Voluntary Carbon Standard
Project Description
19 November 2007

Date: 14 November 2009

Version: 4.0

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1 Description of Project:

1.1 Project title

Grid connected bundled wind power project in Gujarat managed by Enercon (India) Limited.

1.2 Type/Category of the project

The project considered is under VCS approved baseline and monitoring methodologies; 'grid-connected electricity generation from renewable sources' that generates approximately 30.624 GWh electricity annually. As per the scope of the project activity enlisted in the 'list of sectoral scopes and related approved baseline and monitoring methodologies (version 09)', the project activity may principally be categorized in Scope Number 1, Sectoral Scope - Energy industries (renewable/ non-renewable sources).

The project activity is considered as grouped project.

1.3 Estimated amount of emission reductions over the crediting period including project size:

The project is estimated to have average of 26,416 tCO_2e reductions per year and hence the project activity comes under second group "Projects". Yearly emission reduction for project activity is shown below:-

Years	Annual estimation of emission reductions in tones of CO_2e
01 Feb 2007 – 31 Jan 2008	15,996
01 Feb 2008 – 31 Jan 2009	26,252
01 Feb 2009 – 31 Jan 2010	27,740
01 Feb 2010 – 31 Jan 2011	27,740
01 Feb 2011 – 31 Jan 2012	27,740
01 Feb 2012 – 31 Jan 2013	27,740
01 Feb 2013 – 31 Jan 2014	27,740
01 Feb 2014 – 31 Jan 2015	27,740
01 Feb 2015 – 31 Jan 2016	27,740
01 Feb 2016 – 31 Jan 2017	27,740
Total estimated reductions (tonnes of CO_2e)	2,64,168
Total number of crediting years	10
Annual average over the crediting period (10 years) of estimated reductions (tonnes of CO_2e)	26,416

1.4 **A brief description of the project:**

The purpose is development, design, engineering, procurement, finance, construction, operation and maintenance of bundled wind power project of 15.2 MW in the Indian state of Gujarat to provide reliable, renewable power to the Gujarat state electricity grid which is part of the NEWNE electricity grid. The project considered has used the barren land at Jamnagar District in the state of Gujarat. The project is helping in bridging the gap between demand and supply of by using wind as a source of generating electrical energy.

The project activity consists of the 19 E-48 machines of Enercon make of 800 KW each totaling to the capacity of 15.2 MW. The Project considered harness renewable resources in the region, thereby displacing non-renewable natural resources and ultimately leading to sustainable, economic and environmental development. Enercon (India) Ltd ("Enercon" or "EIL") is the equipment supplier and the operations and maintenance contractor for the Project.

1.5 **Project location including geographic and physical information allowing the unique identification and delineation of the specific extent of the project:**

The Project is spread across villages in Khirsara, Okhamadhi, Jodhpar, Methan, Bhupat Ambardi and Seth Vadala of Jamnagar District. The location of the units is on the micrositing data to get optimum performance. The latitudinal & longitudinal as well as the unique identification details of individual machines are as given in the following table:

Sr No.	Sub Project	Machine capacity	Village	Machine Unique Id Number	Latitude	Longitude
1	Amar Builders	0.8	Khirsara	EIL/800/06-07/0265	N21º 58' 23."	E70º 15' 56"
2	DP Power Pvt Ltd	0.8	Okha Madhi	EIL/800/06-07/0220	N22º 04' 57"	E69º 07' 13"
3	DP Wires Pvt Ltd	0.8	Okha Madhi	EIL/800/06-07/0214	N22º 04' 55"	E69º 06' 56"
4	DP Wires Pvt Ltd	0.8	Jodhpar	EIL/800/06-07/0215	N21º 59' 11"	E69º 18' 36"
5	Kataria Wires Pvt. Ltd.	0.8	Okha Madhi	EIL/800/06-07/0217	N22º 04' 43"	E69º 07' 06"
6	Mahanagar Developers	0.8	Jodhpar	EIL/800/06-07/0414	N21º 59' 02"	E69º 18' 40"
7	Mahanagar Developers	0.8	Jodhpar	EIL/800/06-07/0415	N21º 59' 07"	E69º 18' 38"
8	PBM Polytex	0.8	Okha Madhi	EIL/800/06-07/0219	N22º 01' 20"	E70º 14' 13"
9	PBM Polytex	0.8	Methan	EIL/800/07-08/0667	N22º 01' 04"	E70º 12' 05"
10	PBM Polytex	0.8	Methan	EIL/800/07-08/0668	N22º 05' 19"	E69º 07' 01"
11	Powerica Limited	0.8	Bhupat Ambardi	EIL/800/07-08/0916	N22º 02' 48"	E70º 07' 29"
12	Powerica Limited	0.8	Bhupat Ambardi	EIL/800/07-08/0917	N22º 01' 31"	E70º 05' 46"
13	Powerica Limited	0.8	Bhupat Ambardi	EIL/800/07-08/01145	N22º 01' 24"	E70º 05' 47"

14	Powerica Limited	0.8	Bhupat Ambardi	EIL/800/07-08/0914	N22º 01' 20"	E70º 05' 59"
15	Powerica Limited	0.8	Bhupat Ambardi	EIL/800/07-08/0915	N22º 01' 14"	E70º 06' 00"
16	Powerica Limited	0.8	Seth Vadala	EIL/800/07-08/0918	N22º 01' 08"	E70º 06' 03"
17	Ratlam Wires Pvt Ltd.	0.8	Okhamadhi	EIL/800/06-07/0216	N22º 04' 51"	E69º 07' 18"
18	Tarak Chemicals	0.8	Jodhpar	EIL/800/06-07/0213	N21º 59' 18"	E69º 18' 33"
19	Zaveri & Company	0.8	Okhamadhi	EIL/800/06-07/0221	N22º 05' 01"	E69º 06' 50"

1.6 Duration of the project activity/crediting period:

Project Start date: The Project start date is considered as 01 February 2007. This is the date when the first machine got commissioned. This date is considered due to the fact that the project activity began reducing GHG emissions from this date.

Sr No.	Customer name	Site	Sub Project Capacity	EIL Sub Station	GEB Sub Station	Purchase Order Date	Commercial Operation Date
1	Amar Builders	Khirsara	0.8	**Sadodar**	**Motipaneli**	27-Nov-06	24-Mar-07
2	DP Power Pvt Ltd.	Okhamadhi	0.8	**Bhogat**	**Bhatia**	1-Sep-06	12-Feb-07
3	DP Wires Pvt. Ltd.	Okhamadhi	0.8	**Bhogat**	**Bhatia**	1-Sep-06	1-Feb-07
4	DP Wires Pvt. Ltd.	Jodhpar	0.8	**Bhogat**	**Bhatia**	2-Sep-06	19-Mar-07
5	Kataria Wires Pvt. Ltd.	Okhamadhi	0.8	**Bhogat**	**Bhatia**	1-Sep-06	1-Feb-07
6	Mahanagar Developers	Jodhpar	0.8	**Bhogat**	**Bhatia**	27-Oct-06	19-Mar-07
7	Mahanagar Developers	Jodhpar	0.8	**Bhogat**	**Bhatia**	27-Oct-06	19-Mar-07
8	PBM Polytex	Okhamadhi	0.8	**Bhogat**	**Bhatia**	25-Sep-06	12-Feb-07
9	PBM Polytex	Methan	0.8	**Samana**	**Sadodar**	8-May-07	1-Sep-07
10	PBM Polytex	methan	0.8	**Samana**	**Sadodar**	8-May-07	28-Sep-07
11	Powerica Limited	Bhupat Ambardi	0.8	**Samana**	**Sadodar**	30-Aug-07	31-Mar-08
12	Powerica Limited	Bhupat Ambardi	0.8	**Samana**	**Sadodar**	30-Aug-07	31-Mar-08
13	Powerica Limited	Bhupat Ambardi	0.8	**Samana**	**Sadodar**	30-Aug-07	31-Mar-08
14	Powerica Limited	Bhupat Ambardi	0.8	**Samana**	**Sadodar**	30-Aug-07	8-Apr-08
15	Powerica Limited	Bhupat Ambardi	0.8	**Samana**	**Sadodar**	30-Aug-07	8-Apr-08

16	Powerica Limited	Seth Vadala	0.8	**Samana**	**Sadodar**	30-Aug-07	8-Apr-08
17	Ratlam Wires Pvt. Ltd.	Okhamadhi	0.8	**Bhogat**	**Bhatia**	1-Sep-06	7-Feb-07
18	Tarak chemicals	Okhamadhi	0.8	**Bhogat**	**Bhatia**	12-Sep-06	19-Mar-07
19	Zaveri & Co. ltd	Okhamadhi	0.8	**Bhogat**	**Bhatia**	21-Aug-06	1-Feb-07
	TOTAL		15.2				

Crediting period start date: 01 Feb 2007 (Since the commissioning date of first machine is 01 Feb 2007). The renewable of the crediting period can be done at most one time as project technical lifetime is 20 years. Thus the crediting period has been renewed once.

VCS Project crediting period: The project has now been submitted to DOE at the stage of validation; hence the vintage of the project activity is considered. The crediting period considered is Feb 01, 2007 up to ten years till to Jan 31, 2017.

1.7 Conditions prior to project initiation:

There was no power generation project existing prior to the development of this project activity.

1.8 A description of how the project will achieve GHG emission reductions and/or removal enhancements:

The Project is wind based renewable energy source, zero emission power project connected to the Gujarat state grid, which forms part of the NEWNE regional electricity grid. The Project 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 regional electricity grid.

1.9 Project technologies, products, services and the expected level of activity:

The Project involves 19-wind energy converters (WECs) of Enercon make (800 KW E-48) with internal electrical lines connecting the Project with local evacuation facility. The WECs generates 3-phase power at 400V, which is stepped up to 22 KV. The Project can operate in the frequency range of 47.5–51.5 Hz and in the voltage range of 400 V ± 12.5%. The technical specification of E-48 WEG is as follows:

1	**Turbine Model**	**Enercon E-48**
2	Rotor Diameter	48 m
3	Hub Height	74.85 m
4	Turbine Type	Gearless horizontal axis wind turbine with variable rotor speed.
5	Power Regulation	Independent electromechanical pitch system

		for each blade.
6	Design Lifetime	20 Years
7	Cut-in wind speed	2.5 m/s
8	Rated wind speed	12 m/s
9	Cut-out wind speed	28-34 m/s
10	Extreme wind speed	59.5 m/s
11	Rated rotational wind speed	31.5 rpm
12	0perating range rotational speed	16.0 – 31.5 rpm
13	Orientation	Upwind
14	No of blades	3
15	Blade material	Glass fiber reinforced Epoxy
16	Gear Box type	Gear less
17	Generator type	Synchronous generator
18	Braking	Aerodynamic
19	Output voltage	400V
20	Yaw System	Active yawing with 4 electric yaw drives with brake motor and friction bearing.
21	Tower	74 meter concrete

The other salient features of the state-of-art-technology are:

- Gearless Construction - Rotor & Generator Mounted on same shaft eliminating the Gearbox.
- Variable Pitch functions ensuring maximum energy capture.
- Near Unity Power Factor at all times.
- Minimum drawl (less than 1% of kWh generated) of Reactive Power from the grid.
- No voltage peaks at any time.
- Operating range of the WEC with voltage fluctuation of -20 to +20%.
- Less Wear & Tear since the system eliminates mechanical brake, which are not required due to low speed generator that runs at maximum speed of 33 rpm and uses Air Brakes.
- Three Independent Braking Systems.
- Incorporates lightning protection system, which includes blades.

Enercon (India) Ltd has secured and facilitated the technology transfer for wind based renewable energy generation from Enercon GmbH and has established a manufacturing

plant at Daman in India, where along with other components the "Synchronous Generators" using "Vacuum Impregnation" technology are manufactured.

The expected electricity produced from the project under consideration can be calculated as follows:

Annual electricity supplied to the grid by the Project

= 15.2MW (Capacity) x 23% (PLF) x 8,760 (hours) / 1,000 GWh

= 30.624 GWh

= 30,624,000 kWh/year

Expected electricity generation for the rest of the technical life of the project activity calculated with 23% PLF is expected to be 30,624,000 kWh per year.

1.10 Compliance with relevant local laws and regulations related to the project:

There are no legal and regulatory requirements to be complied with for the project under consideration.

1.11 Identification of risks that may substantially affect the project's GHG emission reductions or removal enhancements:

The associated risks for the renewable energy technology identified by the project proponent are technological, financial, policy, and regulatory nature. Due to the fact that wind is an intermittent source of power, wind energy involves relatively high risk compared with fossil fuel forms of energy or hydro energy.

1.12 Demonstration to confirm that the project was not implemented to create GHG emissions primarily for the purpose of its subsequent removal or destruction.

The project activity generates clean energy through wind energy converters and does not create any GHG emissions. Therefore, the project was not implemented to create GHG emissions primarily for the purpose of its subsequent removal or destruction.

1.13 Demonstration that the project has not created another form of environmental credit (for example renewable energy certificates).

The project under consideration has been developed as per the modalities of Clean Development Mechanism of the Kyoto Protocol. The project has now been submitted for Validation with the DOE. It is hereby stated that the project has not created any other form of environmental credit.

1.14 Project rejected under other GHG programs (if applicable):

Not applicable.

1.15 Project proponents roles and responsibilities, including contact information of the project proponent, other project participants:

Roles and Responsibility:

The Project is operated and managed by Enercon (India) Ltd. The operational and management structure implemented by Enercon is as follows:
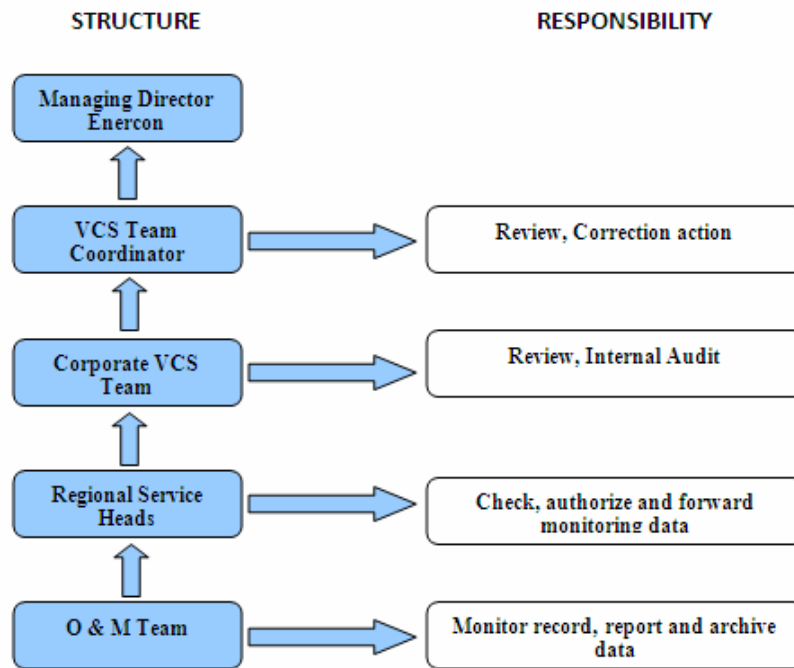
The Contact details are as follows:

Organization:	Enercon (India) Limited
Street/P.O.Box:	A-9, Veera Industrial Estate, Veera Desai Road, Andheri (W)
Building:	Enercon Tower
City:	Mumbai
State/Region:	Maharashtra
Postfix/ZIP:	400 053
Country:	India
Telephone:	+91-22-6692 4848
FAX:	+91-22 - 67040473 / 66921175
E-Mail:	yogesh.mehra@enerconindia.net
URL:	www.enerconindia.net
Represented by:	
Title:	Managing Director
Salutation:	Mr.
Last Name:	Mehra

Middle Name:	
First Name:	Yogesh
Department:	Corporate
Mobile:	+91-98200 40301
Direct FAX:	+91-22-6692 1177
Direct tel:	+91-22-6702 2832
Personal E-Mail:	yogesh.mehra@enerconindia.net

1.16   Any information relevant for the eligibility of the project and quantification of emission reductions or removal enhancements, including legislative, technical, economic, sectoral, social, environmental, geographic, site-specific and temporal information.):

- Estimated amount of emission reduction for crediting period of 10 years

Year	Estimation of project activity emissions (tonnes of CO_2e)	Estimation of baseline emissions (tonnes of CO_2e)
01 Feb 2007 – 31 Jan 2008	0	15,996
01 Feb 2008 – 31 Jan 2009	0	26,252
01 Feb 2009 – 31 Jan 2010	0	27,740
01 Feb 2010 – 31 Jan 2011	0	27,740
01 Feb 2011 – 31 Jan 2012	0	27,740
01 Feb 2012 – 31 Jan 2013	0	27,740
01 Feb 2013 – 31 Jan 2014	0	27,740
01 Feb 2014 – 31 Jan 2015	0	27,740
01 Feb 2015 – 31 Jan 2016	0	27,740
01 Feb 2016 – 31 Jan 2017	0	27,740
Total (tonnes of CO_2e)	0	2,64,168

- Legislative: There is no legal or regulatory requirement enforced for the project activity.
- Technical:
    - ✓ Host party: The host party to the project activity is the Government of India.
    - ✓ Region/State/Province: Located in the State of Gujarat that forms the part of western regional electricity grid

- ✓ City/Town/Community: located in Sumana, Okhamadhi and Jodhapar sites of Jamnagar district in the State of Gujarat
- ✓ Increased interest in wind energy projects will further push R&D efforts by technology providers to develop more efficient and better machinery in future

- Economic:
  - ✓ 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 western regional grid through local grid, thereby improving the grid frequency and availability of electricity to the local consumers (villagers & sub-urban habitants) which will provide new opportunities for industries and economic activities to be setup in the area thereby resulting in greater local employment, ultimately leading to overall development.

- Sectoral Scope: 1
  - ✓ Increase in the electricity availability.
  - ✓ Shorter power cuts.
  - ✓ Optimum utilization of freely available natural resources.

- Social:
  - ✓ The project activity has led to the development of supporting infrastructure such as road network etc., in the wind park location, which also provides access to the local population.
  - ✓ The project activity leads 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 increased energy security.

- Environmental:
  - ✓ The project activity involves use of 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 contributing to environmental well being.

- Geographic:
  - ✓ The project is located at Sumana, Okhamadhi and Jodhapar of Jamnagar district of Gujarat. The location of the units is on the micrositing data to get optimum performance.
  - ✓ The project location extends between latitude N21º 58' 23.7" to N22º 05' 01.1" and E70º 15' 56.7" to E69º 06' 50.8".
  - ✓ The project involves 19 units of 800 KW:
    - 9 Units are located at Sumana
    - 3 Units are located at Jodhapar &
    - 7 Unit is located at Okhamadhi

1.17 List of commercially sensitive information (if applicable):

There is no commercial sensitive information regarding the project activity provided in the PD.

2   VCS Methodology:

2.1 Title and reference of the VCS methodology applied to the project activity and explanation of methodology choices:

The project uses UNFCCC Clean Development Mechanism program, which is approved under VCS. The project under consideration has capacity greater than 15 MW i.e. the threshold for small-scale projects under the UNFCCC CDM program; hence the project has adopted the approved consolidated baseline and monitoring methodology ACM0002 Version 9.0. The titles of these baseline and monitoring methodologies are "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" and "Consolidated monitoring methodology for grid-connected electricity generation from renewable sources.

2.2 Justification of the choice of the methodology and why it is applicable to the project activity:

The Project is wind based renewable energy source, zero emission power project connected to the Gujarat state grid, which forms part of the NEWNE regional electricity grid. The Project displaces 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 regional electricity grid.

The approved consolidated baseline and monitoring methodology ACM0002 Version 09 is the choice of the baseline and monitoring methodology and it is applicable because:

- The Project is grid connected renewable power generation project activity
- The Project represents electricity capacity additions from wind sources
- The Project does not involve switching from fossil fuel to renewable energy at the site of project activity since the Project is green-field electricity generation capacities from wind sources at sites where there was no electricity generation source prior to the Project, and
- The geographical and system boundaries of the NEWNE electricity grid can be clearly identified and information on the characteristics of the grid is available.

2.3   Identifying GHG sources, sinks and reservoirs for the baseline scenario and for the project:

✓ The sources, sinks and reservoir controlled by the project proponent would be the mitigation of CO2 which would have otherwise been liberated from the fossil fuel based power plants.

✓ There are no sources sinks and reservoir related to the GHG project

✓ There are no sources sinks and reservoir affected by the GHG project

2.4   Description of how the baseline scenario is identified and description of the identified baseline scenario:

According to ACM0002, for project activities that do not modify or retrofit an existing electricity generation facility, 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 below.

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 using calculation of Combined Margin multiplied by electricity delivered to the grid by the Project. The average of 3 years operating margin emission factor of NWENE grid is 1.00862 tCO_2e/MWh and build margin emission factor for the year (2007-2008) is 0.59771 tCO_2e/MWh. Thus the combined margin emission factor is 905.89 tCO_2e/GWh or 0.90589 tCO_2e/MWh.

2.5   Description of how the emissions of GHG by source in baseline scenario are reduced below those that would have occurred in the absence of the project activity (assessment and demonstration of additionality):

The latest additionality tool i.e. Tool for the demonstration and assessment of additionality version 05.2 approved by CDM Executive Board in its 39th meeting is used to demonstrate project's additionality.
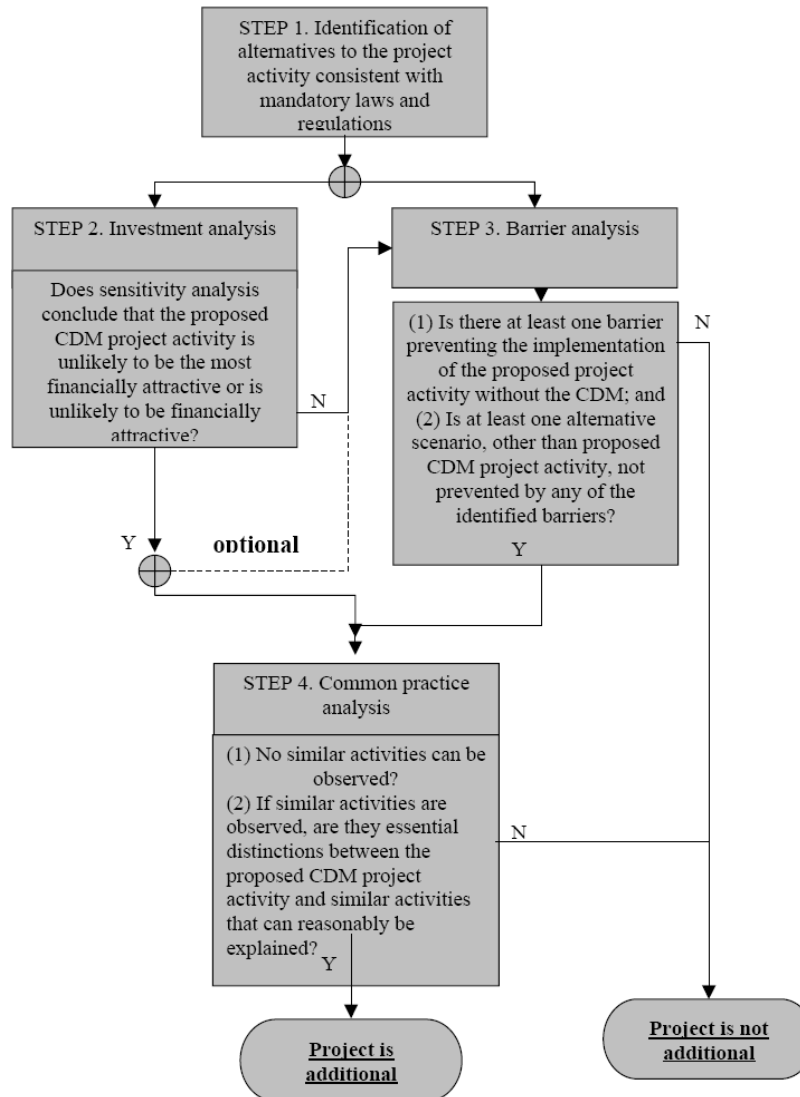
Step 1: Identification of alternatives to the project activity consistent with current laws and regulations

Sub-step 1: Define alternatives to the project activity:

(1) Identify realistic and credible alternative(s) available to the project participants or similar project developers that provide outputs or services comparable with the proposed CDM project activity. These alternatives are to include:

(a) The proposed project activity undertaken without being registered as a CDM project activity;

(b) Other realistic & credible alternative scenario(s) to the proposed CDM project activity scenario that deliver outputs services (e.g., cement) or services (e.g. electricity, heat) with comparable quality, properties and application areas; taking into account, where relevant, examples of scenarios identified in the underlying methodology;

(c) If applicable, continuation of the current situation (no project activity or other alternatives undertaken)

Accordingly, the realistic and credible alternatives to the project activity are:

(a) The Project is not undertaken as a CDM project activity.

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

(c) Continuation of the current situation where no project activity or any of the above Alternatives are undertaken would not be applicable as Western region under NEWNE Grid had maximum energy (MU) shortages of 38,945 mu or 15.8% and maximum peak shortages of 88,892 mw or 23.2%. (Source: http://www.financialexpress.com/news/cea-projects-8.8-power-shortage-in-200809/350803/0).

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

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

2. The alternative(s) shall be in compliance with all applicable legal and regulatory requirements, even if these laws and regulations have objectives other than GHG reductions, e.g. to mitigate local air pollution. (This sub-step does not consider national and local policies that do not have legally-binding status.)

3. If an alternative does not comply with all mandatory applicable legislation and regulations, then show that, based on an examination of current practice in the country or region in which the law or regulation applies, those applicable legal or regulatory requirements are systematically not enforced and that non-compliance with those requirements is widespread in the country. If this cannot be shown, then eliminate the alternative from further consideration.

4. If the proposed project activity is the only alternative amongst the ones considered by the project participants that is in compliance with all regulations with which there is general compliance, then the proposed CDM project activity is not additional.

There are no legal and regulatory requirements for this particular technology for power generation

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

Determine whether the proposed project activity is not:

(a) The most economically or financially attractive; or

(b) Economically or financially feasible, without the revenue from the sale of certified emission reductions (CERs).

To conduct the investment analysis, use the following Sub-steps:

Sub-step 2a: Determine appropriate analysis method

1. Determine whether to apply simple cost analysis, investment comparison analysis or benchmark analysis (Sub-step 2b). If the CDM project activity and the alternatives identified in Step 1 generate no financial or economic benefits other than CDM related income, then apply the simple cost analysis (Option I). Otherwise, use the investment comparison analysis (Option II) or the benchmark analysis (Option III).

Sub-step 2b: Option I. Apply simple cost analysis

2. Document the costs associated with the CDM project activity and the alternatives identified in Step 1 and demonstrate that there is at least one alternative which is less costly than the project activity.

Option I – Simple cost analysis is not applicable as the project activity sells electricity to the grid and obtains economic benefits in the form of electricity tariffs.

Sub-step 2b: Option II. Apply investment comparison analysis

3. Identify the financial indicator, such as IRR, NPV, cost benefit ratio, or unit cost of service (e.g., levelized cost of electricity production in $/kWh or levelized cost of delivered heat in $/GJ) most suitable for the project type and decision-making context.

Sub-step 2b: Option III. Apply benchmark analysis

4. Identify the financial/economic indicator, such as IRR, most suitable for the project type and decision context.

5. When applying Option II or Option III, the financial/economic analysis shall be based on parameters that are standard in the market, considering the specific characteristics of the project type, but not linked to the subjective profitability expectation or risk profile of a particular project developer. Only in the particular case where the project activity can be implemented by the project participant, the specific financial/economic situation of the company undertaking the project activity can be considered.

6. Discount rates and benchmarks shall be derived from:

   a. Government bond rates, increased by a suitable risk premium to reflect private investment and/or the project type, as substantiated by an independent (financial) expert or documented by official publicly available financial data;

   b. Estimates of the cost of financing and required return on capital (e.g. commercial lending rates and guarantees required for the country and the type of project activity concerned), based on bankers views and private equity investors/funds' required return on comparable projects;

   c. A company internal benchmark (weighted average capital cost of the company), only in the particular case referred to above in paragraph 5. The project developers shall demonstrate that this benchmark has been consistently used in the past, i.e. that project activities under similar conditions developed by the same company used the same benchmark;

   d. Government/official approved benchmark where such benchmarks are used for investment decisions;

   e. Any other indicators, if the project participants can demonstrate that the above Options are not applicable and their indicator is appropriately justified

As per Guidance to investment analysis issued in EB 41 (paragraph 11), the weighted average cost of capital can be considered as appropriate benchmark for project IRR. 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 (such as company WACC, project and company specific interest rates, etc.).

Accordingly, the WACC (Weighted Cost of capital) has been considered as a benchmark.

Weighted average cost of capital (WACC) is calculated as weighted average cost of equity and cost of debt as illustrated below

WACC = [D / (D+E)]*[Cost of Debt] + [E / (D+E)]*[Cost of Equity]

For calculation of WACC, a debt: equity ratio of 70:30 has been considered, as typical for the project type[1]

Detailed calculations have in described in WACC benchmark calculation sheet.

Cost of Debt:

Cost of debt is defined as the rate at which lenders agree to lend money to a project. The additionality tool and the guidance to investment analysis clarify that for projects that benchmark for project with more than one potential developer should not be based on project specific parameters but should represent the standard in the market. Prime Lending Rate is defined as the benchmark rate for all bank loans. Historically, the PLR is the rate at which banks lend to the best borrower—one who is the safest or the least likely to default on the loan. Accordingly, the bank prime lending prevailing at the time of decision making has been considered as the cost of debt. The prime lending rate at the time of investment decision (August 2006) was in the range of 10.75%-11.25% [Source: Reserve Bank of India **http://rbidocs.rbi.org.in/rdocs/Wss/DOCs/71884.xls**], the average PLR of 11.00% has been considered.

Interest costs are tax deductible, therefore in order to arrive at the post tax cost of debt, the cost of debt is multiplied with marginal tax rate. The marginal tax rate of 33.66 % is applicable for the project activity.

The post tax cost of debt therefore works out to: 11.00% * (1-33.66%) = 7.30%

Calculation of Cost of Equity:

The expected return on equity has been determined using the Capital Asset Pricing Model (CAPM)[2]. 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.

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[1] Several regulations and orders refer this as the normative debt equity ratio for wind power projects.

[2] 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 rate of interest on government bonds are considered as risk free rates. Accordingly the risk free rate has been taken from long dated Indian government bond yield rates. One year average value of government bond yied rate prior to the one month from the date of placement of Purchase Order i.e Aug 2006 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) has been used. The data on government bond rates is published by Reserve Bank of India. (Web-link: http://rbidocs.rbi.org.in/rdocs/Bulletin/DOCs/71985.xls)

Risk Premium:

The most common approach for estimating the 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 average return on government securities over an extended period of history. 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. It is also preferred to calculate the risk premium based on geometric mean of the returns since arithmatic mean overstates the risk premium. Geometric mean is defined as the compounded annual return over the same period.

Therefore the risk premium has been calculated as the difference in compounded annual return bewteen the BSE-500 and the Government bond rates since the year of inception of BSE Sensex, i.e. 1979 – 80. The detailed calculations are presented in the attached excel sheet.

Source: BSE Stock Exchange (www.bseindia.com)

The applicable risk premium is 12.84%.

Beta:

Beta (B) indicates the sensitivity of the company to market risk factors. For companies that are not publicly 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 or renewable energy power generation company (BF Utility) listed on any stock exchange in India (both BSE-Bombay Stock Exchange and NSE-National Stock Exchange) in year 2006 [3]. 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.

Therefore, 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. 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.). The use of this Beta value is therefore considered conservative, as it does not add for the higher risk of non-conventional energy.

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 and values corresponding to each project are mentioned in benchmark calculation sheet.

The table below summarises the beta values:

Bloomberg Symbol	Company Name	Beta
RELI IN Equity	RELIANCE ENERGY	1.13
GIP IN Equity	GUJARAT INDS	1.19
TPWR IN Equity	TATA POWER CO	1.29
NLC IN Equity	NEYVELI LIGNITE	1.50
CESC IN Equity	CESC LTD	1.48
BFUT IN Equity	BF Utility	1.59
	Average Beta	**1.36**

WACC = [D/ (D+E)]*[Cost of Debt] + [E/ (D+E)]*[Cost of Equity]

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[3] This can be verified from the database available at the web-link www.securities.com (This website is owned by a Euromoney Institutional Investor Company and It delivers hard-to-get information on more than 80 emerging markets through its award-winning online Emerging Markets Information Service.)

For calculation of WACC, a debt: equity ratio of 70:30 has been considered, as typical for the project type[4].

WACC = 70%* 11.00%* (1-33.66%) + 30%*(7.59% +1.36* 12.84%)
= 12.63 %

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

7. Calculate the suitable financial indicator for the proposed VCS Project and, in the case of Option II above, for the other alternatives. Include all relevant costs (including, for example, the investment cost, the operations and maintenance costs), and revenues (excluding VER revenues, but including *inter alia* subsidies/fiscal incentives, ODA, etc, where applicable), and, as

8. Present the investment analysis in a transparent manner and provide all the relevant assumptions, preferably in the VCS PD, or in separate annexes to the PD, so that a reader can reproduce the analysis and obtain the same results. Refer to all critical techno-economic parameters and assumptions (such as capital costs, fuel prices, lifetimes, and discount rate or cost of capital). Justify and/or cite assumptions in a manner that can be validated by the DOE. In calculating the financial indicator, the project's risks can be included through the cash flow pattern, subject to project-specific expectations and assumptions (e.g. insurance premiums can be used in the calculation to reflect specific risk equivalents).

9. Assumptions and input data for the investment analysis shall not differ across the project activity and its alternatives, unless differences can be well substantiated.

10. Present in the VCS PD submitted for validation a clear comparison of the financial indicator   for the proposed VCS activity and:

    (a) The alternatives, if Option II (investment comparison analysis) is used. If one of the other alternatives has the best indicator (e.g. highest IRR), then the VCS project activity can not be considered as the most financially attractive;

    (b) The financial benchmark, if Option III (benchmark analysis) is used. If the VCS project activity has a less favourable indicator (e.g. lower IRR) than the benchmark, then the VCS project activity cannot be considered as financially attractive.

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[4] Several regulations and orders refer this as the normative debt equity ratio for wind power projects.

Project IRR Sheet:

The key assumptions used for calculating the benchmark for the project yielding the highest IRR (post-tax equity IRR for sub project 9 i.e. Powerica Limited) are set out below:

Powerica Limited-I	
Project:	2.4 MW Wind Power Project
Location :	Gujarat

Assumptions for Financial Model	Reference No.	9

Project Capacity in MW	2.40
Project Commissioning Date	31-Mar-08
Project Cost per MW (Million Rs)	47.5

Operations		
PLF	23.00%	**GERC tariff order**
Insurance Charges @ % of capital cost	0.18%	
Operation & Maintanance Cost base year @ % of capital cost	1.50%	**GERC tariff order**
% of escalation per annum on O & M Charges	5.0%	

Tariff		
Base year Tariff – Rs./Kwh	3.37	**GERC tariff order**
Annual Escalation (Rs./kWh per Year)	0.00	
Tariff applicable upto 20 years (Rs/kWh)	3.37	

Project Cost	Rs Million	
Enercon make Wind Energy Generators, Type E-48, 800 KW consisting of following major componenets:-3 blades per set-1, synchronous type generator-1, Power cabinets-3 per set, Control Cabinets-1.	84.0	
Steel tower , 56 meters height	12.0	
950 kva, 400V/33KV 3ph transformers, make E-48, DP structure	2.7	
Civil works, foundation and electrical lines within windfarm	7.5	
Installation , insurance, commissioning and other services	4.2	
transportation charges,Land Cost	3.6	
Total Project Cost	**114.0**	**Purchase Order**

Means of Finance		Rs Million
Equity	100%	114.0
Total Loan	0%	0.0
Total		**114.0**

Terms of Loan		
Interest Rate	0.00%	
Tenure	-	Years
Moratorium	-	Months

Income Tax Depreciation Rate (Written Down Value basis)		
on Wind Energy Generators	80%	
On other Assets	10%	
Book Depreciation Rate (Straight Line Method basis)		
On all assets	4.50%	**GERC tariff order standard industry practice**
Book Depreciation up to (% of asset value)	90%	

Income Tax		
Income Tax rate	33.99%	
Minimum Alternate Tax	11.33%	

Working capital		
Receivables (no of days)	0	**GERC order**
O & m expenses (no of days)	0	
Working capital interest rate	0%	

VER Revenues		
VER Price in $	-	
Exchange rate Rs./$	50.00	

Crediting period starts	1-Apr-07
Length of Crediting period	10

Baseline Emission Factor for NEWNE Grid (tCO2/GWh)	905.89	**CEA data base**

Senstivity Analysis	
PLF	0%
O & M	0%

Project IRR	**10.78%**

The post tax project IRR for the sub project 9 (Powerica Limited) without VCUrevenues is 10.78% i.e. less than the benchmark WACC 12.63% (benchmark relative to the sub project) respectively. The Post Tax Project IRR for all other sub-projects lies in the range of 8.74%-10.78%. This is well below the WACC benchmark of 12.63%.

It is clear from the analysis that Project IRR of individual projects is below the Benchmark. Accordingly it can be concluded that Project is not the most financially attractive without VCU revenues.

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

1.   Include a sensitivity analysis that shows whether the conclusion regarding the financial/economic attractiveness is robust to reasonable variations in the critical assumptions. The investment analysis provides a valid argument in favour of additionality only if it consistently supports (for a realistic range of assumptions) the conclusion that the project activity is unlikely to be the most financially/economically attractive (as per Step 2c para 11a) or is unlikely to be financially/economically attractive (as per Step 2c para 11b).

Sensitivity Analysis:

Further, to show the robustness of financial analysis, sensitivity analysis is carried out as per the EB guidance on the 'Assessment of Investment Analysis', version-02, Annex-45, EB 41.The investment in wind power project shall be tested based on following parameters based on Annex 45 of EB41.

- Capital Cost
- Plant Load Factor
- O&M cost

Capital Cost

In accordance with the investment guidance, the additionality for the project activity is demonstrated at the time of decision making. The price is taken from the actual purchase order placed by individual sub project owner. Therefore sensitivity analysis on project cost is not required.

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. The project activity is located in the district of Jamnagar and Rajkot respectively in the state of Gujarat. Gujarat Electricity Regulatory Commission has set the 23% PLF for the state of Gujarat. The actual observed average PLF for the project activity over the period of April-2007 to March-2009 is below than 20%. Accordingly 10% sensitivity analysis has been done on base plf.

S.No.	Customer Name	Common Benchmark - WACC	Sensititvity @10% downward PLF	Post tax Project IRR @Base PLF (23%)	Sensititvity @10% upward PLF
1	Amar Builders	12.63%	7.26%	8.74%	10.15%
2	DP Power Pvt Ltd.	12.63%	8.63%	10.19%	11.68%
3	DP Wires Pvt. Ltd.(Okhamadhi)	12.63%	8.50%	10.05%	11.55%
4	DP Wires Pvt. Ltd.(Jodhpar)	12.63%	8.32%	9.85%	11.33%
5	Kataria Wires Pvt. Ltd.	12.63%	8.33%	9.94%	11.52%
6	Mahanagar Developers	12.63%	7.69%	9.16%	10.58%
7	PBM Polytex(okhamadhi)	12.63%	8.61%	10.18%	11.52%
8	PBM Polytex (Jamjodhpar)	12.63%	8.39%	10.02%	11.58%
9	Powerica Limited-I	12.63%	8.94%	10.78 %	12.28%
10	Powerica Limited-II	12.63%	8.92%	10.75 %	12.25%
11	Ratlam Wires Pvt. Ltd.	12.63%	8.57%	10.12%	11.61%
12	Tarak chemicals	12.63%	8.21%	9.83%	11.38%
13	Zaveri & Co. ltd	12.63%	8.51%	10.13%	11.72%

However, it is submitted that actual average PLF over two years, which covers all seasonal/other variations over two complete cycles is only 18%, which is very less as compared to GERC's benchmark. Considering the average historical PLF for two years, it is apparent that the probability of PLF reaching GERC's benchmark is almost nil. Hence, the IRR calculated at GERC's benchmark PLF is already very conservative and may be considered for the purpose of additionality.

From above table it is clear the Project IRR of individual projects is below the benchmark. Accordingly it can be concluded that Project is not the most financially attractive without VCU revenues.

O&M Cost

The Sensitivity in O&M maintenance cost is conducted after taking to consideration +/- 10% change in O&M Cost.

S.No.	Customer Name	Benchmark – WACC (common)	-10 % decrease in O & M	Post tax Project IRR @Base O & M cost	+10 % increase in O & M
1	Amar Builders	**12.63%**	8.95%	**8.74%**	8.54%
2	DP Power Pvt Ltd.	**12.63%**	10.38%	**10.19%**	10.00%
3	DP Wires Pvt. Ltd.(Okhamadhi)	**12.63%**	10.24%	**10.05%**	9.85%
4	DP Wires Pvt. Ltd.(Jodhpar)	**12.63%**	10.04%	**9.85%**	9.65%
5	Kataria Wires Pvt. Ltd.	**12.63%**	10.13%	**9.94%**	9.73%
6	Mahanagar Developers	**12.63%**	9.36%	**9.16%**	8.96%
7	PBM Polytex(okhamadhi)	**12.63%**	10.38%	**10.18%**	9.77%
8	PBM Polytex (Jamjodhpar)	**12.63%**	10.23%	**10.02%**	9.81%
9	Powerica Limited-I	**12.63%**	10.99%	**10.78 %**	10.57%
10	Powerica Limited-II	**12.63%**	10.96%	**10.75 %**	10.55%
11	Ratlam Wires Pvt. Ltd.	**12.63%**	10.31%	**10.12%**	9.92%
12	Tarak chemicals	**12.63%**	10.03%	**9.83%**	9.63%
13	Zaveri & Co. ltd	**12.63%**	10.32%	**10.13%**	9.93%

The sensitivity analysis clearly shows even with a lower O & M, the project is not able to generate sufficient returns. The Post tax project IRR is below the benchmark IRR for individual project. It can therefore be concluded that the project is financially not viable without VCU benefits.

Outcome of Step 2: From the sensitivity analysis it is concluded that the proposed 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: Analyse other activities similar to the proposed project activity:

The proposed CDM project activity pertains to generation of power using wind energy in the state of Gujarat. In the following paragraphs an account of wind power generation in India in general and wind power generation in the state of Gujarat in particular has been provided.

Table 1 provides details of state wise wind power potential in India. Table 1 also provides the wind power capacity installed in different states as on 31/03/2006:

Table 1: State wise wind power Potential and Installed Capacity

State	Gross Potential (MW)	Installed Capacity (MW)
Andhra Pradesh	8275	121.1
Gujarat	9675	338.1
Karnataka	6620	584.6
Kerala	875	2.00
Madhya Pradesh	5500	40.3
Maharashtra	3650	1001.3
Orissa	1700	2.00
Rajasthan	5400	358.1
Tamil Nadu	3050	2892.5
West Bengal	450	1.10
Other States	-	1.60
Total	45195	5340.6

Source: http://windpowerindia.com/statstate.html

In India the power generation sector is dominated by fossil fuel based technology. As on 31/03/2006, the total installed capacity of power generation in India was 126031.27 MW. Against this, the installed capacity of wind power in India is 5340.6 MW. Thus only 4.2 % of the total installed capacity for power generation in India is through wind energy based generation sources. Given that the gross potential for wind power in India is 45,195 MW, the exploitation of the wind energy based power generation technology is very low.

As can be seen from the table above, the state of Gujarat has the highest gross potential for wind power generation among all the states. However, the installed capacity for

wind power generation in the state is much lesser when compared to other states like Tamil Nadu, Maharashtra and Karnataka. Against the potential to generate 9,675 MW of power from wind energy in Gujarat, only 338.1 MW of wind power has been installed till 31 March 2006 which is just 3.4 % of the gross potential of wind power generation in the state.

Out of 338.1 MW installed capacity of wind in Gujarat, most of the private investors in the region in the past have opted for captive utilization of the generated output. A couple of other large grid connected wind power projects in the state of Gujarat are being established now. However, most of such projects are being implemented as CDM project activity. This is probably due to the fact that without CDM benefits it is not financially attractive enough for the promoters to put up wind power projects of this magnitude.

As has been stipulated before most of the wind energy produced in the state of Gujarat is utilized for captive consumption. In the year 2004-05, out of the approximately 248 Million Units produced by wind power projects in the state, only 24 Million Units were purchased by the state utility, and the balance generation was used captively[5].

In the year 2005-06, the total power generated from all sources of power generation in Gujarat was 45070.44 Million Units [6]whereas the power generated from wind power projects was only 1613.04 Million Units[7] constituting only 3.6 % of the total power generated.

As is evident from the foregoing discussions, generation of power using wind energy and selling the generated power to the state utility as is being done under the proposed VCS project activity is not a common practice.

Sub-steps 4a is satisfied and 4b is not required as no similar activities are observed. It is very clear that project activity is not a financial attractive option and not a common practice in the region. Hence project activity is additional.

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[5] GETCO tarrif order dated 6th May 2006

[6] www.indiasstat.com

[7] Indian Wind Power Directory 2006

3   Monitoring:

3.1   **Title and reference of the VCS methodology (which includes the monitoring requirements) applied to the project activity and explanation of methodology choices:**

The titles of these baseline and monitoring methodologies are "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" and "Consolidated monitoring methodology ACM0002 Version 9 for grid-connected electricity generation from renewable sources.

3.2   **Monitoring, including estimation, modelling, measurement or calculation approaches:**

- *Purpose of monitoring:* The main purpose of the monitoring is to check the electricity generation from the project under consideration.

- *Types of data and information to be reported, including units of measurement:*
  - *Type of Data:* Eg_y
  - *Unit of Measurement:* MWh (Mega-watt hour)

- *Origin of the data:* Electricity supplied by the project activity to the grid as per energy generation certificates by Gujarat Energy Development Association (GEDA).

- *Monitoring, including estimation, modelling, measurement or calculation approaches:*
  - *Estimation: Annual* expected electricity supplied to the grid by the Project

    = 15.2 MW (Capacity) x 23% (PLF) x 8760 (hours)

   = 30624.96 MWh

  - *Measurement or Calculation Approaches:* Net electricity supplied to the grid will be measured by the two-way export Trivector meter. The Net electricity is recorded as following

    (Net Electricity = Net Export – Net Import)

    The procedures for metering and meter reading will be as per the provisions of the power purchase agreement.

- *Monitoring times and periods, considering the needs of intended users:* The Net electricity supplied to the grid is recorded monthly by taking a Joint Meter Reading (JMR) in the presence of officials from GEDA and Enercon as O&M contractor, on behalf of project sponsor. The Joint meter reading contains the value of energy imported and exported and the net export to the grid during the recording period.

This Joint meter reading is certified by the Executive engineer of GEDA and by Enercon Officials.

- *Monitoring roles and responsibilities:* The sole parameter for monitoring is the electricity supplied to the grid. The Project is operated and managed by Enercon (India) Ltd. The operational and management structure implemented by Enercon is as follows:
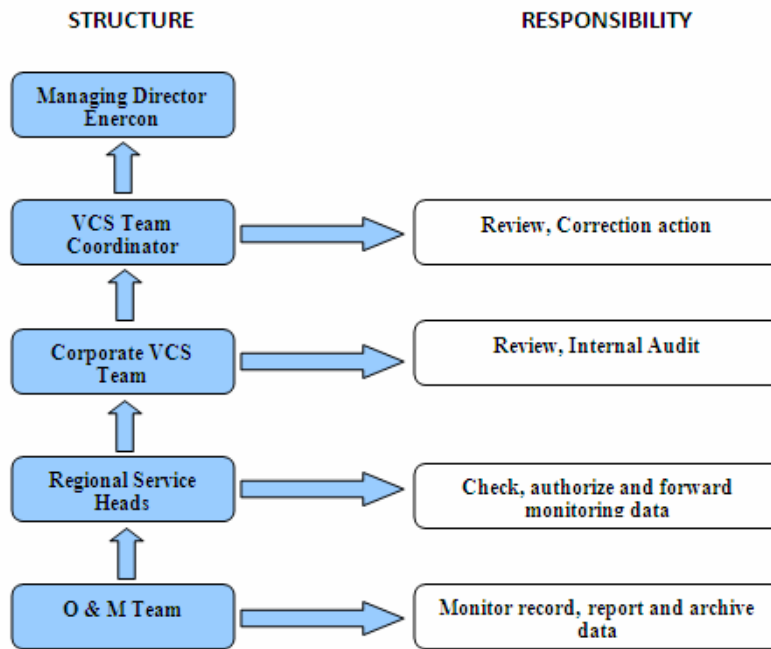
3.3 Data and parameters monitored / Selecting relevant GHG sources, sinks and reservoirs for monitoring or estimating GHG emissions and removals:

Data / Parameter:	EG,Export
Data unit:	MWh (Mega-watt hour)
Description:	Electricity exported to the grid by the project activity.
Source of data to be used:	Certification of metering records and share certificate for electricity produced by wind farm provided by GEDA (Gujarat Energy Development Agency)
Value of data applied for the purpose of calculating expected emission reductions	Annual electricity supplied to the grid by the Project = 15.2 MW (Capacity) x 23% (PLF) x 8760 (hours) = 30624.96 MWh
Description of measurement methods and procedures to	Electricity exported to grid is measured by main meter's export reading at the Metering Point. The procedures for

be applied:	metering and meter reading will be as per the provisions of the PPA.
QA/QC procedures to be applied:	Every month these meter readings are jointly recorded by GEDA representative and plant personnel. The meters at the wind farm and substation are the two-way meters and are in the custody of GEDA. QA/QC procedures will be as implemented by GEDA. Since the readings are taken at the point of supply of power to the grid, the transmission and distribution losses and the minimum reactive power consumption has already been taken into account. The meters used are calibrated annually to ensure accuracy of data. Monthly tariff invoices raised by the customer can be used to cross verify the generation details.
Any comment:	The data will be archived on electronic media as well as on paper. The data will be kept for two years after the end of the crediting period or the last issuance of VCS for this project activity, whichever occurs later

Data / Parameter:	EG,Import
Data unit:	MWh (Mega-watt hour)
Description:	Electricity imported from grid by the project activity.
Source of data to be used:	Certification of metering records and share certificate for electricity produced by wind farm provided by GEDA (Gujarat Energy Development Agency)
Value of data applied for the purpose of calculating expected emission reductions	0 MWh (assumed)
Description of measurement methods and procedures to be applied:	Electricity exported to grid is measured by main meter's import reading at the Metering Point. The procedures for metering and meter reading will be as per the provisions of the PPA.
QA/QC procedures to be applied:	Every month these meter readings are jointly recorded by GEDA representative and plant personnel. The meters at the wind farm and substation are the two-way meters and are in the custody of GEDA. QA/QC procedures will be as

	implemented by GEDA. Since the readings are taken at the point of supply of power to the grid, the transmission and distribution losses and the minimum reactive power consumption has already been taken into account. The meters used are calibrated annually to ensure accuracy of data. Monthly tariff invoices raised by the customer can be used to cross verify the generation details.
Any comment:	The data will be archived on electronic media as well as on paper. The data will be kept for two years after the end of the crediting period or the last issuance of VCS for this project activity, whichever occurs later

Data / Parameter:	EG_y
Data unit:	MWh (Mega-watt hour)
Description:	Net electricity supplied to the grid by the Project
Source of data to be used:	Certification of metering records and share certificate for electricity produced by wind farm provided by GEDA (Gujarat Energy Development Agency)
Value of data applied for the purpose of calculating expected emission reductions	Annual electricity supplied to the grid by the Project = Electricity exported to grid- electricity imported from grid = 30624.96 -0 MWh =30624.96 MWh
Description of measurement methods and procedures to be applied:	Net electricity supplied to the grid will be measured by the two-way export Trivector meter. The Net electricity is recorded as following *(Net Electricity = Net Export – Net Import)* The procedures for metering and meter reading will be as per the provisions of the power purchase agreement..
QA/QC procedures to be applied:	Every month these meter readings are jointly recorded by GEDA representative and plant personnel. The meters at the wind farm and substation are the two-way meters and are in the custody of GEDA. QA/QC procedures will be as implemented by GEDA. Since the readings are taken at the point of supply of power to the grid, the transmission and distribution losses and the minimum reactive power consumption has already been taken into account. The meters

	used are calibrated annually to ensure accuracy of data. Monthly tariff invoices raised by the customer can be used to cross verify the generation details.
Any comment:	The data will be archived on electronic media as well as on paper. The data will be kept for two years after the end of the crediting period or the last issuance of VCS for this project activity, whichever occurs later

3.4 Description of the monitoring plan

Approved monitoring methodology ACM0002 / Version 9 Sectoral Scope: 1, "Consolidated monitoring methodology for zero-emissions grid-connected electricity generation from renewable sources", by CDM - Meth Panel is proposed to be used to monitor the emission reductions.

The general conditions set out for metering, recording, meter readings, meter inspections, Test & Checking and communication are as per the agreement with state electricity board . However, the procedures adopted for metering details vary with the EPC contractor. The paragraphs below present the procedure adopted by the respective EPC contractors:

Metering: Electricity supplied to the grid is metered through the two-way export meter installed by GEDA at the high voltage side of the step up transformer installed at the Project Site.

Metering Equipment: Metering equipment is an electronic trivector meter of accuracy class 0.5 required for the Project. The meter is installed and owned by GEDA. The metering equipment is maintained in accordance with electricity standards prevalent in Gujarat. The calibrations of metering equipments are subject to the requirements of EIL officials. As per the requirements of VCS, the calibration of the meter should be performed once in 3 years. However the procedures mentioned in PAA has been followed for accuracy in meter readings and accordingly calibration for meters is done annually..

Meter Test Checking: The meter is tested for accuracy with reference to a portable standard meter. The portable standard meter is also owned by GEDA. The meter is deemed to be working satisfactorily if the errors are within specifications for meters of 0.5 accuracy classes. The consumption registered by the meter alone holds good for the purpose of metering electricity supplied to the grid as long as the error in the meter is within the permissible limits.

If during the meter test checking, The meter is found to be beyond permissible limits of error, the meter shall be immediately calibrated and the correction applied to the reading registered by the meter to arrive the correct reading of energy supplied for metering electricity supplied to the grid for the period from the last month's meter reading up to the current test. Meter reading for the period thereafter till the next monthly reading shall be as per the calibrated meter.

Monthly Meter Readings: The Net electricity supplied to the grid is recorded monthly by taking a Joint Meter Reading (JMR) in the presence of officials from GEDA and Enercon as O&M contractor, on behalf of project sponsor on the first day of every month at the Delivery Point. The Joint meter reading contains the value of energy imported and exported and the net export to the grid during the recording period. This Joint meter reading is certified by the Executive engineer of GEDA and by Enercon Officials .

Calibration frequency: Calibration of meters shall be done annually by GEDA officials in presence of EIL officials.

QA/QC Procedures: Every month these meter readings are jointly recorded by GEDA representative and plant personnel. The meters at the wind farm and substation are the two-way meters and are in the custody of GEDA. QA/QC procedures will be as implemented by GEDA.

<u>Base Line emission calculation:</u>

The emission reduction ER_y by the project activity during a given year y is the difference between baseline emissions (BE_y), project emissions (PE_y) and emissions due to leakage (L_y), as follows:

$$ERy = BEy - PEy - Ly$$

Project emissions: The project involves the operation of a zero-emission wind farm, so $PE_y = 0$

Leakage: According to ACM0002, the main emissions potentially giving rise to leakage in the context of electric sector projects are emissions arising due to activities such as power plant construction, fuel handling (extraction, processing, and transport), and land inundation (for hydroelectric projects). Project participants do not need to consider these emission sources as leakage in applying this methodology. Project activities using

ACM0002 shall not claim any credit for the project on account of reducing these emissions below the level of the baseline scenario. Thus the leakage emissions are NIL.

There is no leakage to this project so $L_y = 0$

Thus, $ER_y = BE_y$

i.e. the emission reductions are the baseline emissions in this project.

Baseline Emissions:

The baseline emissions (BE_y in tCO_2) are the product of the baseline emissions factor (EFy in tCO_2/MWh) times the electricity supplied by the project activity to the grid (EG_y in MWh)

$$BEy = EFy * EGy$$

Baseline emission factor (EF_y) has been calculated ex-ante and taken from CEA baseline published by central electricity authority ,Version 4.0, Dated: October 2008. Value of $EF_y = 0.90589\ tCO_2/GWh$ as per CEA databse version 4.0.

Estimated annual electricity supplied to the grid by the Project :

$EG_y = $ 15.2 MW (Capacity) x 23% (PLF) x 8760 (hours) / 1000 GWh

$EG_y = $ 30.624 GWh

Annual baseline emissions $BE_y = EF_y * EG$

$$BE_y = \textbf{905.89}\ \text{tCO2e/GWh} \times 30.624\ \text{GWh}$$

$$BE_y = \textbf{27,740}\ tCO_2e/year.$$

Procedure for apportioning of electricity:

Project activity has the dedicated metering system for individual customer at WEGs location which is used to calculate the export and import of electricity by individual customer's machines.Enercon has installed the meters for each customer, which is sealed in presence of representatives of Enercon and GEDA (Gujarat Energy Development Agency). This value of the monthly joint meter reading of the EIL sub-station is then apportioned to the EB reading taken for each customer to get the net supply of electricity to the grid for that particular customer. The share certificate is signed by the GEDA (Gujarat Energy development Agency) officials, which is used to produce invoice on behalf of the customer. The meters will be jointly inspected/ tested once in a year as per the terms of the PPA. Joint inspection and testing will also be

carried out as and when difference in monthly meter readings exceeds the sum of maximum error as per accuracy class of main and back up meters. Since electricity generated by all the customers is feed into single EB meter at sub-station, apportioning of electricity is to be done according to following procedure:

Step 1: **Net electricity generated by individual customer of project activity (at individual meter location):**

1) Total Number of customers of project activity= N (1,2,3......N)

2) Electricity export by individual customer meter = $E_{N,export}$

3) Electricity import by individual customer meter = $E_{N,,import}$

4) Net electricity generated by individual customer = $E_{N, net}$

$$\text{Where, } \mathbf{E_{N,net} = E_{N,,export} - E_{N,import}} \text{...(1)}$$

Step 2: **Net electricity generated by other customer at wind farm (at individual meter location)**

1) Total Number of customers of project activity= M (1,2,3......M)

2) Electricity export by individual customer meter = $E_{M,export}$

3) Electricity import by individual customer meter = $E_{M,,import}$

4) Net electricity generated by individual customer = $E_{M, net}$

$$\text{Where, } \mathbf{E_{M,net} = E_{M,,export} - E_{M,import}} \text{...(2)}$$

Step 3: **Net electricity exported to grid as per EB main meter at 132 KVsub-station (at common metering location at sub-station):**

1) Electricity export to grid by EB main meter at 132 KV sub-station including customers of project activity (N) and including other customers (M)

$$= E_{(N+M), export}$$

2) Electricity import as per EB main meter at 132 KV sub-station including customers of project activity (N) and including other customers (M)

$$= E_{(N+M), import}$$

3) Net Electricity supplied to grid by EB main meter at 132 KV sub-station including customers of project activity (N) and including other customers (M) ;

$$\mathbf{E_{(N+M), net} = E_{(N+M), export} - E_{(N+M), import}}\text{...........................(3)}$$

Step 4: Net electricity supplied (billing unit as per GEDA certificate) to grid by individual customers (1, 2, 3....N) = $EG_{,N,net}$

Where,

$$EG_{,N,net} = \frac{E_{N,net} * E_{(N+M),net}}{(E_{N,net} + E_{M,net})}$$

$EG_{,N,net}$ is the net electricity exported to grid by individual customer from project activity , where N= 1,2,3,...N.

The invoice of energy units generated are issued on the net Export Units to grid ($EG_{,N,net}$) for each Customer on monthly basis.

4   GHG Emission Reductions:

4.1   Explanation of methodological choice:

According to the approved baseline methodology ACM0002 (Version 9), the emission reductions ER_y by the project activity during a given year "y1" is

$$ER_y = BE_y - PE_y - L_y \ldots\ldots\ldots\ldots\ldots(1)$$

Where: BE_y is the baseline emissions

   PE_y is project activity emissions and;

   L_y is the amount of emissions leakage resulting from the project activity.

Baseline Emissions for the amount of electricity supplied by project activity, BE_y is calculated as

$$BE_y = EG_y * EF_y \ldots\ldots\ldots\ldots\ldots\ldots(2)$$

Where: EG_y is the electricity supplied to the grid;

   EF_y is the CO_2 emission factor of the grid as calculated below.

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[1] Throughout the document, the suffix *y* denotes that such parameter is a function of the year y, thus to be monitored at least annually.

The emission factor EF_y of the grid is represented as a combination of the Operating Margin (OM) and the Build Margin (BM). Considering the emission factors for these two margins as EFOM,y and EFBM,y, then the EF_y is given by:

$$EF_y = {}_wOM * EF_{OM,y} + wBM * EFBM,y \dots\dots\dots\dots\dots\dots\dots\dots\dots..(2)$$

With respective weight factors wOM and wBM (where wOM + wBM = 1).

4.2   Quantifying GHG emissions and/or removals for the baseline scenario:

As per ACM0002 (Version 9), dispatch data analysis should be the first methodological choice. However, this option is not selected because the information required to calculate OM based on dispatch data is not available in the public domain for the Western electricity regional grid.

The Simple Operating Margin approach is appropriate to calculate the Operating Margin emission factor applicable in this case. As per ACM 0002 the Simple OM method can only be used where low cost must run resources constitute less than 50% of grid generation based on average of the five most recent years. The generation profile of the NEWNE grid in the last five years is as follows:

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North (N)	25.90%	25.70%	26.10%	28.10%	26.80%	28.10%
East (E)	10.80%	13.40%	7.50%	10.30%	10.50%	7.20%
West (W)	**8.20%**	**8.50%**	**8.20%**	**9.10%**	**8.80%**	**12.00%**
North-East (NE)	42.20%	41.70%	45.80%	41.90%	55.50%	52.70%
South	28.10%	25.50%	18.30%	16.20%	21.60%	27.00%
NEWNE	21.78%	22.33%	21.90%	22.35%	25.40%	25.00%

Source: Table 3.4 of CEA General Review 2004-05, 2003-04, 2002-03, 2001-02, 2000-01

From the available information it is clear that low cost/must run sources account for less than 50% of the total generation in the Western grid in the last five years. Hence the Simple OM method is appropriate to calculate the Operating Margin Emission factor applicable.

Build Margin Emission Factor

The Build Margin emission factor EF_BMy (tCO_2/GWh) is given as the generation-weighted average emission factor of the selected representative set of recent power plants represented by the 5 most recent plants or the most recent 20% of the generating units built (summation is over such plants specified by k):

$$EFBM,y = [\sum i\ Fi,m,y*COEFi] / [\sum k\ GENk,m,y]\ldots\ldots\ldots\ldots\ldots\ldots\ldots(5)$$

The summation over i and k is for the fuels and electricity generation of the plants in sample m mentioned above.

The choice of method for the sample plant is the most recent 20% of the generating units built as this represents a significantly larger set of plants, for a large regional electricity grid have a large number of power plants connected to it, and is therefore appropriate.

The Central Electricity Authority (CEA), 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 Operating Margin and Build Margin Emission Factors of all the regional electricity grids in India. The Operating Margin in the CEA database is calculated ex ante using the Simple OM approach and the Build Margin is calculated ex ante based on 20% most recent capacity additions in the grid based on net generation as described in ACM0002 (version 9). We have, therefore, used the Operating Margin and Build Margin data published in the CEA database, for calculating the Baseline Emission Factor.

Combined Margin Emission Factor

As already mentioned, baseline emission factor (EF_y) of the grid is calculated as a combined margin (CM), calculated as the weighted average of the operating margin (OM) and build margin (BM) factor. In case of wind power projects, default weights of 0.75 for EF_{OM} and 0.25 for EF_{BM} are applicable as per ACM0002. No alternate weights are proposed.

Using the values for operating margin and build margin emission factors provided in the CEA database and their respective weights for calculation of combined margin emission factor, the baseline carbon emission factor (CM) is **0.90589** tCO_2e/MWh or **905.89** tCO_2e/GWh.

Details of Baseline data:

Data of Operating and Build Margin for the three financial years from 2005-06 to 2007-08 has been obtained from –

The CO_2 Baseline Database for the Indian Power Sector

Ministry of Power: Central Electricity Authority (CEA)

Version 4.0, Dated: October 2008

Key baseline information is reproduced in Annexure I.

The detailed excel sheet is available at:

http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm

4.3   Quantifying GHG emissions and/or removals for the project:

Project Emissions: The project activity uses wind power to generate electricity and hence the emissions from the project activity are taken as nil.

$PE_y = 0$

Leakage: Emissions Leakage on account of the project activity is ignored in accordance with ACM0002.

$L_y = 0$

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

4.4   Quantifying GHG emission reductions and removal enhancements for the GHG project:

Baseline emission factor (combined margin)

= 905.89 tCO_2e/GWh

Estimated annual electricity supplied to the grid by the Project

= 15.2 MW (Capacity) x 23% (PLF) x 8760 (hours) / 1000 GWh

= 30.624 GWh

Annual baseline emissions = **905.89** tCO2e/GWh x 30.624 GWh

= **27,741** tCO_2e/year.

5   Environmental Impact:

Environmental Impact Assessment (EIA) of this project is not an essential regulatory requirement, as it is not covered under the categories as described in EIA Notification of 1994 or the Amended Notification of 2006. However, Enercon conducted the EIA to study impacts on the environment resulting from the project activity.

The EIA study included identification, prediction and evaluation of potential impacts of the CDM activities on air, water, noise, land, biological and socio-economic environment within the study area. The ambient air concentrations of Suspended

Particulate Matter, Respirable Particulate Matter, Oxides of Nitrogen, Sulphur dioxide and Carbon Monoxide were monitored and were found under limits as specified by Central Pollution Control Board (CPCB), India. The noise levels were observed through out the study period and were found to be in the permissible range as specified by the state pollution control board and National Ambient Air Quality Standards. Water quality monitoring studies were carried out for determination of physico-chemical characteristics of bore wells. The pH level of water was found to be under the specified limits.

The site does not involve any sensitive archaeological monuments as per the Archaeological Survey of India. No Historical and Cultural Monuments have been affected due to project location. The project area consists of some grass shrubs and does not have much to offer aesthetically. However, construction of wind power mills with pleasing architectural design that blends with the landscape will have a positive impact on the aesthetics of the present surrounding of the site.

6   Stakeholders comments:

The comments from local stakeholders were invited through local stakeholder meetings conducted on 25 October 2007, from 1100HRS to 1500HRS in Hotel Vishal International, Jamnagar District. Individual invitation letter to 34 local stakeholders were sent on behalf of EIL for the stakeholder meeting.

The local stakeholder consultation meeting had representatives from the nearby villages, representatives of Enercon. The meeting commenced on scheduled time. Local stakeholders from nearby villages were present to attend the meeting. The villagers freely expressed their views about the development of wind farm in the area. No negative comment was received during the course of the meeting by any of the local stakeholder. The meeting ended on a positive note.

7   Schedule:

Chronological plan for the date of initiating project activities, date of terminating the project, frequency of monitoring and reporting and the project period, including relevant project activities in each step of the GHG project cycle.

The detail chronological order of the project is provided as Annexure II

8   Ownership:

8.1 **Proof of Title:**

The title of the project activity is 'Grid Connected Bundled Wind Power Project in Gujarat'.Authorization letter from each investors stating Enercon (India) Limited as Project proponent has been given as proof of title.

8.2 **Projects that reduce GHG emissions from activities that participate in an emissions trading program (if applicable):**

Not Applicable. The project activity is under consideration by the Executive Board of UNFCCC. The project has not been registered yet. Project activity has not claimed any other form of GHG emission for crediting period Feb 07 to Feb 2017.

Annexure I

The Operating Margin data for the most recent three years and the Build Margin data for the Western Region Electricity Grid as published in the CEA database (Version 4) are as follows:

Simple Operating Margin

	tCO_2e/GWh
Simple Operating Margin – 2005-06	1019.48
Simple Operating Margin – 2006-07	1008.34
Simple Operating Margin – 2007-08	999.174
Average Operating Margin of last three years	1008.98

Net Generation in Operating Margin (GWh)

	tCO_2e/GWh
2005-06	359271
2006-07	379471
2007-08	401642

Simple Operating Margin = (1.0195×359271+1.0083×379471+0.9992×401642) /Sum (359271+379471+401642)
= 1.008626

Build Margin

	tCO_2e/GWh
Build Margin- 2007-08	597.71

Combined Margin calculations

	Weights	tCO_2e/GWh
Operating Margin	0.75	1008.62
Build Margin	0.25	597.71
Combined Margin		905.89

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

Annexure II

Chronology of Events for Grid Connected Bundled Wind Power Project in Gujarat

Sr.No.	Name of the Customer	Site	Capacity of Each WEC (MW)	No. Of WEC	Capacity of Each Customer (MW)	EIL Sub Station	GEB Sub Station (33/132 KV).	Purchase Order Date	Date of commissioning	VER authorization date
1	Amar Builders	Khirsara	0.8	1	0.8	Sadodar	Motipaneli	27-Nov-06	24-Mar-07	18-Aug-07
2	DP Power Pvt Ltd	Okha Madhi	0.8	1	0.8	Bhogat	Bhatia	1-Sep-06	12-Feb-07	24-Sep-08
3	DP Wires Pvt Ltd	Okha Madhi	0.8	1	0.8	Bhogat	Bhatia	1-Sep-06	1-Feb-07	23-Sep-08
4	DP Wires Pvt Ltd	Jodhpar	0.8	1	0.8	Bhogat	Bhatia	2-Sep-06	19-Mar-07	
5	Kataria Wires Pvt. Ltd.	Okha Madhi	0.8	1	0.8	Bhogat	Bhatia	1-Sep-06	1-Feb-07	24-Sep-08
6	Mahanagar Developers	Jodhpar	0.8	2	1.6	Bhogat	Bhatia	27-Oct-06	19-Mar-07	24-Aug-07
7	PBM Polytex	Okha Madhi	0.8	1	0.8	Bhogat	Bhatia	25-Sep-06	12-Feb-07	
8	PBM Polytex	Methan	0.8	1	0.8	Samana	Sadodar	8-May-07	1-Sep-07	15-Feb-08
		Methan	0.8	1	0.8	Samana	Sadodar	8-May-07	28-Sep-07	
9	Powerica Limited	Bhupat Ambardi	0.8	3	2.4	Samana	Sadodar	30-Aug-07	31-Mar-07	
10	Powerica Limited	Bhupat Ambardi	0.8	1	0.8	Samana	Sadodar	30-Aug-07	8-Apr-08	12-Oct-07
		Bhupat Ambardi	0.8	1	0.8	Samana	Sadodar	30-Aug-07		
		Seth Vadala	0.8	1	0.8	Samana	Sadodar	30-Aug-07		
11	Ratlam Wires Pvt Ltd.	Okha Madhi	0.8	1	0.8	Bhogat	Bhatia	1-Sep-06	12-Feb-07	24-Sep-08

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12	Tarak chemicals	Jodhpar	0.8	1	0.8	Bhogat	Bhatia	12-Sep-06	19-Mar-07	23-Aug-07
13	Zaveri & Co. ltd	Okha Madhi	0.8	1	0.8	Bhogat	Bhatia	21-Aug-06	1-Feb-07	23-Aug-07
	Total				**15.2**					

Environment Impact Assessment (EIA) Report Study by M/s Care Sustainability Pvt Ltd in January 2007

**Stake Holders meeting 16 December 2006*

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