculated ex ante using the guidelines provided by the UNFCCC in the "Tool to calculate the emission factor for an electricity system". We have, therefore, used the Combined Margin data published in the CEA database, for calculating the Baseline Emission Factor.

The CEA database uses the option A i.e. data on net electricity generation and $CO_2$ emission factor for each power unit, the average efficiency of each power unit and the fuel type(s) used in each power unit, to calculate the OM of the different regional grids.
The simple OM emission factor is calculated based on the net electricity generation of each power unit and an emission factor for each power unit, as follows:

$$\mathbf{EF_{grid,OMsimple,y} = \Sigma\ (EG_{m,y} \times EF_{EL,m,y}) / \Sigma EG_{m,y}}$$

Where:

| | |
|---|---|
| $EF_{grid,OMsimple,y}$ | Simple operating margin $CO_2$ emission factor in year y ($tCO_2/MWh$) |
| $EG_{m,y}$ | Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh) |
| $EF_{EL,m,y}$ | $CO_2$ emission factor of power unit m in year y ($tCO_2/MWh$) |
| m | All power units serving the grid in year y except low-cost / must-run power units |
| y | The relevant year as per the data vintage chosen in step 3 |

The emission factor of each power unit m has been determined as follows:

$$\mathbf{EF_{EL,m,y} = (\Sigma\ FC_{i,m,y} \times NCV_{i,y} \times EF_{CO2,I,y}) / EG_{m,y}}$$

Where:

| | |
|---|---|
| $EF_{EL,m,y}$ | $CO_2$ emission factor of power unit m in year y ($tCO_2/MWh$) |
| $FC_{i,m,y}$ | Amount of fossil fuel type i consumed by power unit m in year y (Mass or volume unit) |

| | |
|---|---|
| $NCV_{i,y}$ | Net calorific value (energy content) of fossil fuel type i in year y (GJ / mass or volume unit) |
| $EF_{CO2,I,y}$ | $CO_2$ emission factor of fossil fuel type i in year y ($tCO_2/GJ$) |
| $EG_{m,y}$ | Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh) |
| m | All power units serving the grid in year y except low-cost / must-run power units |
| i | All fossil fuel types combusted in power unit m in year y |
| y | The relevant year as per the data vintage chosen in step 3 |

**STEP 5. Calculate the build margin (BM) emission factor:**

The build margin emission factor has been calculated ex-ante based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation. This option does not require monitoring the emission factor during the crediting period.

The build margin emissions factor is the generation-weighted average emission factor of all power units m during the most recent year y for which power generation data is available, calculated as follows:

$$\mathbf{EF_{grid,BM,y} = (\Sigma\, EG_{m,y} \times EF_{EL,m,}) / \Sigma\, EG_{m,y}}$$

Where:

| | |
|---|---|
| $EF_{grid,BM,y}$ | Build margin $CO_2$ emission factor in year y ($tCO_2/MWh$) |
| $EG_{m,y}$ | Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh) |
| $EF_{EL,m,y}$ | $CO_2$ emission factor of power unit m in year y ($tCO_2/MWh$) |
| m | Power units included in the build margin |
| y | Most recent historical year for which power generation data is available |

The $CO_2$ emission factor of each power unit m ($EF_{EL,m,y}$) is determined as per the procedures given in step 4 (a) for the simple OM, using option A1 for *y* most recent historical year for which power generation data is available, and using for *m* the power units included in the build margin.

**STEP 6. Calculate the combined margin emissions factor:**

The calculation of the combined margin (CM) emission factor ($EF_{grid,CM,y}$) is based on one of the following methods:

(a) Weighted average CM; or
(b) Simplified CM.

Since project activity is located in the state of Rajasthan state of India, which is not a Least Developed Country (LDC) or in a country with less than 10 registered projects at the starting date of validation; that's why the weighted average CM method (option A) is preferred option.

The combined margin emissions factor is calculated as follows:

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

Where:

| | |
|---|---|
| $EF_{grid,BM,y}$ | Build margin $CO_2$ emission factor in year y ($tCO_2/MWh$) |
| $EF_{grid,OM,y}$ | Operating margin $CO_2$ emission factor in year y ($tCO_2/MWh$) |

$w_{OM}$ Weighting of operating margin emissions factor (%)
$w_{BM}$ Weighting of build margin emissions factor (%)
(where $w_{OM} + w_{BM} = 1$).

According to ACM0002 the weights for OM and BM are 0.75 and 0.25 respectively.

Using the values for operating and build margin emission factor provided in the CEA database and their respective weights for calculation of combined margin emission factor, the baseline carbon emission factor (CM) is 0.9225$tCO_2e$/MWh.

**Details of Baseline data:**
Data of operating for the three financial years from 2006-07, 2007-08,and 2008-09 and Build Margin for 2008-09 has been obtained from:-

**The $CO_2$ Baseline Database for the Indian Power Sector**
Ministry of Power: Central Electricity Authority (CEA)
Version 5
Key baseline information is reproduced in Appendix 3.The detailed excel sheet is available at:
http://www.cea.nic.in/reports/planning/cdm_co2/cdm_co2.htm

**Estimation of Project Emissions**
The project activity involves harnessing of wind energy and its conversion to electricity. Hence according to ACM0002 Version 12.3 0, there will be no project emissions in the project activity ($PE_y = 0$).

**Estimation of Leakage Emissions**
As per ACM0002 Version 12.3 0, no leakage has been considered for the calculation of emission factor ($LE_y = 0$).

The details on OM, BM and CM estimates as provided by the CEA are shown in Appendix-3.

**B.6.2. Data and parameters fixed ex ante**

| **Data / Parameter** | $EF_{grid,OM,y}$ |
|---|---|
| **Unit** | $tCO_2e$/MWh |
| **Description** | Operating Margin Emission Factor of NEWNE Electricity Grid |
| **Source of data** | "$CO_2$ Baseline Database for Indian Power Sector", version 5 published by the Central Electricity Authority, Ministry of Power, Government of India.<br><br>The "$CO_2$ Baseline Database for Indian Power Sector" is available at www.cea.nic.in |
| **Value(s) applied** | 1.0050 |
| **Choice of data or Measurement methods and procedures** | Operating Margin Emission Factor has been calculated by the Central Electricity Authority using the simple OM approach in accordance with ACM0002. |
| **Purpose of data** | Calculation of Baseline Emissions |
| **Additional comment** | Value is fixed ex-ante for entire crediting period. |

| | |
|---|---|
| **Data / Parameter** | $EF_{grid,BM,y}$ |
| **Unit** | $tCO_2e/MWh$ |
| **Description** | Build Margin Emission Factor of NEWNE Electricity Grid |
| **Source of data** | "$CO_2$ Baseline Database for Indian Power Sector , version 5 published by the Central Electricity Authority, Ministry of Power, Government of India.<br><br>The "$CO_2$ Baseline Database for Indian Power Sector" is available at www.cea.nic.in |
| **Value(s) applied** | 0.6752 |
| **Choice of data or Measurement methods and procedures** | Build Margin Emission Factor has been calculated by the Central Electricity Authority in accordance with ACM0002. |
| **Purpose of data** | Calculation of Baseline Emissions |
| **Additional comment** | Value is fixed ex-ante for entire crediting period. |

| | |
|---|---|
| **Data / Parameter** | $\boldsymbol{EF_{grid,CM,y}}$ |
| **Unit** | $tCO_2e/MWh$ |
| **Description** | Combined Margin Emission Factor of NEWNE Electricity Grid |
| **Source of data** | Combined Margin Emission Factor ($\boldsymbol{EF_{grid,CM,y}}$) is calculated as the weighted average of Operating Margin Emission Factor ($\boldsymbol{EF_{grid,OM,y}}$) and Build Margin Emission Factor ($EF_{grid,BM,y}$).<br><br>The "$CO_2$ Baseline Database for Indian Power Sector" published by the Central Electricity Authority, Ministry of Power, Government of India.<br><br>The "$CO_2$ Baseline Database for Indian Power Sector" is available at www.cea.nic.in |
| **Value(s) applied** | "$CO_2$ Baseline Database for Indian Power Sector", version 5 published by the Central Electricity Authority, Ministry of Power, Government of India.<br><br>Combined Margin Emission Factor ($\boldsymbol{EF_{grid,CM,y}}$) 0.9225<br><br>Refer Appendix – 3 for comprehensive calculation of Combined Margin Emission Factor. |
| **Choice of data or Measurement methods and procedures** | Combined Margin Emission Factor has been calculated by the Central Electricity Authority in accordance with CDM methodologies: ACM0002, and Tool to Calculate the emission Factor for an Electricity System. |
| **Purpose of data** | Calculation of Baseline Emissions |
| **Additional comment** | Value is fixed ex-ante for entire crediting period. |

**B.6.3. Ex ante calculation of emission reductions**

>>

Ex-ante calculation of emission reductions is equal to ex-ante calculation of baseline emissions as project emissions and leakage are nil.

Baseline emissions for project activity is calculated as explained below:

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

Where:

$BE_y$ = Baseline emissions in year *y* ($tCO_2$/yr)

$EG_{PJ,y}$ = 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)

$EF_{grid,CM,y}$ = Combined margin $CO_2$ 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" ($tCO_2$/MWh)

Baseline emission factor (Combined Margin) ($EF_{grid, CM, y}$) = 0.9225 $tCO_2e$/MWh

Since the project activity is the installation of a new grid connected renewable power plant the $EG_{PJ,y}$ is calculated as :

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

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

Annual electricity supplied to the grid by the Project ($EG_{facility,y}$ ) is calculated as follows:-

$EG_{facility,y}$ = 29.6 MW (Capacity) x 20.48 % (PLF) x 8,760 (hours) MWh/yr
= 53,064.93 MWh/yr

Hence,

$EG_{PJ,y}$ = $EG_{facility,y}$
= 53,103.82 MWh/yr

Annual Baseline Emissions Reduction: $BE_y$ = $EG_{PJ, y} * EF_{grid, CM, y}$
= $EG_{facility,y} * EF_{grid, CM, y}$
= 0.9225 $tCO_2e$/MWh x 53,103.82 MWh
= 48,988 $tCO_2e$/yr

Emission reductions for project activity are calculated according to following equation:
$ER_y = BE_y – PE_y$

Where,

$ER_y$ = Emission reductions in year, y (tCO2e/y)
$BE_y$ = Baseline Emissions in year, y (tCO2e/y)
$PE_y$ = Project Emissions in year, y (tCO2e/y)

Since, Project emissions $PE_y = 0$

Hence $ER_y = BE_y$

Hence emission reduction ( $ER_y$)= $BE_y$
= 48,988 $tCO_2e/yr$

The emission reductions per year are estimated to be 48,988 $tCO_2e/yr$.

**B.6.4. Summary of ex ante estimates of emission reductions**

| Year | Baseline emissions (t $CO_2e$) | Project emissions (t $CO_2e$) | Leakage (t $CO_2e$) | Emission reductions (t $CO_2e$) |
|---|---|---|---|---|
| Year 1* | 48,988 | 0 | 0 | 48,988 |
| Year 2 | 48,988 | 0 | 0 | 48,988 |
| Year 3 | 48,988 | 0 | 0 | 48,988 |
| Year 4 | 48,988 | 0 | 0 | 48,988 |
| Year 5 | 48,988 | 0 | 0 | 48,988 |
| Year 6 | 48,988 | 0 | 0 | 48,988 |
| Year 7 | 48,988 | 0 | 0 | 48,988 |
| Year 8 | 48,988 | 0 | 0 | 48,988 |
| Year 9 | 48,988 | 0 | 0 | 48,988 |
| Year 10 | 48,988 | 0 | 0 | 48,988 |
| **Total** | 489,880 | 0 | 0 | 489,880 |
| **Total number of crediting years** | 10 | | | |
| **Annual average over the crediting period** | 48,988 | 0 | 0 | 48,988 |

* Year 1begins from the date of registration, and each year extend for 12 months.

**B.7. Monitoring plan**
**B.7.1. Data and parameters to be monitored**

| **Data / Parameter** | **$EG_{facitlity,y}$** |
|---|---|
| **Unit** | MWh (Mega-watt hour) |
| **Description** | Net electricity generation supplied to the grid by the Project activity. |
| **Source of data** | The break-up sheet prepared by EPC contractor based on Joint Meter Reading (JMR) |
| **Value(s) applied** | =53,103.82 |
| **Measurement methods and procedures** | **Jodhpur Site:-**<br>• There is a billing metering point (one main & one check meter) located at 132kV Discom's sub-station at PS-8 Narwa.<br>• There is also a backup metering (one main & one check meter) located at 132kV WWIL's sub-station at Salodi.<br>• All the above meters are 0.2% accuracy class. There are other WEGs apart from the project activity WEGs that are connected to these meters at respective sub-station.<br>**Jaisalmer Site:-**<br>• There is a billing metering point (one main meter) located at 220kV Discom's sub-station at Akal[7].<br>• There is also a backup metering (one main meter) located at 220kV WWIL's sub-station at BHU<br>• All the above meters are 0.2% accuracy class. There are other WEGs apart from the project activity WEGs that are connected to these meters at respective sub-station.<br>**Measurement & Recording of electricity:**<br>-Main and Backup meters measures the electricity (export & Import) on continuous basis and recorded by state utility on monthly basis.<br>-Panel meter (LCS controller) measures the net electricity generation (Gross Export - Gross Import) on continuous basis and daily/monthly data can be sourced/recorded from online SCADA system.<br>Detailed procedure calculating net electricity supplied to the grid is given in section B.7.3 |
| **Monitoring frequency** | Continuously |
| **QA/QC procedures** | Value of $EG_{facitlity,y}$ can be cross checked with the tariff invoices raised on the DISCOM .<br>All the billing Main & Backup meters are calibrated by DISCOM annually and the records are available with the EPC Contractor (WWIL) |
| **Purpose of data** | To calculate Baseline Emissions. |

[7] The connection point of the project activity to a particular substation is decided by state utility and hence, the same might change in future. However the procedure for allocation of apportioning of electricity generated will remain same.

| | |
|---|---|
| **Additional comment** | The data will be archived both in electronic and hard paper format for crediting period + 2 years. |

| | |
|---|---|
| **Data / Parameter** | $EG_{Export,y}$ |
| **Unit** | MWh (Mega-watt hour) |
| **Description** | Electricity export to the grid by the Project activity. |
| **Source of data** | The break-up sheet based on Joint Meter Reading (JMR) prepared by EPC Contractor. |
| **Value(s) applied** | - |
| **Measurement methods and procedures** | **Measurement & Recording of electricity:**<br><br>-Main and Backup meters measures the electricity (export & Import) on continuous basis and recorded by state utility on monthly basis.<br>-Panel meter (LCS controller) measures the net electricity generation (Gross Export-Gross Import) on continuous basis and daily/monthly data can be sourced/recorded from online SCADA system.<br><br>Refer section B.7.3 for detailed measurement procedure. |
| **Monitoring frequency** | Monthly |
| **QA/QC procedures** | Value of $EG_{Export,y}$ can be cross checked with the tariff invoices raised on the DISCOM.<br>All the billing & Backup meters are calibrated by DISCOM annually and the records are available with the EPC Contractor (WWIL). |
| **Purpose of data** | To calculate Baseline Emissions. |
| **Additional comment** | The data will be archived both in electronic and hard paper format for crediting period + 2 years. |

| | |
|---|---|
| **Data / Parameter** | $EG_{Import,y}$ |
| **Unit** | MWh (Mega-watt hour) |
| **Description** | Electricity Import from grid by the Project activity. |
| **Source of data** | The break-up sheet based on Joint Meter Reading (JMR) prepared by EPC Contractor. |
| **Value(s) applied** | - |
| **Measurement methods and procedures** | **Measurement & Recording of electricity:**<br><br>-Main and Backup meters measures the electricity (export & Import) on continuous basis and recorded by state utility on monthly basis.<br>-Panel meter (LCS controller) measures the net electricity generation (Gross Export-Gross Import) on continuous basis and daily/monthly data can be sourced/recorded from online SCADA system.<br><br>Refer section B.7.3 for detailed measurement procedure. |
| **Monitoring frequency** | Monthly |
| **QA/QC procedures** | Value of $EG_{Import,y}$ can be cross checked with the tariff invoices raised on the DISCOM.<br>All the billing & Backup meters are calibrated by DISCOM annually and the records are available with the EPC Contractor (WWIL). |
| **Purpose of data** | To calculate Baseline Emissions. |
| **Additional comment** | The data will be archived both in electronic and hard paper format for crediting period + 2 years. |

| | |
|---|---|
| **Data / Parameter** | $\sum EG_{Controller, j}$ |
| **Unit** | MWh (Mega-watt hour) |
| **Description** | Summation of net electricity generation (Gross Export-Gross Import) by all the WEGs of project activity (j number of WEGs), as measured at the controller (LCS meter) at project site. Each WEG has exclusive LCS meter that records net electricity generation (Gross Export-Gross Import) from the WEG.<br><br>j is number of WEGs of project activity connected to main meter (JMR/billing meter) at DISCOM substation and backup meter at WWIL substation. |
| **Source of data** | Monthly operating logs recorded in electronic format by EPC contractor. |
| **Value(s) applied** | - |
| **Measurement methods and procedures** | The value is recorded continuously by the online monitoring station. This reading can also be seen in the electronic panel installed inside the WEG tower. The LCS meters do not require calibration as the energy readings of electricity generated at the LCS meter is cross verified by the energy calculated by inverting system installed in the WEGs. In case there is any mismatch in the energy values recorded by the Panel meter and the energy values calculated by the inverting system; the machine will stop working and generate the error report. The operations and maintenance staff will attend to the problem immediately in order to identify and correct the error. |
| **Monitoring frequency** | Continuously |
| **QA/QC procedures** | This data parameter will be logged electronically on a monthly basis by EPC contractor on its online portal. The value of this parameter shall be compared with the value of $EG_{facitlity,y}$ and the conservative approach would be taken by the PP for estimating the net electricity supplied value for the calculation of emission reduction. |
| **Purpose of data** | To calculate Baseline Emissions. |
| **Additional comment** | The data will be archived in electronic form for crediting period + 2 years. |

**B.7.2. Sampling plan**

>>

Not Applicable

**B.7.3. Other elements of monitoring plan**

>>

Wind World (India) Limited is EPC contractor for the project activity. Wind World (India) Limited will be responsible for the maintaining all the monitoring data on behalf of Vish Wind Infrastructure LLP in respect of the project activity. Wind World (India) Limited has implemented the management structure for managing the monitored data.

This approved monitoring methodology requires monitoring of the following:

- Net electricity supplied from the project activity; and
- Operating margin emission factor and build margin emission factor of the grid, where *ex post* determination of grid emission factor has been chosen

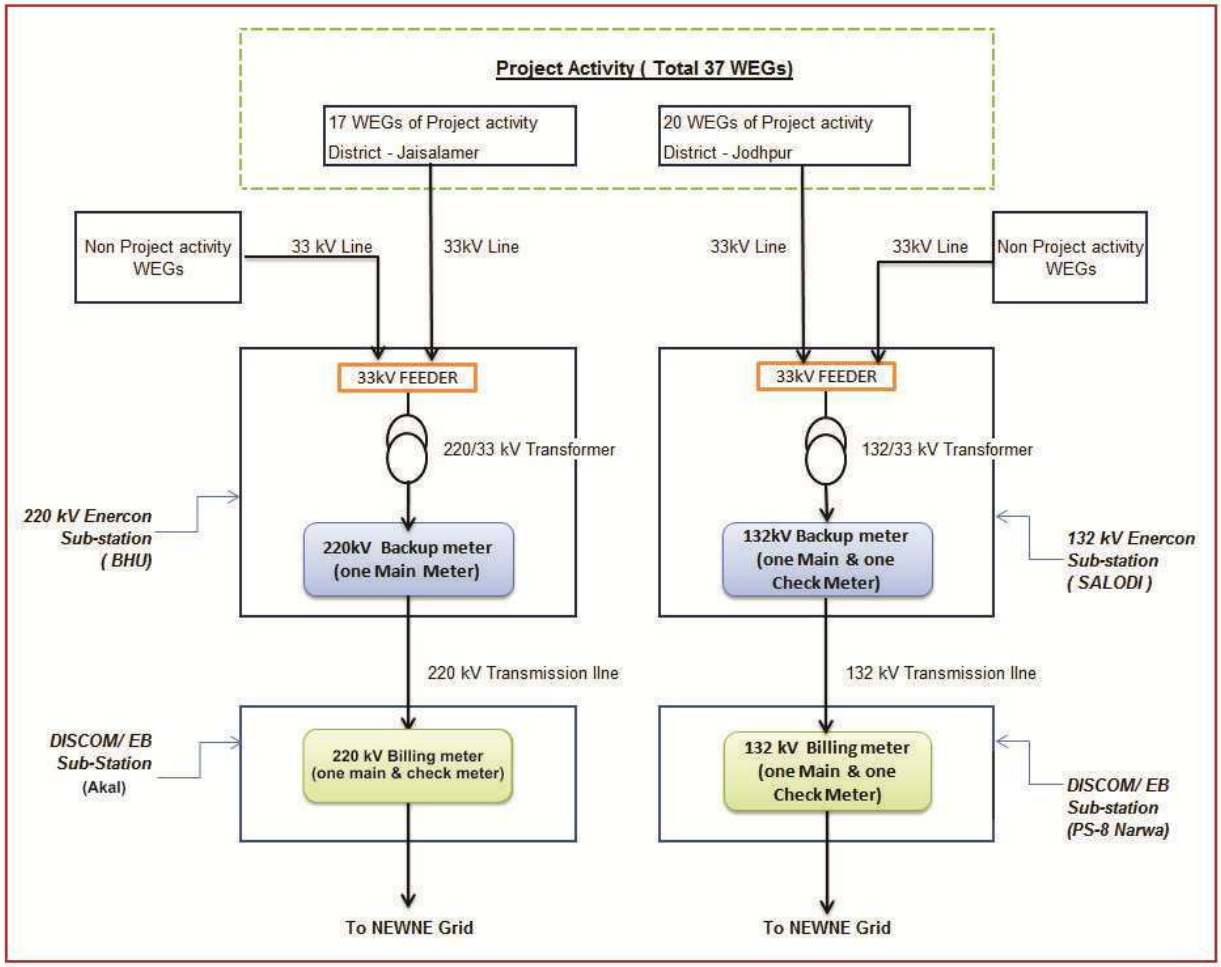
Emission factor of the project activity is fixed ex ante hence no further monitoring of this parameter is required. As per ACM0002 leakage need not be considered hence leakage has not been considered for the project activity. Hence, the sole parameter for monitoring is the net electricity supplied by the project activity to the grid.

The Project activity is operated by WWIL (EPC contractor for the project activity) and managed by the PP. The operational and maintenance contract for the project activity is with WWIL, which is an ISO 9001 certified company. WWIL follows the documentation practices to ensure the reliability and availability of the data for all the activities as required from the identification of the site, wind resource assessment, logistics, finance, construction, commissioning and operation of the wind power project.

The break-up sheet reflecting net electricity supplied by the project activity to the grid is prepared by EPC contractor based on the allocation procedure explained below. Based on this break-up sheet, tariff Invoice is raised by PP to DISCOM.

**Calculation of Net Electricity Supplied to the grid by project activity:**

Layout of Metering arrangement for project activity is as follows:-



From the above layout it is clear that project activity WEGs (37Nos) along with WEGs of other customers, who are not the part of project activity are connected to WWIL Sub-stations which are further connected to EB sub-station through EHV line. The detail of metering points are as follows;-

1) 17WEGs of project activity installed in Jaisalmer district is connected through 220kV Wind World (India) Limited (herein after referred as WWIL) pooling sub-station (220kV BHU sub-station), through 33kV feeder lines. At WWIL pooling sub-station BHU electricity is stepped up to 220kV, wherein the backup meter (one main meter) is connected. From WWIL pooling sub-station electricity is transmitted to state utility (DISCOM) sub-station (AKAL sub-station) through 220kV transmission line/ EHV line wherein the billing meter (one main meter & one check meter) is connected. At Akal sub-station metering is done at 220kV billing meter. From EB sub-station electricity is further transmitted to NEWNE grid.

2) 20WEGs of project activity installed in Jodhpur district is connected through 132kV Wind World (India) Limited (herein after referred as WWIL) pooling sub-station (132kV SALODI sub-station), through 33kV feeder lines. At WWIL pooling sub-station SALODI electricity is stepped up to 132kV, wherein the backup meter (one main & one check meter) connected. From WWIL pooling sub-station electricity is transmitted to state utility (DISCOM) sub-station (PS-8 Narwa Sub-station) through 132kV transmission line/ EHV line wherein billing meter (one main & one check meter) is connected. At EB sub-station metering is done at 132kV billing meter. From EB sub-station electricity is further transmitted to NEWNE grid.

The net electricity supplied to the grid will be calculated on monthly basis at the EB/DISCOM substations (Akal & PS-8 Narwa) wherein the billing meter is connected. The monthly joint meter readings are taken by the representatives of DISCOM and WWIL (EPC Contractor) who also signs the JMR. Simultaneously, the monthly joint meter reading of backup meters available at WWIL pooling sub-stations (BHU & SALODI) is also taken by representatives of RVPN/DISCOM and WWIL. The copy of JMR at backup meters is available with WWIL.

Since the project activity WEGs are connected through common metering system along with non project activity WEGs of other customers at the main meter, apportioning of electricity export & import as recorded in JMR is being done to calculate the electricity export & import by individual customer's WEGs Apportioning is being done based on the net electricity generation (Gross Export-Gross Import) recorded at LCS meter installed in individual WEGs

Based on the monthly JMR reading, which is signed by representative of DISCOM and EPC contractor; WWIL prepares the monthly breakup[8] generation sheets which indicate the export, import & net electricity supplied by individual customers to the grid.

The monthly generation sheet is submitted to both, DISCOM as well as individual investors. PP raises the invoice based on the monthly breakup sheet corresponding to the net electricity generation value indicated in the monthly breakup sheet. DISOM based on the JMR reading along with monthly breakup sheet prepared by WWIL and the invoice raised by investors, conduct the audit to cross check the net electricity values and in case all the values are found to be correct, DISCOM release the payment against the invoice raised by individual investors.

[8] As per section 4.2 (ii) of PPA 'Measurement of Energy and Metering':- The Joint Meter Reading taken at common evacuation /injection system shall be supported by controller readings of individual power producers using such common evacuation/ injection system. Based on this breakup, limited to total energy injection, the power purchase form the individual power plant shall be regulated for the purpose of payment.

The values of the net electricity supplied to grid by project activity can be cross checked with invoices raised by the PP on DISCOM.

**Procedure for apportioning:-**

***Case 1*:- Procedure used by EPC Contractor to prepare monthly breakup sheets for project activity.**

The monthly JMR reading contains the electricity export, import & net electricity supplied by all the WEGs of project activity as well as non project activity connected to the metering system at DISCOM substation. Hence in order to arrive at the electricity export, import & net electricity supplied by WEGs of the project activity based on the net electricity generation (Gross Export-Gross Import) recorded at LCS meter, following procedure is used by EPC contractor:-.

As LCS meter measures the net electricity generation (Gross Export-Gross Import) by individual WEG, which is the difference of export and import and doesn't provide individual reading of Export & Import; the apportioning of electricity export & import at recorded at billing meter as indicated in JMR sheet is done based on net electricity generation (Gross Export-Gross Import) of WEGs. This is a standard procedure that is followed in the state of Rajasthan and is accepted by the state DISCOM for payment of tariff invoices.

Electricity exported by all WEGs of project activity is apportioned on the basis of summation of net electricity generation (Gross Export-Gross Import)[9] ( by all the WEGs (j number of WEGs) of project activity, as measured at the controller (LCS meter) at project site and the electricity export recorded at the main meter mentioned in the JMR. The formula used for computing electricity export to the grid by the project activity is as follows:-

Electricity Export to the grid by the Project activity,

$$\mathbf{EG_{Export,y}} = \frac{\mathbf{EG}_{JMR,Export} * \sum \mathbf{EG}_{Controller,\ j}}{\sum EG_{Controller,i}} \quad \text{.....(1)}$$

As LCS meter measures the net electricity generation (Gross Export – Gross Import) by WEGs and doesn't provide individual reading of Export & Import. Therefore apportioning of export as well as import for all WEG of the project activity is also apportioned on the basis of summation of net electricity generation by all the WEGs (j number of WEGs) of project activity, as measured at the controller (LCS meter) at project site and the electricity import recorded at the main meter mentioned in the JMR. The formula used for computing electricity import from the grid by the project activity is as follows

Electricity Import from the grid by the Project activity,

$$\mathbf{EG_{Import,y}} = \frac{\mathbf{EG}_{JMR,Import} * \sum EG_{Controller,\ j}}{\sum EG_{Controller,i}} \quad \text{.....(2)}$$

Wherein,

[9] LCS meter installed in individual WEGs control panel measures the net electricity generation (Gross Export-Gross Import) by WEG and therefore $\sum EG_{Controller,\ j}$ is used by developer to calculate electricity export & import by individual developer (project activity & non project activity WEGs).

$\sum EG_{Controller, j}$ = Summation of net electricity generation by all the WEGs (j number of WEGs) of project activity, as measured at the controller (LCS meter) at project site.

$\sum EG_{Controller,i}$ = Summation of net electricity generation by all WEG (i number of WEGs) of project activity or non project activity, as measured at the controller (LCS meter) at project site,

$EG_{JMR,Export}$ = Electricity export by project and non project recorded at respective billing meters located at DISCOM sub-station. This can be checked from JMR certificates.

$EG_{JMR,Import}$ = Electricity import by project and non project recorded at respective billing meters located at DISCOM sub-station. This can be checked from JMR certificates.

$\mathbf{EG_{Export,y}}$ = Electricity export by project activity calculated as per formula 1 above

$\mathbf{EG_{import,y}}$ = Electricity import by project activity calculated as per formula 2 above.

Therefore net electricity supplied to grid by 37 WEGs of the project activity is calculated as the difference of equation (1) & (2),

$$\mathbf{EG_{Facitlity,y} = EG_{Export,y} - EG_{Import,y}}$$

Even though the above mentioned of apportioning is done by the EPC Contractor and submitted to respective DISCOM, the same undergoes the series of audit by the hierarchy of auditors (Asst. Auditors, divisional auditors & account auditors) and then finally authorised by the Superintending engineer (SE) of the circle office of respective DISCOMs. The above mentioned procedure of apportioning will be done separately for WEGs of project activity installed at Jaisalmer & Jodhpur site by EPC Contractor.
The apportioning of electricity generated by the all WEGs (project activity and non-project activity) is entirely under the jurisdiction of the EPC Contractor. The project participant has no role in computing and furnishing the apportioned electricity generated for them or any other project developer. The above apportioning procedure for deriving the apportioned electricity generated by the project activity has been included only to bring clarity to the apportioning and overall monitoring procedure.

***Case 2*:- Apportioning procedure in case the date of verification period doesn't match with the billing cycle dates**

In case the date of project registration is not in line with billing cycle of project activity then the calculation of net electricity supplied to grid for period between date of registration and next date of billing cycle will be done by PP based on data available for that month.

Net electricity export to the grid by a WEG @ SEB meter for n no. of days =

(Daily controller net electricity generation (Gross Export-Gross Import) of that WEG for n no. of days)

| |
|---|
| x (Total Net generation of that WEG @ SEB main meter for a month) |
| Monthly controller net electricity generation (Gross Export-Gross Import) of that WEG for that month |

**Procedure to deal with data uncertainty:**

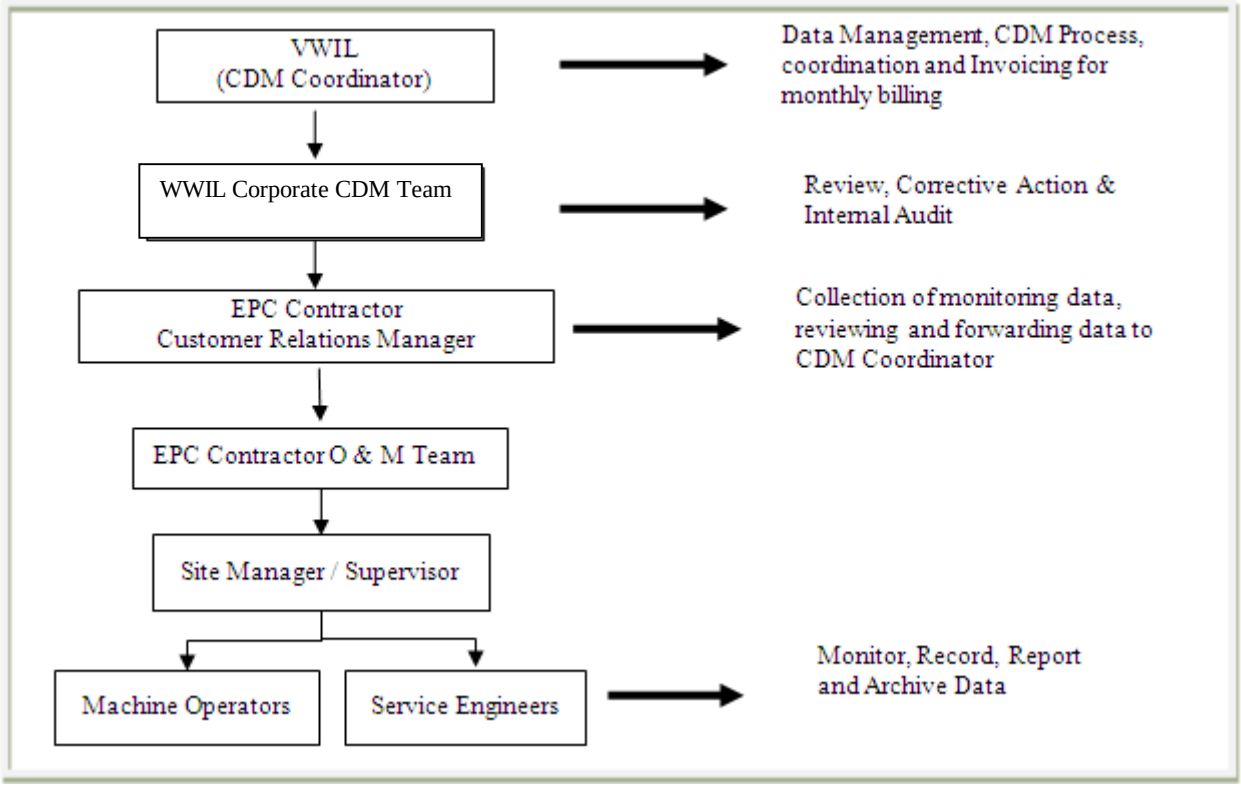
During the annual calibration, if the meter is found to be outside the permissible limits of the error and if that meter readings have been used in JMR, the (–ve) error value would be applied to electricity export and (+ve) error value will be applied to import of electricity from grid to all the JMR values since the date of last calibration. The meter would be replaced immediately with new calibrated meter.

**Training and maintenance requirements:**

Training on the machine is an essential pre-requisite, to ensure necessary safety of man and machine. Further, in order to maximize the output from the Wind Energy Generators (WEGs), it is extremely essential, that the engineers and technicians understand the machines and keep them in good health. In order to ensure, that WWIL's service staffs is deft at handling technical snags on top of the turbine, the necessity of ensuring that they are capable of climbing the tower with absolute ease and comfort has been established. The Wind World Training Academy provides need-based training to meet the training requirements of WWIL projects. The training is contemporary, which results in imparting focused knowledge leading to value addition to the attitude and skills of all trainees. This ultimately leads to creativity in problem solving.

**Monitoring roles and responsibilities**

The operational and management structure implemented for data monitoring is as follows:



**SECTION C. Duration and crediting period**

**C.1. Duration of project activity**

**C.1.1. Start date of project activity**

>>

10/07/2010, being the earliest date of placement of purchase order for the wind energy convertors.

As per the CDM –PDD guideline on starting date

"The starting date of a CDM project activity is the earliest of the date(s) on which the implementation or construction or real action of a project activity begins/has begun".

The PP placed the purchased order dated 10/07/2010 on WWIL and therefore has been selected as the project start date.

**C.1.2. Expected operational lifetime of project activity**

>>

20 Years 0 Months

**C.2. Crediting period of project activity**

**C.2.1. Type of crediting period**

>>

The project proponent has selected the fixed crediting period for the project activity.

**C.2.2. Start date of crediting period**

>>

15/01/2012 or date of registration of project with UNFCCC.

**C.2.3. Length of crediting period**

10 years and 0 months

**SECTION D. Environmental impacts**

**D.1. Analysis of environmental impacts**

>>

As per the Schedule 1 of Ministry of Environment and Forests (Government of India) notification dated January 27, 1994 and EIA Notification (S.O 1533) dated 14th September 2006 ( web-link: http://envfor.nic.in/legis/eia/so1533.pdf ), a list of activities that require undertaking environmental impact assessment studies has been provided. EIA is not a regulatory requirement in India for wind energy projects and PP does not expect any adverse impacts of the proposed CDM project activity on the environment.

**D.2. Environmental impact assessment**

>>

The project activity does not fall under the purview of the Environmental Impact Assessment (EIA) notification of the Ministry of Environment and Forest, Government of India. Hence, EIA is not required by the host party.

**SECTION E. Local stakeholder consultation**

**E.1. Solicitation of comments from local stakeholders**

>>

The comments from local stakeholders were invited through a local stakeholder meeting conducted at Jaisalmer on 25th Oct 2010 & at Jodhpur on 27th October 2010 in the state of Rajasthan. A local newspaper advertisement was placed in Nafa Nuksan on 12th October 2010 inviting the local stakeholders for the

meeting. In case the stakeholder is not able to make up for the meeting, the stakeholder was also provided with the opportunity to submit the comments via email by 07th Nov 2010. There were no stakeholders comments received through email. The local stakeholder consultation meeting had representatives from the nearby villages and CDM representative on behalf of Vish Wind Infrastructure LLP and WWIL (EPC contractor). The meeting was presided over by Mr. Rajesh Sahani (Customer Support -WWIL), Mr. Saujanya Kumar (CDM representative on behalf of VWIL). Following stakeholders are identified for the project activity:

- Local stakeholders and villagers
- Employees from wind farm developer (WWIL)
- CDM Representatives on behalf of VWIL

Following was the agenda of meeting:

1. Welcome address and introduction
2. Project profile
3. CDM, social issues and environmental issues
4. Suggestions and opinions
5. Queries from the stakeholders and response by respective authorized persons
6. Vote of thanks

**E.2. Summary of comments received**

>>

Mr. Rajesh Sahani welcomed the participants and introduced the company and explained the stake holders on the purpose of the meet is that to create awareness on global warming, its effects and on the Clean Development Mechanism

Mr. Rajesh Sahani explained the company profile of Vish Wind Infrastructure LLP and explained about the current project activity.

Mr. Saujanya Kumar (CDM representative on behalf of VWIL) introduced about project activity, reasons for setting up the project, costs and benefits of setting up the project and role and benefits of wind power project to reduce the emissions of green house gases in the atmosphere thus mitigating global warming.

**Summary of comments received during the stakeholder meeting held on 25th Oct 2010**

Mr. Kishan Singh Bhati, the chairperson appreciated the management of Vish Wind Infrastructure LLP for going for pollution free technology for power generation. Mr. Kishan Singh informed the villagers about how Wind Mills are helped our Villagers and Farmers, benefits to the unemployed one

The following queries/comments were raised by the stakeholders:-

| S.No. | Name of Stakeholder | Queries/Comment raised |
|---|---|---|
| 1. | Mr. Sawai Singh | Enquired about the benefits of the wind power projects that stakeholders shall observe? |
| 2. | Mr. Sukh Singh | Enquired that whether there is any effect on the cattle grazing near wind farms? |
| 3. | Mr. Jay Singh | Enquired do WWIL take care of safety issues? |
| 4. | Mr. Abdul Khan | Enquired whether the electricity generated from this project will be directly fed to the local community. |

**Summary of comments received during the stakeholder meeting held on 27th Oct 2010**

Mr. Roop Singh, the chairperson of meeting to express his views on the proposed Wind Power Project. The chairperson of the meeting briefed the advantages of the wind farm. The project will provide the employment opportunities to the local people as the result of which may result in increase of the income of local people as is the case of Jodhpur where the Wind World India Limited Projects has provided the employment opportunities to the local people. He also praised Vish Wind Infrastructure LLP for their decision to invest in district of Jodhpur

The following queries/comments were raised by the stakeholders:-

| S.No. | Name of Stakeholder | Queries/Comment raised |
|---|---|---|
| 1. | Mr. Kishan Singh | Enquired whether the project is useful to the villagers. |
| 2. | Mr. Gulab Singh | Enquired does the earthing of Wind Energy Machines affects / disturbs domestic animals or people residing nearby area? |
| 3. | Mr. Deva Ram | Enquired that in the near time whether company will restrict us and our cattle coming for grazing? |
| 4. | Mr. Abdul Khan | Enquired that will the villagers will get the electricity generated from the project? |

**E.3. Report on consideration of comments received**

>>

1) Clarifications that were addressed by the representatives of WWIL and CDM representatives during the meeting held on 25th Oct 2010:-

| S.No. | Name of Stakeholder | Queries/Comment raised | Responses of Queries/ Comment raised |
|---|---|---|---|
| 1. | Mr. Sawai Singh | Enquired about the benefits of the wind power projects that stakeholders shall observe? | Mr. Saujanya Kumar replied that the project will provide the people with the employment opportunities. The project shall give jobs and economic opportunities in terms of small shops and construction workers. |
| 2. | Mr. Sukh Singh | Enquired that whether there is any effect on the cattle grazing near wind farms? | Mr. Rajesh Sahani replied that there is no effect and no reduction on the flora and fauna and in turn for the grazing of grass at wind farms. But will help in economic development and job opportunities. |
| 3. | Mr. Jay Singh | Enquired do WWIL take care of safety issues? | Mr. Rajesh Sahani replied that the Wind World India Limited takes care about the safety issues. Appropriate protocols are in place to take care of all the safety issues. |
| 4. | Mr. Abdul Khan | Enquired whether the electricity generated from this project will be directly fed to the local community. | Mr. Rajesh Sahani informed that the electricity generated will be supplied to the state electricity grid which further distributes the electricity as per the state policy. |

2) Clarifications that were addressed by the representatives of WWIL and CDM representatives during the meeting held on 27th Oct 2010:-

| S.No. | Name of Stakeholder | Queries/Comment raised | Responses of Queries/ Comment raised |
|---|---|---|---|

| | | | |
|---|---|---|---|
| 1. | Mr. Kishan Singh | Enquired whether the project is useful to the villagers. | Mr. Saujanya Kumar clarified that by establishing the wind power projects, village development takes place and by this, the towns and the states. Also told that the job opportunities, scarcity of electricity, improved distribution of power will be of importance to the nearby villages where the WPP is established and there on to other villages. |
| 2. | Mr. Gulab Singh | Enquired does the earthing of Wind Energy Machines affects / disturbs domestic animals or people residing nearby area? | Mr. Rajesh Sahani answered the question stating that the current pas through earthing in the land / fie and as such it will not disturb animals or people while crossing the installed area. |
| 3. | Mr. Deva Ram | Enquired that in the near time whether company will restrict us and our cattle coming for grazing? | Mr. Rajesh Sahani replied that No, cattle are grazing in the area as usual. |
| 4. | Mr. Abdul Khan | Enquired that will the villagers will get the electricity generated from the project? | Mr. Rajesh Sahani informed that the electricity generated will be supplied to the state electricity grid which further distributes the electricity as per the state policy. |

The stakeholder meetings were very cordial and ended on a positive note. No adverse comments were received during the stakeholder meets. They were strongly supporting the project activity and were happy due to the potential benefits to their local area.

**SECTION F. Approval and authorization**

>>

Approval & Authorization of Govt. of India (Host Party).

- - - - -

## Appendix 1: Contact information of project participants

| | |
|---|---|
| **Organization name** | Vish Wind Infrastructure LLP |
| **Street/P.O. Box** | A-9, Veera Industrial Estate, Veera Desai Road, Andheri (W) |
| **Building** | Wind World Tower |
| **City** | Mumbai |
| **State/Region** | Maharashtra |
| **Postcode** | 400 053 |
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| **Telephone** | +91-22-6692 4848 |
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| **Salutation** | Mr. |
| **Last name** | Mehra |
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## Appendix 2: Affirmation regarding public funding

The project activity does not involve any public funding from parties included in Annex 1.

## Appendix 3: Applicability of selected methodology

The same has been explained in Section B.2.

## Appendix 4: Further background information on ex ante calculation of emission reductions

The Operating Margin data for the most recent three years and the Build Margin data for the NEWNE Region Electricity Grid as published in the CEA database version 5.0 are as follows:

**Simple Operating Margin**

| | **NEWNE Grid ($tCO_2e/GWh$)** |
|---|---|
| Simple Operating Margin – 2006-07 | 1.0085 |
| Simple Operating Margin – 2007-08 | 0.9999 |

| | |
|---|---|
| Simple Operating Margin – 2008-09 | 1.0066 |
| Average Operating Margin of last three years | 1.0050 |

**Build Margin**

| | **NEWNE Grid ($tCO_2e/GWh$)** |
|---|---|
| Build Margin- 2008-09 | 0.6752 |

**Combined Margin Calculations**

| | Weights | **NEWNE Grid ($tCO_2e/GWh$)** |
|---|---|---|
| Operating Margin | 0.75 | 1.0050 |
| Build Margin | 0.25 | 0.6752 |
| Combined Margin | | 0.9225 |

Detailed information on calculation of Operating Margin Emission Factor and Build Margin Emission Factor is available at www.cea.nic.in.

## Appendix 5: Further background information on monitoring plan

Detailed metering information has been provided in section B.7.3**.**

## Appendix 6: Summary of post registration changes

- There is a correction in PDD with respect to change of name of equipment supplier/ EPC contractor. With effect from 01/01/2013 name of Enercon (India) Limited (equipment supplier/ EPC contractor) has been changed to 'Wind World (India) Limited'. Change of name has been reported in revised PDD.
- At many places references from Appendix to Annex and from Annex to Appendix changed in line with the PDD completion guideline.
- The change in section reference number from B.7.2 to B.7.3 is done in line with the PDD completion guideline.
- Under Section A.1 and A.3 of revised PDD, weblink has been corrected in the footnote.
- Under Title page of the PDD and Sections B.1, B.2, B.5, & B.6.1of revised PDD, Version of monitoring methodology has been changed from 12.1.0 to 12.3.0
- Under Section B.4 of revised PDD, weblink has been corrected in footnote.
- Typo error in the name of state under 'step-6 -Calculate the combined margin emissions factor' (section B.6.1) has been rectified from Andhra Pradesh to Rajasthan in revised PDD.
- Under Section B.6.2 of revised PDD, parameter $EF_{grid,OM,y}$ irrelevant sentence from additional comment has been removed .
- Wind World (India) Ltd. is the EPC contractor of PP, the same has been corrected under Section B.7.1 B.7.3 in revised PDD instead of O&M.
- Under section B.7.1 of revised PDD, description of source of data has been changed for $EG_{facitlity,y}$ $EG_{Export,y}$ $EG_{Import,y}$ & $\sum EG_{Controller,\ j.}$

- As per revised monitoring plan, value of $EG_{Facitlity,y}$ is sourced from breakup sheet prepared by EPC Contractor, based on which invoice is raised by PP to the DISCOM. Hence, $E_{JMR, Export}$ & $E_{JMR, Import}$, $\sum EG_{Controller, i}$, $EG_{Controller,i}$ cannot be used as monitoring parameters and have been removed from Section B.7.1 & for $EG_{facitlity,y}$, $EG_{Export,y}$, $EG_{Import,y}$, $\sum EG_{Controller, j}$ measurement method & procedures has been described in detail.
- Due to revision in monitoring plan, QA/QC procedure under section B.7.1 of revised PDD has been updated for more transparency. Further, the sentence RTGS transaction or cheque copy from QA/QC procedure is removed as crosschecking is already done with the invoice.
- Under Section B.7.3 name of PP was mentioned as KPCPL which has been corrected to Vish Wind Infrastructure LLP in revised PDD.
- Correction has been made under section B.7.3 of PDD to make it more understanding and transparent.
- In Appendix 1 contact details have been updated.

- - - - -

**History of the document**

| Version | Date | Nature of revision |
|---|---|---|
| 04.1 | 11 April 2012 | Editorial revision to change version 02 line in history box from Annex 06 to Annex 06b. |
| 04.0 | EB 66<br>13 March 2012 | Revision required to ensure consistency with the "Guidelines for completing the project design document form for CDM project activities" (EB 66, Annex 8). |
| 03 | EB 25, Annex 15<br>26 July 2006 | |
| 02 | EB 14, Annex 06b<br>14 June 2004 | |
| 01 | EB 05, Paragraph 12<br>03 August 2002 | Initial adoption. |
| **Decision Class:** Regulatory<br>**Document Type:** Form<br>**Business Function:** Registration | | |

**Annex 1: Latitude-Longitude detail for individual WEGs.**

| S.No. | WEG Loc No. | Village | District | State | Latitude | Longitude |
|---|---|---|---|---|---|---|
| 1 | 41 | Ugawa | Jaisalmer | Rajasthan | N 26° 37’51.5” | E 70° 57’51.2” |
| 2 | 39 | Ugawa | Jaisalmer | Rajasthan | N 26° 37’41.5” | E 70° 57’33.5” |
| 3 | 38 | Ugawa | Jaisalmer | Rajasthan | N 26° 37’35.4” | E 70° 57’38.7” |
| 4 | 37 | Ugawa | Jaisalmer | Rajasthan | N 26° 37’33.3” | E 70° 57’45.8” |
| 5 | 36 | Ugawa | Jaisalmer | Rajasthan | N 26° 37’27.8” | E 70° 57’49.9” |
| 6 | 35 | Ugawa | Jaisalmer | Rajasthan | N 26° 37’21.6” | E 70° 57’53.9” |
| 7 | 34 | Ugawa | Jaisalmer | Rajasthan | N 26° 37’17.7” | E 70° 57’59.2” |
| 8 | 33 | Ugawa | Jaisalmer | Rajasthan | N 26° 37’14.6” | E 70° 58’05.7” |
| 9 | 31 | Ugawa | Jaisalmer | Rajasthan | N 26° 37’11.3” | E 70° 58’13.3” |
| 10 | 30 | Ugawa | Jaisalmer | Rajasthan | N 26° 37’01.5” | E 70° 58’13.1” |
| 11 | 50 | Korwa | Jaisalmer | Rajasthan | N 26° 37’47.9” | E 70° 56’27.3” |
| 12 | 53 | Korwa | Jaisalmer | Rajasthan | N 26° 38’06.1” | E 70° 56’13.0” |
| 13 | 121 | Kita | Jaisalmer | Rajasthan | N 26° 41’05.2” | E 71° 00’07.2” |
| 14 | 582 | Kita | Jaisalmer | Rajasthan | N 26° 41’58.8” | E 71° 01’44.9” |
| 15 | 601 | Kita | Jaisalmer | Rajasthan | N 26° 40’24.0” | E 71° 04’28.4” |
| 16 | 602 | Kita | Jaisalmer | Rajasthan | N 26° 40’12.2” | E 71° 04’31.5” |
| 17 | 603 | Kita | Jaisalmer | Rajasthan | N 26° 40’08.5” | E 71° 04’19.3” |
| 18 | 153 | Jelu | Jodhpur | Rajasthan | N 26° 31’22.3” | E 72° 46’00.2” |
| 19 | 154 | Jelu | Jodhpur | Rajasthan | N 26° 31’24.2” | E 72° 45’52.0” |
| 20 | 155 | Jelu | Jodhpur | Rajasthan | N 26° 31’31.9” | E 72° 45’46.5” |
| 21 | 156 | Jelu | Jodhpur | Rajasthan | N 26° 31’44.0” | E 72° 45’39.4” |
| 22 | 157 | Jelu | Jodhpur | Rajasthan | N 26° 31’49.0’ | E 72° 45’33.5” |
| 23 | 158 | Jelu | Jodhpur | Rajasthan | N 26° 31’50.8” | E 72° 45’25.1” |
| 24 | 159 | Jelu | Jodhpur | Rajasthan | N 26° 31’55.7” | E 72° 45’17.0” |
| 25 | 161 | Jelu | Jodhpur | Rajasthan | N 26° 31’22.1” | E 72° 45’03.8” |
| 26 | 162 | Jelu | Jodhpur | Rajasthan | N 26° 31’26.4” | E 72° 45’15.8” |
| 27 | 163 | Jelu | Jodhpur | Rajasthan | N 26° 31’19.3” | E 72° 45’24.0” |
| 28 | 164 | Jelu | Jodhpur | Rajasthan | N 26° 31’15.2” | E 72° 45’11.9” |
| 29 | 165 | Jelu | Jodhpur | Rajasthan | N 26° 30’49.8” | E 72° 45’18.1” |
| 30 | 166 | Jelu | Jodhpur | Rajasthan | N 26° 30’44.3” | E 72° 45’22.1” |
| 31 | 167 | Jelu | Jodhpur | Rajasthan | N 26° 30’32.8” | E 72° 45’17.4” |
| 32 | 168 | Jelu | Jodhpur | Rajasthan | N 26° 30’36.7” | E 72° 45’40.3” |
| 33 | 169 | Jelu | Jodhpur | Rajasthan | N 26° 30’43.3” | E 72° 45’35.3” |
| 34 | 10 | Salodi | Jodhpur | Rajasthan | N 26 ° 25’35.7” | E 72° 48’32.9” |
| 35 | 11 | Salodi | Jodhpur | Rajasthan | N 26 ° 25’25.2” | E 72 ° 48’35.8” |

| | | | | | | |
|---|---|---|---|---|---|---|
| 36 | 509 | Salodi | Jodhpur | Rajasthan | N 26 $^{o}$ 26'51.1" | E 72 $^{o}$ 50'44.5" |
| 37 | 510 | Salodi | Jodhpur | Rajasthan | N 26 $^{o}$ 26'57.7" | E 72 $^{o}$ 50'35.8" |

## Annex2

## CALCULATION OF BENCHMARK COST OF EQUITY

**Selection of Appropriate Benchmark:**

In choosing an appropriate benchmark we have based our approach on the principles of financing and investment decision making that are well found in theory and practice of corporate financing worldwide. We have derived from text book on "Corporate Finance Theory and Practice" by Dr. Aswath Damodaran of Stern School of Business, New York University. Dr. Damodaran is one of the foremost authorities in the world in the field of Investment Analysis.

The guidance to investment analysis issued in EB 51 (paragraph 12) states that in cases where a benchmark approach is used the applied benchmark shall be appropriate to the type of IRR calculated. Local commercial lending rates or weighted average costs of capital (WACC) are appropriate benchmarks for a project IRR. Required/expected returns on equity are appropriate benchmarks for equity IRR. Benchmarks supplied by relevant national authorities are also appropriate if the DOE can validate

It is also worthwhile to note that the captioned project is a Greenfield wind power generation project that generates and supplies electricity to the state grid, therefore the project cannot have only one possible project developer. The tool for demonstration and assessment of additionality [para-5, sub step 2(b)] states that in such cases (where the project has more than one potential developer) the benchmark cannot be based on internal cost of equity or WACC and shall be based on parameters that are standard in the market, considering the specific characteristics of the project type. Hence, we have not used company or project specific parameters for the calculation of the benchmark.

Accordingly, the cost of equity applicable to the project type has been considered and calculation of cost of equity is described as follows:-

**Cost of Equity:**

The expected return on equity has been determined using the Capital Asset Pricing Model (CAPM)[10]. The CAPM economic model is used worldwide to determine the required/expected return on equity based on potential risk of an investment. The CAPM framework is the Nobel award winning work of financial economist Dr. William Sharpe.

[10] The Capital Asset Pricing Model (CAPM) was published in 1964 by William Sharpe, for his work on CAPM Sharpe received the Nobel Prize in 1990. http://www.investopedia.com/articles/06/CAPM.asp

Ke = Rf + B x (Rm - Rf)

where:

Ke = Rate of return on equity capital;

Rf = Risk-free rate of return;

B = Beta;

Rm – Rf = Market risk premium;

**Risk free rate:**

The risk free rate is understood as the rate of return on an asset that is theoretically free of any risks, therefore the yeild rates are considered as risk free rates. Page 188 of text book on "Corporate Finance Theory and Practice" by Dr. Aswath Damodaran[11], Stern School of Business, New York University, describes that the yield rates are suitable indicators of risk free rates when the time horizon for the investment is long term.

Accordingly the risk free rate has been taken from yield rates available at the decision making date. This has been considered as it was in the year of investment (i.e in that year, the company had the alternative of this long term risk free investment). The data on risk free rate is published by Reserve Bank of India. (Web-link: http://rbidocs.rbi.org.in/rdocs/Bulletin/PDFs/26CT_BUL110610.pdf )

The applicable risk free rate is 8.38%.

**Market Risk Premium:**

The most common approach for estimating the market risk premium is to base it on historical data, in the CAPM, the premium is estimated by looking at the difference between average return on stocks and risk free return. It is preferred to use long term premimums, i.e over a period of 25 years, since considering shorter time periods can lead to large standard errors because volatility in stock returns [page 191, Corporate Finance Theory and Practice, Dr. Aswath Damodaran]. It is also preferred to calculate the risk premium based on geometric mean of the returns since arithmetic mean overstates the risk premium. Geometric mean is defined as the compounded annual return over the same period [page 191, Corporate Finance Theory and Practice, Dr. Aswath Damodaran].

Therefore the market risk premium has been calculated as the difference in compounded annual return bewteen the BSE-Sensex (being conservative minimum value out of BSE Sensex, BSE-100, BSE-200 and BSE-500 has been choosen) and the risk free rate applicable at the time of investment decision. The detailed calculations are presented in the attached excel sheet.

The applicable market risk premium = 15.77%- 8.38%

= 7.39%.

**Beta:**

Beta (B) indicates the sensitivity of the company to market risk factors. Beta represents the market risk for an asset and is calculated as the statistical measure of volatility of a specific asset/investment relative to the movement of a market group. The conventional approach for estimating beta of an investment is a regression of returns on investment against returns on a market index. For companies that are not publicly

[11] Dr. Damodaran, one of the foremost authorities in the world in the field of Investment Analysis

listed, the beta is determined by referring beta values of publicly listed companies that are engaged in similar types of business. The project activity type is wind power generation; the approach therefore should be to base the beta for the project on the beta values of listed wind power generation companies in India. However, there was only one wind energy company (BF Utility) listed on any stock exchange in India (both BSE- Bombay Stock Exchange and NSE-National Stock Exchange) in year. Therefore, in the absence of adequate data on companies which are exclusively into the exactly same type of business (i.e wind power projects), the next best option for assessing the risk of these projects is to consider the data available on companies which are involved in similar businesses.

The Beta Value represents two types of risk:-

(1) Financial Risk

(2) Business Risk

We have considered beta values of all electricity generating companies in India. The group of companies considered includes renewable as well as conventional power generating companies. It is understood that risky businesses are likely to have higher cost of equity than safer businesses; projects in riskier businesses will have to cover these higher costs. Hence, investors demand a higher return from renewable energy projects than from conventional energy ones, given the higher risks in renewable, including risks of technology, risks from significantly varying and unpredictable resource availability (e.g. wind), and a lower established support base for such projects relative to that for conventional power (e.g. grid connections, bank finance, suppliers, etc.).

Unlevered beta represents the companies that do not carry financial (leverage) risk which is not the case for our project activity. To account for such differences in leverage (debt equity gearing), beta values of reference companies shall be first unlevered.

Since the project activity is 100% equity financed that's why Unlevered Beta has been used while calculating the benchmark.

The applicable Beta value has been determined on the basis of the Beta values of all power generating companies in India which were listed on the stock exchange at the time of this investment. Beta values of individual companies have been sourced from Bloomberg. The table below summarises the beta values:

| Company Name | Raw Beta | Unlevered Beta |
|---|---|---|
| Tata Power Co Ltd | 1.032 | **0.73** |
| BF Utilities Ltd | 1.950 | **1.07** |
| Neyveli Lignite Corporation | 1.635 | **1.24** |
| Reliance Infrastructure Ltd | 1.955 | **1.60** |
| Gujarat Inds Power Co Ltd | 1.365 | **0.79** |
| | **Average** | **1.09** |

*Source: Bloomberg, Beta snapshots are provided in Annex 3.*

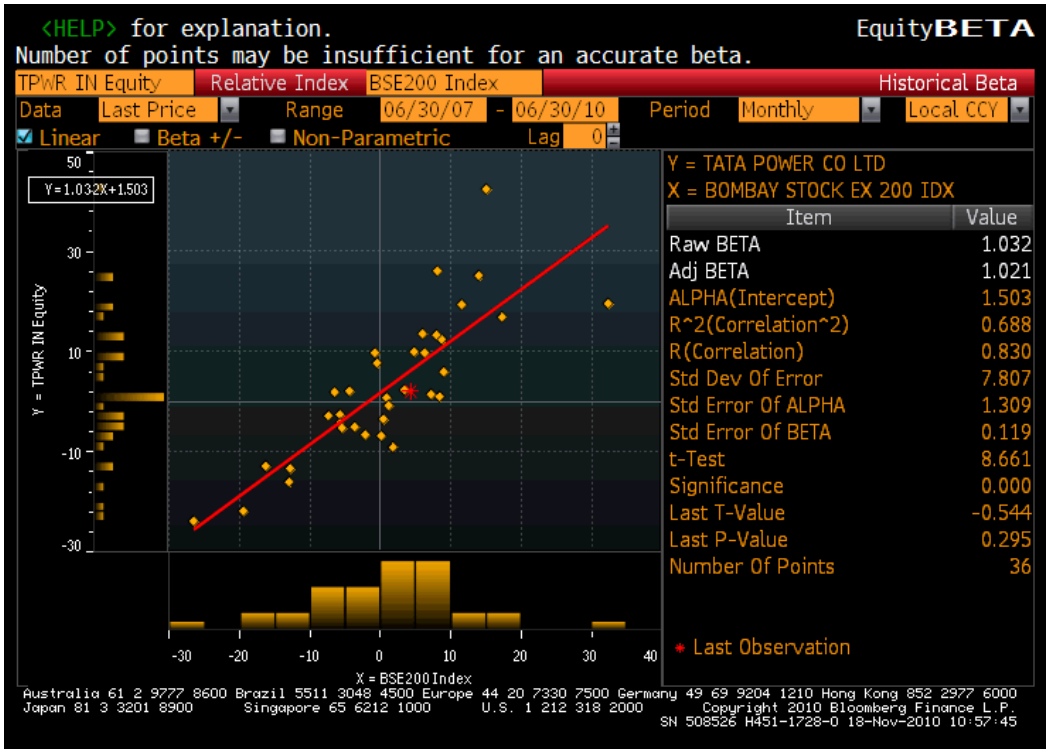
**Calculation of Benchmark cost of equity:-**

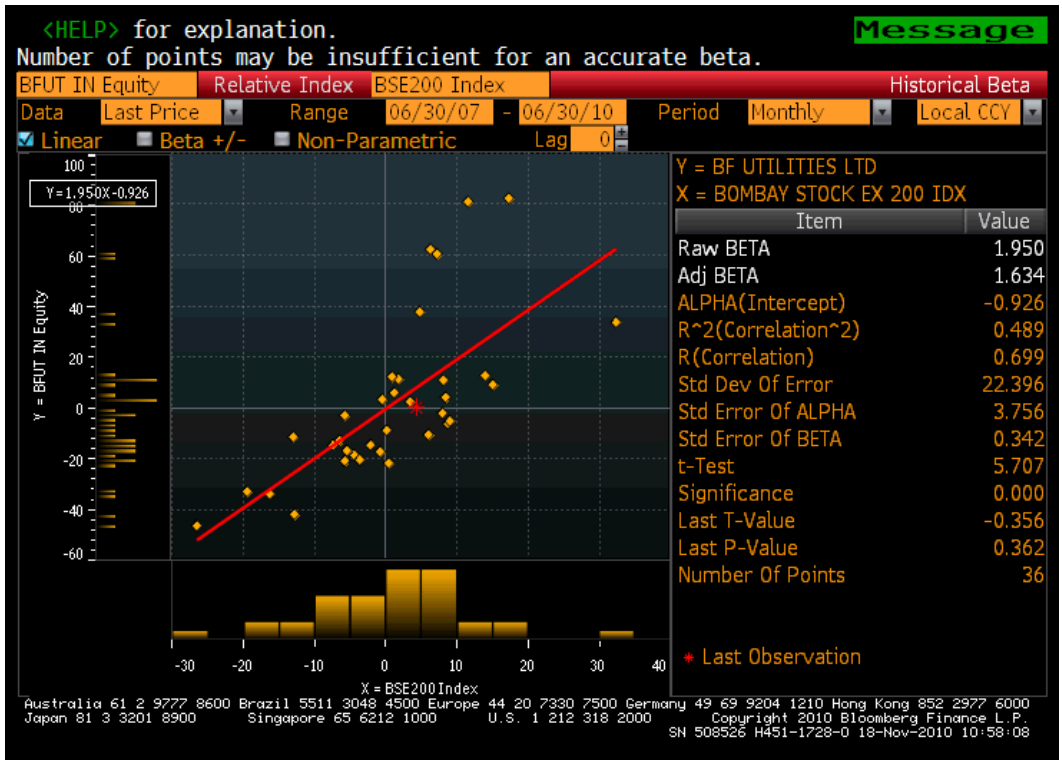
$$Ke = Rf + B \times (Rm - Rf)]$$

Therefore, cost of equity benchmark, Ke = 8.38% + 1.09 * 7.39% = **16.40%**

## Annex 3

## BETA SNAPSHOTS FROM BLOOMBERG

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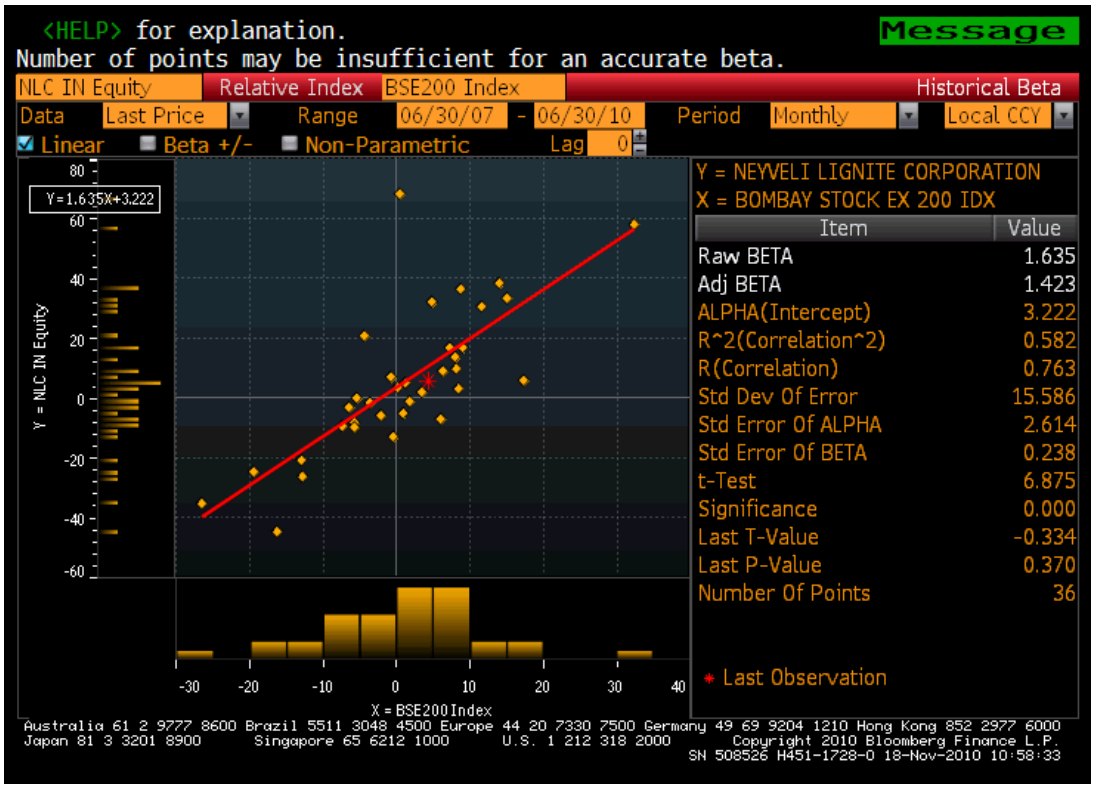
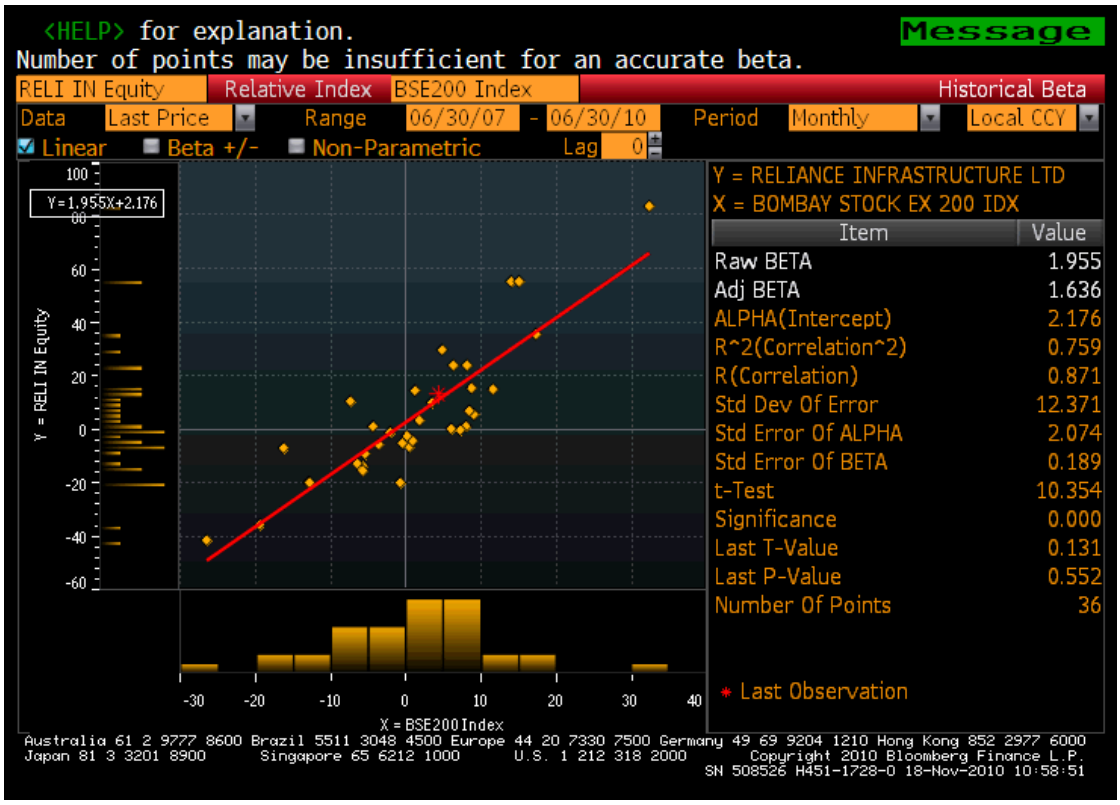
Number of points may be insufficient for an accurate beta.
BFUT IN Equity
Relative Index
BSE200 Index
Historical Beta
Data
Last Price
Range
06/30/07
- 06/30/10
Period
Monthly
Local CCY
Linear
Beta +/-
Non-Parametric
Lag
0
Y=1.950X-0.926
Y = BFUT IN Equity
X = BSE200Index
Y = BF UTILITIES LTD
X = BOMBAY STOCK EX 200 IDX
Item
Value
Raw BETA 1.950
Adj BETA 1.634
ALPHA(Intercept) -0.926
R^2(Correlation^2) 0.489
R(Correlation) 0.699
Std Dev Of Error 22.396
Std Error Of ALPHA 3.756
Std Error Of BETA 0.342
t-Test 5.707
Significance 0.000
Last T-Value -0.356
Last P-Value 0.362
Number Of Points 36
* Last Observation
Australia 61 2 9777 8600 Brazil 5511 3048 4500 Europe 44 20 7330 7500 Germany 49 69 9204 1210 Hong Kong 852 2977 6000
Japan 81 3 3201 8900 Singapore 65 6212 1000 U.S. 1 212 318 2000
Copyright 2010 Bloomberg Finance L.P.
SN 508526 H451-1728-0 18-Nov-2010 10:58:08


<HELP> for explanation.
Message
Number of points may be insufficient for an accurate beta.
NLC IN Equity
Relative Index
BSE200 Index
Historical Beta
Data
Last Price
Range
06/30/07
- 06/30/10
Period
Monthly
Local CCY
Linear
Beta +/-
Non-Parametric
Lag
0
Y=1.635X+3.222
Y = NLC IN Equity
X = BSE200Index
Y = NEYVELI LIGNITE CORPORATION
X = BOMBAY STOCK EX 200 IDX
Item
Value
Raw BETA 1.635
Adj BETA 1.423
ALPHA(Intercept) 3.222
R^2(Correlation^2) 0.582
R(Correlation) 0.763
Std Dev Of Error 15.586
Std Error Of ALPHA 2.614
Std Error Of BETA 0.238
t-Test 6.875
Significance 0.000
Last T-Value -0.334
Last P-Value 0.370
Number Of Points 36
* Last Observation
Australia 61 2 9777 8600 Brazil 5511 3048 4500 Europe 44 20 7330 7500 Germany 49 69 9204 1210 Hong Kong 852 2977 6000
Japan 81 3 3201 8900 Singapore 65 6212 1000 U.S. 1 212 318 2000
Copyright 2010 Bloomberg Finance L.P.
SN 508526 H451-1728-0 18-Nov-2010 10:58:33


<HELP> for explanation.
Message
Number of points may be insufficient for an accurate beta.
RELI IN Equity
Relative Index
BSE200 Index
Historical Beta
Data
Last Price
Range
06/30/07
- 06/30/10
Period
Monthly
Local CCY
Linear
Beta +/-
Non-Parametric
Lag
0
Y=1.955X+2.176
Y = RELI IN Equity
X = BSE200 Index
Y = RELIANCE INFRASTRUCTURE LTD
X = BOMBAY STOCK EX 200 IDX
Item
Value
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Adj BETA 1.636
ALPHA(Intercept) 2.176
R^2(Correlation^2) 0.759
R(Correlation) 0.871
Std Dev Of Error 12.371
Std Error Of ALPHA 2.074
Std Error Of BETA 0.189
t-Test 10.354
Significance 0.000
Last T-Value 0.131
Last P-Value 0.552
Number Of Points 36
Last Observation
Australia 61 2 9777 8600 Brazil 5511 3048 4500 Europe 44 20 7330 7500 Germany 49 69 9204 1210 Hong Kong 852 2977 6000
Japan 81 3 3201 8900 Singapore 65 6212 1000 U.S. 1 212 318 2000
Copyright 2010 Bloomberg Finance L.P.
SN 508526 H451-1728-0 18-Nov-2010 10:58:51