CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)
Version 03 - in effect as of: 22 December 2006

CONTENTS

Annexes

Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
03	22 December 2006	• The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.

SECTION A. General description of small-scale project activity

A.1 Title of the small-scale project activity:

>>

13.7 MW Bundled Grid-connected wind electricity generation in Jamnagar & Kachchh, Gujarat.
Version 1
Dated: 06/02/2008

A.2. Description of the small-scale project activity:

>>

The proposed wind based power generation is a small scale bundled project activity with an installed capacity of 13.7 MW in Jamnagar and Kachchh districts of the state of Gujarat, India. The technology envisaged for this project is the state-of-the-art and modern 1.25 MW wind energy generators (WEG) along with the advanced 0.6 MW wind turbines, developed by Suzlon Energy Limited. The details of the investors and the turbines have been furnished in Annexure 6 to the PDD.

The electricity generation from the wind parks will contribute annually GHG reductions estimated at 24,462 tCO2e (tonnes of carbon dioxide equivalent). Although the project life is envisaged as 20 years, it is proposed that the project activity needs to mitigate the risks involved in Renewable Energy Technology for the first 10 years. The project activity will evacuate approximately 27.15 Million units of renewable power annually to the power deficit Western Region Grid.

The bundled project activity has been conceived for utilising the generated output for self consumption by 8 project promoters in the bundle. The wind power will be wheeled utilizing the regional grid. Remaining 2 project promoters will be supplying the electricity to the electricity board.

Hence the wind power generated from the project site will be replacing the electricity generated from thermal power stations feeding into regional grid and will be replacing the usage of diesel generators for meeting the power demand during shortage periods.

Purpose of the project activity

The main purpose of the project activity is to generate electrical energy through sustainable means using wind power resources, to utilize the generated output for captive consumption at the investor facilities and to contribute to global climate change mitigation efforts.

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

- To enhance the propagation of commercialisation of wind turbines in the region
- To contribute to the sustainable development of the region, socially, environmentally and economically
- To reduce the prevalent regulatory risks for this wind park through revenues from the CDM

View of the project participants on the contribution of the project activity to sustainable development

Ministry of Environment and Forests, Govt. of India has stipulated the following indicators for sustainable development in the interim approval guidelines for CDM projects:

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

b>*Economic well being* - The project activity leads to an investment of about INR 897 million to a developing region which would not have happened in the absence of the project activity. The generated electricity is fed into the Western Regional Grid through the local grid, thereby improving grid frequency. The project activity also leads to diversification of the national energy supply, which is dominated by conventional fuel based generating units.

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

d >*Technological well being* - The project activity leads to the promotion of 1.25 MW and 0.6 MW Wind Electric Generators (WEGs) into the region, demonstrating the success of wind turbines, which feed the generated power into the nearest sub-station, thus increasing energy availability, reducing line losses and improving quality of power under the service area of the substation. Hence the project leads to technological well being.

A.3. Project participants:

>>

Name of Party involved (*) ((host) indicates a host party)	Private and/or public entity (ies) Project participants (*) (as applicable)	Kindly indicate if the party involved wishes to be considered as project participant (Yes/No)
Government of India	M/s Senergy Global Private Limited*	No

*****The investors authorize M/s Senergy Global Pvt. Ltd to be the bundling agency and also to be the authorized representative of the project for the entire CDM cycle.*

A.4. Technical description of the small-scale project activity:

A.4.1. Location of the small-scale project activity:

A.4.1.1. Host Party(ies):

India

A.4.1.2. Region/State/Province etc.:

State: Gujarat
Districts: Jamnagar and Kachchh

A.4.1.3. City/Town/Community etc:

Taluka: Kalyanpur and Abdasa

A.4.1.4. Details of physical location, including information allowing the unique identification of this small-scale project activity :

>>

The project activity is spread across two wind farms in two districts of Gujarat. The districts are well connected by railways and highways. The villages are interconnected by both metalled and un-metalled roads. The machines can be well identified with the respective turbine numbers. The location specific details of the WEGs have been furnished in Annexure 6.

District: Jamnagar (Latitude: 21° 54′ N, Longitude: 69 °19′ E)
District: Kachchh (Latitude: 23° 6′ N, Longitude: 69 °12′ E)

Taluka	Village	Installed Capacity (MW)	Land Survey Number
Kalyanpur	Ganghavi	0.60	1/P
	Lamba	1.25	415/P
	Lamba	1.25	415/P
	Lamba	1.25	415/P
	Lamba	1.25	415/P
	Lamba	1.25	415/P
	Navadara	1.25	160/p
Abdasa	Sthri	0.60	870/P
	Kadoli	1.25	116/P
	Kadoli	1.25	117/P
	Kadoli	1.25	109/p
	Kadoli	1.25	109
13.7 MW			

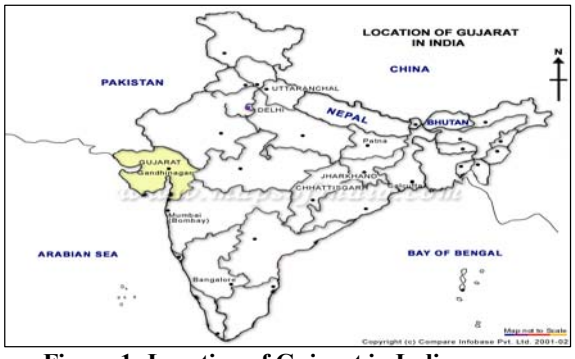


Figure 1: Location of Gujarat in India

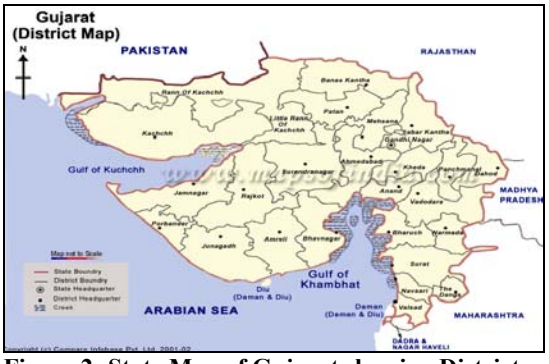


Figure 2: State Map of Gujarat showing Districts

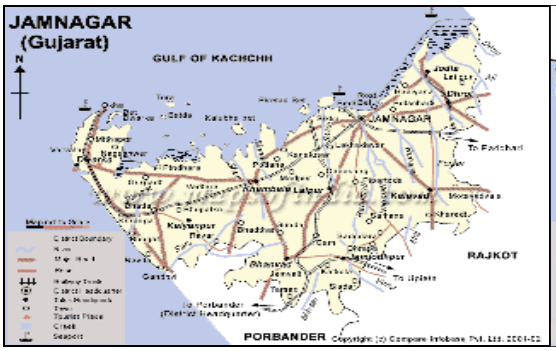


Figure 3: District map of Jamnagar

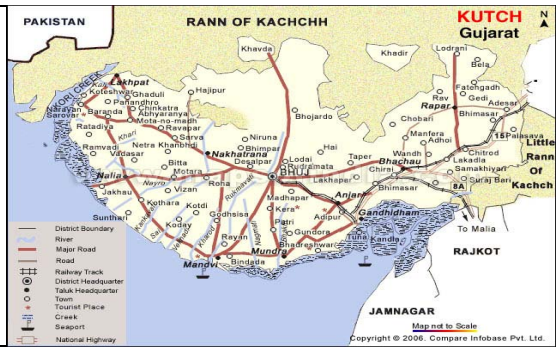


Figure 4: District map Kachchh

A.4.2. Type and category(ies) and technology/measure of the small-scale project activity:

>>

Type and Category

Since, the capacity of the proposed project is only 13.7MW, which is less than the maximum qualifying capacity of 15MW, the project activity has been considered as a small scale CDM project activity and UNFCCC indicative simplified modalities and procedures are applied. The project activity utilizes the wind potential for power generation and evacuates the generated electricity into the regional grid which is henceforth delivered at the industrial premises of the project proponent.

According to the Appendix B to the simplified modalities and procedures for small-scale CDM project activities the proposed project activity falls under the following type and category.

Type : I - Renewable Energy Projects
Category : D - Grid connected renewable electricity generation
Version : 13
Sectoral Scope : 1
Date : 14th December 2007

Technology

In wind energy generation, kinetic energy of the wind is converted into mechanical energy and subsequently into electrical energy. Wind turbines capture the wind's energy with two or three propeller-like blades, which are mounted on a rotor, to generate electricity. The turbines sit high atop towers, taking advantage of the stronger and less turbulent wind at 100 feet (30 meters) or more above ground. When the wind blows through the blades of the windmill, a pocket of low-pressure air forms on the downwind side of the blade. The low-pressure air pocket then pulls the blade towards it, causing the rotor to spin. The rotor turns the shaft that further spins the connected generator. The spinning of this generator produces the required electricity.

The technology is a clean technology since there are no GHG emissions associated with the electricity generation. The project installs Suzlon-make WEGs of individual capacity 1.25 MW and 0.6 MW. Technical specifications of the turbines types are furnished in Annexure 5.

The salient features of the 1.25 MW WEGs are as follows:

1. Higher Efficiency - Designed to achieve increased efficiency and co-efficient of power (Cp)
2. Minimum Stress and Load - Well-balanced weight distribution ensures lower static & dynamic loads
3. Shock Load-free Operation - Advanced hydrodynamic fluid coupling absorbs peak loads and vibrations
4. Intelligent Control – Sophisticated and advanced technologies applied by extensive operational experience maximizes yield
5. Maximum Power Factor - High-speed asynchronous generator with a multi-stage intelligent switching compensation system delivers power factor up to 0.99
6. Climatic Shield - Hermetically sheltered, advanced over-voltage and lightning protection system
7. Unique Micro-Pitching Control - Unmatched fine pitching with 0.1° resolution to extract every possible unit of power
8. Grid-friendly - Grid friendly design generates harmonics-free pure sinusoidal power
9. ISO-certified vendors confirm high quality components
10. ISO 9001:2000 for Design, Development, Manufacture and Supply of Wind Turbines
11. ISO 9001:2000 certification for Installation, Commissioning, Operation and Maintenance
12. Type certification by Germanischer Lloyd, Germany
13. Approved by the Ministry of Non-Conventional Energy Sources (MNES)

The salient features of the 600 KW WEGs are as follows:

1. Unique Micro Pitch System – Unparalleled full span pitching from -5 to 90° with resolution of 0.1° resulting in maximum power harnessing and minimal losses. The system includes smart logic automated pitching and independent electromechanically pitch control for each blade.
2. State-of-the-art Manufacturing Technology – Manufactured using the advanced Vacuum Assisted Resin Infusion Moulding (RIM), the rotor blades have a low weight-to-sweep ratio ensuring higher energy outputs at lower costs.
3. Advanced Control System – Precisely calibrated sensors installed at each critical junction closely monitoring factors like temperature, wind speeds and vibrations.
4. Well balanced design – The wing turbines are designed to withstand the toughest environmental conditions. Robust design and uniform weight distribution ensure high levels of safety & reliability.
5. ISO-certified vendors confirm high quality components
6. ISO 9001:2000 for Design, Development, Manufacture and Supply of Wind Turbines
7. ISO 9001:2000 certification for Installation, Commissioning, Operation and Maintenance
8. Type certification by Germanischer Lloyd, Germany
9. Approved by the Ministry of Non-Conventional Energy Sources (MNES)

Technology transfer:
No technology transfer from other countries is involved in this project activity

A.4.3 Estimated amount of emission reductions over the chosen crediting period:

>>

Year	Annual estimation of emission reductions in tCO_2e
2008	24,462

2009	24,462
2010	24,462
2011	24,462
2012	24,462
2013	24,462
2014	24,462
2015	24,462
2016	24,462
2017	24,462
Total estimated reductions (tonnes of CO_2e)	**24,4620**
Total number of crediting years	**10**
Annual average over the crediting period of estimated reductions (tonnes of CO_2 e)	**24,462**

A.4.4. Public funding of the small-scale project activity:

>>

The project participants have no resource to any public funding. The project proponents hereby confirm that there is no diversion of Official Development Assistance into the project activity.

A.4.5. Confirmation that the small-scale project activity is not a debundled component of a large scale project activity:

>>

According to paragraph 2 of Appendix C to the Simplified Modalities and Procedures for Small-Scale CDM project activities (FCCC/CP/2002/7/Add.3), a small-scale project is considered a debundled component of a large project activity if there is a registered small-scale activity or an application to register another small-scale activity:

- With the same project participants
- In the same project category and technology
- Registered within the previous two years; and
- Whose project boundary is within 1km of the project boundary of the proposed small scale activity

The project promoters hereby confirm that there is no registered small scale project activity registered within the previous two years with them in the same project category and technology whose project boundary is within 1km of the project boundary of the proposed small scale activity. Thus the project is not a de-bundled component of any other large scale project activity.

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline and monitoring methodology applied to the small-scale project activity:

>>

Project Type: I Renewable energy project
Project Category: I D Grid connected renewable electricity generation (Version 13, 14th December 2007 onwards)

Reference: Appendix B of the Simplified Modalities & Procedures for small scale CDM project activities.

B.2 Justification of the choice of the project category:

>>

The project category is renewable electricity generation for a grid system, which is also fed by both fossil fuel fired generating plants (using fossil fuels such as coal, natural gas, diesel, naphtha etc.) and non-fossil fuel based generating plants (such as hydro, nuclear, biomass and wind). Hence, the applicable baseline, as per Clause 29 of Appendix B, indicative simplified baseline and monitoring methodologies is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in kgCO2/kWh) calculated in a transparent and conservative manner.

The project activity meets the eligibility criteria to use simplified modalities and procedure for small-scale CDM project activities as set out in paragraph 6 (c) of decision 17/CP.7.

Selection and justification of calculation approach

As per the Para 9 of methodology I.D. Version 13, the baseline emissions are calculated based on the net energy provided to the grid (in GWh /yr) by renewable generating unit, and an emission factor for the displaced grid electricity (in tCO2equ /GWh).

AMS I.D. Ver. 13 requires that the baseline emission factor be calculated in a transparent and conservative manner, based on either (i) the average emissions intensity, or (ii) the combined margin (CM) consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the approved methodology ACM0002.

The project participants have opted for approach (ii). the combined margin (CM) consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the approved methodology ACM0002.

The baseline emission factor has been considered from the "CO2 Baseline Database" published by CEA. The emission factor published by CEA for the latest year 2006-07 is 724.04 tCO2e/GWh based on combined margin approach. The CEA calculations are based on generation, fuel consumption and fuel quality data obtained from the power stations. Details on the Northern Region Grid and a justification of this choice are provided in Section B.3 (Definition of the project boundary).

The project activity is displacing grid electricity, which is fed by both fossil, and non-fossil fuel based generation sources. Keeping in view of the electricity scenario, the entire Western region electricity grid system with its expansion plans, generation and investment trends is considered for identifying the baseline.

B.3. Description of the project boundary:

>>

The project boundary is defined as the notional margin around a project within which the project's impact (in terms of GHG reduction) will be assessed. The 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. As per the Appendix B of simplified modalities & procedures for small-scale CDM-project activities, the project boundary is "The project boundary encompasses the physical, geographical site of the renewable generation source."

The project boundary is thus composed of the Wind Energy Generators, the metering equipment for each generator and substation, and the grid which is used to transmit the generated electricity.
The project is supplying the generated electricity to the Western Region Grid, thus the Western grid has been chosen as the grid system for the baseline calculation.

Grid System of the proposed project activity:

There are three choices available for choosing the grid system for the project activity, viz. national grid, regional grid or state grid.
In India, electricity is a concurrent subject between the State and the Central Governments. The perspective planning, monitoring of implementation of power projects is the responsibility of Ministry of Power, Government of India. At the state level the state utilities or State Electricity Boards (SEBs) are responsible for generation, transmission, and distribution of power. With power sector reforms there have been unbundling and privatisation of this sector in many states. Many of the state utilities are engaged in power generation also. In addition, there are different central / public sector organizations involved in generation like National Thermal Power Corporation (NTPC), National Hydro Power Corporation (NHPC), etc. in transmission e.g. Power Grid Corporation of India Ltd. (PGCIL) and in financing e.g. Power Finance Corporation Ltd. (PFC).

There are five regional grids: Northern, Western, Southern, Eastern and North-Eastern. Different states are connected to one of the five regional grids as shown in the Table below-

Table 1: States connected to different regional grids

Regional grid	Northern	Western	Southern	Eastern	North Eastern
States	Haryana, Himachal Pradesh, Jammu & Kashmir, Punjab, Rajasthan, Uttar Pradesh, Uttaranchal, Delhi	Gujarat, Madhya Pradesh, Maharashtra, Goa, Chattisgarh	Andhra Pradesh, Karnataka, Kerala, Tamil Nadu,	Bihar, Orissa, West Bengal, Jharkhand	Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura

The management of generation and supply of power within the state and regional grid is undertaken by the state load dispatch centres (SLDC) and regional load dispatch centres (RLDC). Different states within the regional grids meet the demand from their own generation facilities plus generation by power plants owned by the central sector i.e. NTPC and NHPC etc. Specific quota is allocated to different states from the Central sector power plants. Depending on the demand and generation there are exports and imports of power within different states in the regional grid. Thus there is an exchange of power among states in the regional grid. Similarly there exists imports and export of power between regional grids.

The Western Region grid managed by Western Region Electricity Board (WREB) constitutes five states (viz Maharashtra, Madhya Pradesh, Chhatisgarh, Gujarat and Goa) and two Union territories (Daman & Diu and Dadar & Nagar Haveli). These states under the regional grid have their own power generating stations as well as centrally shared power-generating stations. While the power generated by own generating stations is fully owned and consumed through the respective state's grid systems, the power

generated by central generating stations is shared by more than one state depending on their allocated share. WREB facilitates the share of power generated by the central generating stations. Presently the share from central generating stations is a small portion of their own generation.

Map of the Western Region Grid

Since the CDM project would be supplying electricity to the western regional grid it is preferable to take the regional grid as project boundary than the state boundary. It also minimizes the effect of inter state power transactions, which are dynamic and vary widely. Considering free flow of electricity among the member states and the union territory through the Western Region Load Dispatch Centre (WRLDC), the entire western grid is considered as a single entity for estimation of baseline.

B.4. Description of baseline and its development:

>>

The approach adopted for selecting the baseline scenario for the project is based on the existing actual emissions. The investors are currently drawing power from the grid. In the absence of the CDM project, the investors would have continued to draw electricity for meeting their power demands from the western grid. Investment in other technology for power generation would not be feasible as the baseline for the simple reason that the project activity itself is financially not the best course of action for the promoters. Investment in wind energy is demanding a huge share of the financial and human resources. Therefore, the most plausible baseline scenario remains that of power purchase from the regional grid.

Appendix B to the simplified Modalities and Procedures for Small-Scale CDM project activities (FCCC/CP/2002/7/ADD.3) gives two options for calculating the baseline for a Type I D project:

(a) The average of the "approximate operating margin" and the "built margin"

OR

(b) The weighted average emissions (in $kgCO_2$ equ/kWh) of the current generation mix.

The baseline approach (a) i.e. the average of "operating margin" and "built margin" has been chosen to calculate the baseline of the project activity.

i) The "approximate operating margin" is the weighted average emissions (in kg CO2equ/kWh) of all generating sources serving the system, excluding hydro, geothermal, wind, low-cost biomass, nuclear and solar generation;

ii) The "build margin" is the weighted average emissions (in kg CO2equ/kWh) of recent capacity additions to the system, based on the most recent information available on plants already built for sample group *m* at the time of PDD submission. The sample group *m* consists of either the five power plants that have been built most recently or the power plant capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently. Project participants should use from these two options that sample group that comprises the larger annual generation. Power plant capacity additions registered as CDM project activities should be excluded from the sample group *m*. If 20% falls on part capacity of a plant, that plant is included in the calculation.

Details of Baseline data:
Operating margin emission factor and Build Margin emission factor calculations:
Data of Operating and Build Margin for the three financial years from 2002 to 2005 has been obtained from –
"**CO2 Baseline Database for the Indian Power Sector"**
Ministry of Power: Central Electricity Authority (CEA)
Version 3.0
Dated: December 2007
This database is prepared as per ACM0002 version 6.

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered small-scale CDM project activity:

>>

The project activity involves generation of electricity from WEGs and its utilization for captive purposes and sale to electricity board.

The investment / project implementation is carried out in the state of Gujarat. At a state wide level Gujarat is facing considerable shortage between electricity demand and supply. Thus the project proponent could have had the following alternatives to meet his power requirements.

The following alternatives were available to the project proponents:
- The current project activity is executed without considering CDM revenue
- The proponents continues consumption of the available electricity from the grid, as a HT industrial consumer

The alternative 1 is an unattractive proposition as in the absence of returns from carbon credits, the scenario is not feasible. Wind flow is influenced by a number of Natural factors on which there is no control of the project proponents.

The alternative 2 is considered as credible and realistic alternative to the project activity since the project activity is displacing the equivalent amount of electricity in the carbon intensive grid system. In the absence of the present activity, the equivalent amount of electricity would have been replaced/drawn from the existing or new grid connected power plants.

Barrier due to Generation risk

Despite the higher establishment costs in comparison to the conventional generation methods (Hydro, Thermal etc.), the installed WEGs deliver a PLF that is much lower than the former. The companies were also aware of the risks due to the non-availability of wind energy over a significant part of the year. This is the biggest constraint in the project as various factors like wind speed, direction, intensity and others; determine the production of electricity and efficiency of the windmills, at all times.

The pattern of the year-to year variation in wind power generation in Gujarat has been tending to the much lower than the average generation. In Lamba itself, where 6 of the WEGs are installed for the project, the generation on an average from 2000 to 2002 has been less by 6% from the usual. This trend is a reflection of the instability in the wind regime of the state. The average annual generation from the sites is also amongst the minimum in comparison to other states.

This is clearly a loss to the huge investments that have been made and a risk for all potential investors. However, in view of the environmental benefits of wind power and expected CDM revenue flow, the investors confirmed their decision to implement the renewable energy project.

Regulatory Barriers

The electricity policy of the state of Gujarat has brought in significant changes for captive use / sale of power from wind installations which have brought in additional risks for the investors. It has been observed that private investment in a sector is greatly affected by the governing public policy; a non-conducive, stagnant policy in the state brought the investments at a standstill leading to nil (0 MW) installations in the state for four consecutive years (1998 – 2002).

Year	MW
Up to March 1992	14.5
1992-93	1.6
1993-94	10.6
1994-95	37.7
1995-96	51.2
1996-97	31.1
1997-98	20.1
1998-99	0.0
1999-00	0.0
2000-01	0.0
2000-02	0.0
2002-03	6.2
2003-04	28.9
2004-05	51.5
2005-06	84.6

The slump in investments was attributed to poor state policy. The policy status therefore needs attention while arguing about the additionality of the project, the same is briefly indicated below:

January 1993 – September 2001:
Purchase of electricity at Rs 1.75 /kWh (US$ 0.039 /kWh) with wheeling charges of 2% of the energy generated by windmills and provision of banking for a period of 6 months. Electricity duty and demand cut to the extent of 30% of installed capacity of wind farm has been exempted along with 50% sales tax incentives. Additionally the generator was exempted from the electricity duty over the generated electricity. Prior to the first policy, the state was having 16.1 MW of WEG installations. The first public policy for wind sector could attract investment, and the state enjoyed installation of 10.6 MW in 1993-94 followed by 37.7 MW in 1994-95 followed by 51.2 MW in the year 1995-96. The investors were looking forward to further improvement in tariff for this sector, but the public policy continued to remain stagnant leading to reduction in investment, leading to installation of 31.1 MW in 1996-97 and 20.1 in 1997-98. The manufacturer could not further attract the investors because of non-conductive policy and the installation level dropped to Nil during rest of the policy period.

October 2001 – June 2002:
Purchase of electricity at Rs 2.25 /kWh (US$ 0.05/kWh) with 1994-95 as base year with 5% escalation per annum for a period of 10 years from the date of commencement of generation of power. The purchase price after 10 years of commissioning of the project shall be equal to the purchase price at the end of that year or as may be negotiated between the stakeholders. The wheeling charges doubled from 2% to 4% of the generated energy. A provision of banking for 12 months along with 3rd party sale was permitted. The policy was changed after a gap of 7 years, but the new policy couldn't meet the expectations of the investors, because of the less profitable nature of business as compared to available options for investment, hence for all practical purposes, this policy was a total failure and not even a single installation of WEG took place during this regime.

June 2002 – Onwards:
Purchase of electricity at Rs 2.60 /kWh (US$ 0.057 /kWh) with an increase of Rs 0.05/ kWh per annum (US$ 0.001 /kWh p.a.) for 10 years and after 10th year, the rate will be negotiable. The wheeling charges are kept constant at 4%, whereas the banking period has been reduced from 12 months to 6 months. The permission for 3rd party sale of electricity has been banned. Payment of electricity duty and demand cut to the extent of 30% of the installed capacity of the wind farm has been exempted. Some relief to the investors were given with increase in tariff, but because of proactive action by manufacturers playing in the market, some investors were convinced to invest in the RE sector and again a marginal growth has been observed leading to 6.2 MW in 2002-03 and 28.9 MW in 2003-04 (including 13.2 MW installations of this project).

A relative comparison with the prevailing policies of other states vis-à-vis the state of Gujarat (where the installations are carried out) would help in further understanding the regulatory / policy issues pertaining to implementation of wind power projects. The table below details the prevailing policies of other states (rich in wind resources) for implementation of wind turbines for captive purposes.

Comparison of Wind Power Policies in different states updated on 10.03.2005 Recent most 1.9.06

Parameters (Date-Policy)	Maharashtra # (24.11.2003)	Gujarat (20.6.2002)	Rajasthan (25.10.2004)	TN (1.3.2002)	Karnataka @ (18.1.2005)	AP (20.3.2004)	MP (11.6.2004)	Kerala& (3.4.2002)	WB (12.4.1999)

Wheeling	2% of energy wheeled + 5% Transmission Loss	4% of energy wheeled	10% of energy fed (or billed) to the grid	5%	As per KERC (Terms and Conditions of Open Access) Regulations, 2004 *	-	No wheeling charges	5% of energy fed into the grid	Rs 0.30/kWh which would be revised from time to time
Banking	12 months	6 months	Upto 31st Dec of the calendar year	12 months commencing from 1st April of every year with 5% banking charges	As per KERC (Terms and Conditions of Open Access) Regulations, 2004 *	-	Not allowed	Allowed from June to Feb (9 months) for every FY. $	6 months
Third Party Sale	Allowed	Not Allowed	Allowed	Not Allowed	Allowed	Not Allowed	Guided by Open Access Regulations under Electricity Act 2003.	Not Allowed	Not Allowed

Notes:

COD-Commercial Operation Date

DOC-Date of Commissioning

FY- Financial Year

#: The Government of Maharashtra (GoM) policy dated March 1998 has expired on 31/Mar/2003 and the new GoM policy dated 26/Feb/2004 has been issued. But the wheeling, banking, Third Party sales, etc are not discussed in this policy. The Maharashtra Electricity Regulatory Commission (MERC) has issued the tariff order on the wind power procurement, wheeling for third party-sale and/or self-use on 24/11/2003. This tariff order categorises the wind power projects into three groups viz., Group I- the projects commissioned before 27/12/1999, Group II- the projects commissioned after 27/12/1999 but before 1/4/2003 and Group III- the projects commissioned after 1/4/2003. The order discusses about the wheeling, banking and third party sales, which have been referred here.

@: Karnataka Electricity Regulatory Commission (KERC) order in the matter of determination of tariff in respect of renewable sources of energy dated 18.1.2005. The purchase price of Rs.3.40/u without any escalation is applicable to all the Power Purchase Agreements filed before the KERC on or after 10.6.2004 and will be in force for a period of 10 years from COD of the plants.

*: KERC has decided to consider the determination of wheeling and banking charges and surcharge separately while determining charges as required under KERC (Terms and Conditions of Open Access) Regulations, 2004. (Refer: KERC - tariff for renewable energy sources order dated 18.1.2005)

&: Government of Kerala has issued policy guidelines for development of wind power in Kerala through Private Developers on 6.11.2004. This policy doesn't highlight the purchase price by Kerala State Electricity Board (KSEB), wheeling and banking charges, as these would be decided by Kerala State Electricity Regulatory Commission. Third Party Sale is allowed in this policy.

$: 100% banking is allowed from June to Feb for every FY. From Mar to June, the producers can bank power with KSEB. The producer can take this banked power back only during the period from June to Feb, the same FY. (Refer: Kerala Renewable Energy Policy dated 3.4.2002)

The above table clearly indicates that the policy prevailing in the state of Gujarat is not very conducive for captive investment for the following reasons:

- Banking for 6 months instead of 12 months
- No third party sale is allowed in some other states.
- Lapse of banked electricity, whereas the state of Tamil Nadu & Maharashtra purchase the banked electricity at a lower tariff, which lets the investor recover its principal with some profits.

It is observed that power purchase price in the state of Gujarat from wind power was the lowest in comparison to all the other states with wind potential. The tariff according to the new policy has been fixed at Rs. 3.37/kWh which is still less than wind power tariff in states like Rajasthan, Madhya Pradesh, Mahasrashtra and Karnataka. The electricity act 2003 allows third party sale, however the Gujarat Electricity Regulatory Commission (GERC) prohibits third party sale leaving investors to either sell the generated output to the utility at a low tariff or utilise it for captive consumption. As a result most of the investors in Gujarat have opted for captive consumption only.

National and/or Sectoral Policies

The installed capacity of Western Region at the end of financial year 2005-06 as per CEA indicate clearly that GHG emission free sources of energy comprise a bare minimum of 3.1% of the total energy source for the entire grid. As for the state of Gujarat, the proportion of renewable energy remains poor at 2.8% of the total. (Source: Ministry of Power, Government of India, Annual Report, 2005-2006, Website: www.powermin.nic.in) The project will generate electricity from WEGs in the State of Gujarat. The state has been running into power deficit over the past years and would need increased installation to meet this demand. Over the period of April 06 to October 06, the state experienced an energy shortage of 9.8% and a peak electricity shortage of 25%. (Source: http://powermin.nic.in/indian_electricity_scenario/pdf/WR1106.pdf)

As on December 31st, 2005, the share of thermal power plants in Gujarat is 84 % of the total installed capacity (Source: Ministry of Power, Government of India, Annual Report, 2005-2006, Website: www.powermin.nic.in). The state is facing high energy shortages of more than 11% every year since last four years with demand over stripping supply. To meet this excess energy demand, the state needs to invest in a reliable energy source which will be solid fossil fuel based thereby increasing the carbon intensity in the grid and the greenhouse gas emissions. An insight into the Capacity addition in the western region over 2006 and expected installations in 2007 confirms that about 5884MW of coal, lignite, and gas based power plants have been and shall be installed in the near future. (Source: Ministry of Power, Power Sector Profile, November 2006,

http://powermin.nic.in/indian_electricity_scenario/pdf/WR1106.pdf).) This addition shall be responsible for increased and excessive GHG emissions and the power scenario therefore clearly favours such energy intensive and polluting electricity sources.

Hence, there exists scope for reducing the CO2 emissions from the country by way of fuel substitution, increased use of renewable energy sources, and also by improving the thermal efficiency of power generation. Since wind power is GHG emissions free, the wind power generated will save the anthropogenic green house gas (GHG) emissions generated by the fossil fuel based thermal power stations comprising coal, diesel, furnace oil and gas. The estimation of GHG reductions by this project is limited to carbon-di-oxide (CO_2) only.

Gujarat has observed largest captive installations till 1999, but the investors have only made investment in conventional fuel based power generation (100% through Steam / Diesel/ Gas / Naptha). Beyond 1999, no new installation of wind has been carried out in the state till 2002. There have been virtually no similar options occurring within the state of Gujarat for four consecutive years, although other states of Western Grid have observed installations of wind turbines. The project installations are carried out in the year 2004, 2005, & 2006; the state has observed installations of 51.5 MW in the year 2004-05 and 84.6 MW in the year 2005-06 including the project installations of 13.7 MW. So far, of 9675 MW of gross wind potential of Gujarat, only 3.5% potential has been utilized (338.0 MW) (As on 31.03.2006). Thus investing in wind energy is not a common practice in the state.

The proposed project activity evacuates approximately 27.15 Million Units of clean electricity per year using wind turbines. Taking into account energy shortages and current trend of investment in fossil fuel based energy generation in the region, in absence of the candidate project activity, an equivalent amount of electricity would have been generated using fossil fuel based power plants. Thus the generation from the candidate project activity displaces the energy generated using fossil fuel fired power plant and leads to an emission reduction of 24,462 tCO_2e annually over the ten-year crediting period.

Barrier due to natural disasters

Additionally, in the years 1998 and 1999, the state of Gujarat was hit by cyclones, that resulted in huge damage to the WEG installations in Navadra, Bhogat & Lamba. This is a risk that cannot be measured and can lead to severe physical and financial losses. Since the state is prone to cyclones, the investors would require a steady income source in order to compensate for the unexpected losses.

Early Consideration of CDM

The project participants have seriously considered the CDM revenues for the project activity before starting the construction activity of the project itself. Proof of consideration of CDM by all promoters in the bundled project activity will be provided to the operational entity.

In view of the above analysis, the proposed project is additional and not the same as the baseline scenario.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

>>

Baseline Scenario

For the project activities that do not modify or retrofit an existing electricity 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 addition of new generation sources, as reflected in the combined margin (CM) calculations described below.

The baseline emission factor (EF_y) is calculated as a combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM). Calculation of this combined margin is based on data from an official source and is made publicly available.

B.6.2. Data and parameters that are available at validation:

>>

a) EFy

Data / Parameter:	**EFy**
Data unit:	tCO_2/MWh
Description:	CO_2 emission factor of the grid.
Source of data used:	Calculated as weighted sum of the OM and BM emission factors. The formula for this is as per ACM0002.
Value applied:	0.901
Justification of the choice of data or description of measurement methods and procedures actually applied :	– Emission factor is used in the calculation of emission reductions. – The emission factor is calculated ex-ante at the time of PDD submission.
Any comment:	Calculated as weighted sum of the OM and BM emission factors.

b) $EF_{OM,y}$

Data / Parameter:	**$EF_{OM,y}$**
Data unit:	tCO_2/MWh
Description:	CO_2 Operating margin emission factor of the grid.
Source of data used:	CEA: 'The CO_2 Baseline Database for the Indian Power Sector' Version 3.0, December 2007
Value applied:	1.00
Justification of the choice of data or description of measurement methods and procedures actually applied :	– This is used in calculation of emission factor Ey. – The emission factor is calculated ex-ante at the time of PDD submission.
Any comment:	Calculated as indicated in the simple OM baseline method

c) $EF_{BM,y}$

Data / Parameter:	**$EF_{BM,y}$**
Data unit:	tCO_2/MWh

Description:	CO_2 Build Margin emission factor of the grid.
Source of data used:	CEA: 'The CO_2 Baseline Database for the Indian Power Sector' Version 3.0, December 2007
Value applied:	0.593
Justification of the choice of data or description of measurement methods and procedures actually applied :	– This is used in calculation of emission factor Ey. – The emission factor is calculated ex-ante at the time of PDD submission.
Any comment:	Calculated as indicated in ACM0002.

B.6.3 Ex-ante calculation of emission reductions:

>>

The baseline is calculated using the combined margin approach. The baseline emission factor is calculated in the following steps:

Step 1: Calculation of Operating Margin Emission Factor

The operating margin emission factor has been calculated using a 3 year data vintage:

Simple Operating Margin (tCO2/MWh) (incl. Imports)							
					2004-05	2005-06	2006-07
North					0.98	1.00	1.00
East					1.17	1.13	1.09
South					1.00	1.01	1.00
West					1.01	1.00	0.99
North-East					0.90	0.70	0.70
India					1.02	1.02	1.01

The operating margin emission factor has been calculated using a 3 year data vintage:
The $EF_{OM,Y}$ is estimated to be:
For the year 2004-2005 the $EF_{OM,Y}$ is 1.01 tCO_2/MWh
For the year 2005-2006 the $EF_{OM,Y}$ is 1.00 tCO_2/MWh
For the year 2006-2007 the $EF_{OM,Y}$ is 0.99 tCO_2/MWh

Thus the final $EF_{OM,Y}$ based on three years average is estimated to be **1.00 tCO_2/MWh**.

Step 2: Calculation of the Build Margin Emission Factor $EF_{BM,Y}$

The build margin has to be calculated by constituting a sample group m from either the 5 most recently built power plants or the power plant capacity additions in the electricity system that comprise 20% of the system generation (that have been built most recently). The sample group that comprises larger annual generation from either of these has to be chosen. It is observed that the generation from the sample group that comprises 20% of the system generation has larger generation than the 5 most recently built plants. So the Build Margin is calculated from the sample group comprising the most recently additions to the grid that comprise 20% of the system generation.

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North					0.60	0.63
East					0.97	0.93
South					0.71	0.71
West					0.63	0.59
North-East					0.15	0.23
India					0.68	0.68

The $EF_{BM,Y}$ is estimated as **0.593 tCO_2/MWh** (with sample group m constituting most recent capacity additions to the grid comprising 20% of the system generation).

Step 3: Calculation of Baseline Emission Factor EFy

The baseline emission factor EFy is calculated as the weighted average of the Operating Margin emission factor ($EF_{OM,Y}$) and the Build Margin emission factor ($EF_{BM,Y}$):

$$\mathbf{EFy = w_{OM}\ EF_{OM,Y} + w_{BM}\ .EF_{BM,yss}}$$

Where the weights w_{OM} and w_{BM}, are 75% and 25% respectively, and $EF_{OM,y}$ and $EF_{BM,Y}$ are calculated as described in Steps 1 and 2 above and are expressed in tCO2/MWh.

Baseline Emission factor: **0.901tCO_2/MWh**

Baseline emissions due to displacement of grid electricity are the product of the baseline emission factor (EFy) calculated in step 3, times the electricity supplied by the project activity to the grid (EGy), over the crediting period.

$$\mathbf{BEy = EGy.\ EFy}$$

Baseline Emissions = **24,462 tCO2e/yr**

Step 5: Calculation of Emission Reductions (ERy)

The emission reductions by the project activity during a given year y is the difference between Baseline emissions (BEy), project emissions (PEy) and emissions due to leakage (Ly).

$$\mathbf{ERy = BEy – PEy – Ly}$$

- Project Emissions by sources of GHGs due to the project activity within the project boundary are zero since wind power is a GHG emission free source of energy.
- Leakage is not applicable as the renewable energy technology used is not equipment transferred from another activity. Therefore, as per the simplified procedures for SSC project activities, no leakage calculation is required.

Total project activity emissions, including leakage are zero for the project activity.

Therefore, Net anthropogenic emission reductions due to the proposed project are equal to the baseline emissions on a yearly basis. The annual emissions reductions are equal to 24,462 tCO_2eq./yr.

B.6.4 Summary of the ex-ante estimation of emission reductions:

>>

Year	Estimation of project activity emission (tonnes of CO_2e)	Estimation of baseline emissions (tonnes of CO_2e)	Estimation of Leakage (tonnes of CO_2e)	Estimation of overall emission reductions (tonnes of CO_2e)
2008	0	24,462	0	24,462
2009	0	24,462	0	24,462
2010	0	24,462	0	24,462
2011	0	24,462	0	24,462
2012	0	24,462	0	24,462
2013	0	24,462	0	24,462
2014	0	24,462	0	24,462
2015	0	24,462	0	24,462
2016	0	24,462	0	24,462
2017	0	24,462	0	24,462
Total (tonnes of CO_2e)	**0**	**24,4620**	**0**	**24,4620**

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

The following parameter will be monitored during the project activity:
a) EGy

B.7.1 Data and parameters monitored:

Data / Parameter:	**EG_{yNet} ($EG_{y\ export}$ - $EG_{y\ import}$)**
Data unit:	KWh
Description:	Net Electricity wheeled/supplied to the grid by the project.
Source of data to be used:	Measurement records.
Value of data	27.15 Million Units
Description of measurement methods and procedures to be applied:	– The electricity is measured with the help of electronic meters at the wind farm substation. – The data is recorded monthly. – 100% of the data is monitored. – The data will be archived electronically.
QA/QC procedures to be applied:	This data will be directly used for calculation of emission reductions
Any comment:	

Data / Parameter:	**$EG_{y\ export}$**
Data unit:	KWh
Description:	Electricity wheeled/supplied to the grid by the project.
Source of data to be used:	Measurement records.

Value of data	27.15 Million Units
Description of measurement methods and procedures to be applied:	– The electricity is measured with the help of electronic meters at the wind farm substation. – The data is recorded monthly. – 100% of the data is monitored. – The data will be archived electronically.
QA/QC procedures to be applied:	This data will be directly used for calculation of emission reductions.
Any comment:	

Data / Parameter:	**$EG_{y\ import}$**
Data unit:	KWh
Description:	Electricity import
Source of data to be used:	Measurement records.
Value of data	Electricity import
Description of measurement methods and procedures to be applied:	– The electricity is measured with the help of electronic meters at the wind farm substation. – The data is recorded monthly. – 100% of the data is monitored. – The data will be archived electronically.
QA/QC procedures to be applied:	This data will be directly used for calculation of emission reductions.
Any comment:	

B.7.2 Description of the monitoring plan:

>>

The project activity essentially involves generation of electricity from wind, the employed WEG can only convert wind energy into electrical energy and cannot use any other input fuel for electricity generation. Thus no special ways and means are required to monitor leakage from the project activity.

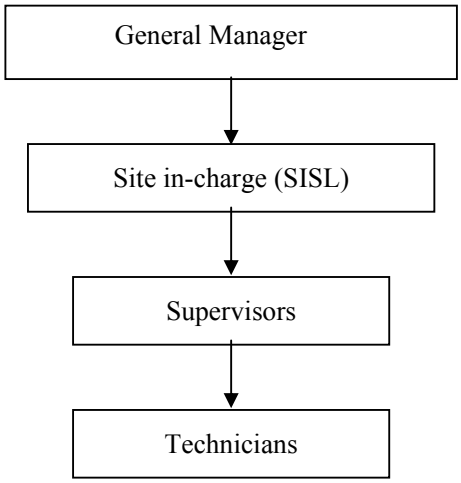
1. The proposed CDM project activity requires evacuation facilities to grid and the evacuation facility is essentially maintained by the state power utility (GEB).
2. The electricity generation measurements are required by the utility and the investors to assess electricity wheeling and banking charges.
3. Metering of Energy: The energy generated at the wind farm will be metered and measured by GETCO and GEDA on monthly basis at sending end sub-station of the wind farm. The qualifying energy to be wheeled or sold will be computed on the basis of this measurement.
4. The project activity has envisaged four independent measurements of generated electricity at controller level, individual metering at feeder level, common meter and at outdoor (OD) meter.
5. Controller level metering: Each WEG is equipped with an integrated electronic meter which measures the individual WEG generation. These meters are software based and connected to the Central Monitoring Station (CMS) of the entire wind farm through cables. The generation data of individual machine can be monitored as a real-time entity at CMS. The snapshot of generation on

the last day of every calendar month will be kept as a record both in electronic as well as printed (paper) form.

6. Individual metering at feeder: Generation from group of turbines of any particular project promoter is being measured at this metering point.
7. Common meter: Generation from all the project proponents for that particular sub-station is being recorded here
8. OD metering: The metering is carried out at the sub station via OD meter for a group of windmills that is inclusive of the WEGs not a part of the project activity. This meter provides monthly generation data from all the WEGs and the records are maintained on paper and electronically for reference. This meter is sealed and maintained by state power utility and are calibrated annually.
9. The readings from the OD metering source can be further apportioned into readings from a particular project promoter based on generation data from the individual meter at the feeder, taking into account the transmission losses.
10. SISL will be responsible for collecting the necessary data in order to monitor emission reductions generated by the project activity.
11. SISL will do the operation and maintenance of the installations and measurement of generated electricity is done by state electricity utility. The EPC contractors are ISO certified organizations and follow designated procedures for the assigned tasks.

All the monitored data will be kept for 2 years after the end of crediting period or the last issuance of CERs for this project activity whichever occurs later. The monitored data will be presented to the DOE to whom verification of emission reductions is assigned.

Project Management for the CDM project



B.8 Date of completion of the application of the baseline and monitoring methodology and the name of the responsible person(s)/entity(ies)

>>

Date of Completion: 27/01/2008

Contact person:

Senergy Global Private Limited
Ground Floor, Eros Plaza, Corporate Tower
Nehru Place
New Delhi – 110019
India
Tel: +91 11 4650 5501
Fax: +91 11 4650 5555
E.mail: mail@senergyglobal.com

The above Entity is the Project participant as mentioned in Annex-1.

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

>>
28/10/2004

C.1.2. Expected operational lifetime of the project activity:

>>
20 years and 0 months

C.2 Choice of the crediting period and related information:

C.2.1. Renewable crediting period

C.2.1.1. Starting date of the first crediting period:

>>
N/A

C.2.1.2. Length of the first crediting period:

>>
N/A

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>
1/05/2008 or the date of registration of the project activity, whichever is earlier

C.2.2.2. Length:

>>
10 years and 0 months (with no renewal)

SECTION D. Environmental impacts

>>

D.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

>>

According to Indian regulation, the implementation of the wind park does not require an Environmental Impact Assessment (EIA) study. As per the prevailing regulations of the Host Party i.e. India represented by the Ministry of Environment and Forests (MoEF), Govt. of India and also the line ministry for environmental issues in India, Environmental Impact Assessment (EIA) studies need not to be conducted for the projects which comes under the list whose investment is less than Rs. 1000 millions[1, 2] Since the Wind projects are not included in this list and also the total cost of the project for individual project proponent is less than the benchmark investment, the project activity doesn't call for EIA study.

Also, in the redefined EIA notification i.e. S.O. 1533[3], dated 14th September 2006, Ministry of Environment & Forests (MoEF), Govt. of India, the wind projects are not included in the list of projects that has to get Prior Environmental Clearance (EC) either from State or Central Govt. authorities and hence no EIA study was conducted.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

>>

The analysis concluded that there are no reasons and areas for concern. The wind park is located in a sparsely populated area with no vulnerable flora or fauna. The wind park results only in positive environmental impacts (lower emissions) and no negative impacts.

SECTION E. Stakeholders' comments

E.1. Brief description how comments by local stakeholders have been invited and compiled:

>>

The following stakeholders were involved during and after implementation of the project.

1. GEDA – The Gujarat Energy Development Agency
2. GEB – Gujarat Electricity Board

GEB (state electricity utility) is responsible for providing evacuation facility for the generated electricity. GEB has entered into agreement with the project proponents for wheeling and banking of generated electricity. The state electricity utility was contacted by the EPC contractor on behalf of the project proponent, and all the necessary modalities and procedures were followed and agreement for wheeling and banking was executed.

---

[1] S.O. 60 (E), Environment Impact Assessment Notification, Ministry of Environment and Forests, Govt. of India dated 27th January 1994.
[2] Amendments made on 13th June 2002 vide S.O. 632 (E), Ministry of Environment and Forests, Govt. of India.
[3] Page No: 10, S. O. 1533, Ministry of Environment & Forests (MoEF), Govt. of India, http://envfor.nic.in/legis/eia/so1533.pdf

GEDA – the state level nodal agency has leased out land for implementation of the project. The major portion of the project has been executed on GEDA leased land. The agency is responsible for promotion of renewable energy technologies in the state. After confirming the inherent wind potential at the sites specified by MNES and the EPC contractor, the land was leased out for execution of project.

E.2. Summary of the comments received:

>>

There were no comments from GEB & GEDA and standard agreements for wheeling & Banking along with lease of land were executed.

- The land will not be sold for project implementation; instead it will be leased out for execution.
- The land will not be used for any other purpose except implementation of wind farm facility

E.3. Report on how due account was taken of any comments received:

>>

- The EPC contractor adhered to the comments of villagers and land was taken on lease for execution of project.
- The land is kept exclusively for the purpose of wind farm and no other commercial activity has been carried out at the site.
- Employment for carrying out operations and maintenance of the project has been given to nearby residing people

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Senergy Global Private Limited
Street/P.O.Box:	Nehru Place
Building:	Ground Floor, Eros Plaza, Corporate Tower
City:	New Delhi
State/Region:	Delhi
Postfix/ZIP:	110 019
Country:	India
Telephone:	+91- 11- 4650 5501 / 5502/03
FAX:	+91- 11- 4650 5555
E-Mail:	mail@senergyglobal.com
URL:	
Represented by:	Mr. Chintan Shah
Title:	Mr.
Salutation:	
Last Name:	Shah
Middle Name:	
First Name:	Chintan
Department:	Carbon Credits
Mobile:	+91- 9818623817
Direct FAX:	
Direct tel:	+91 11 4650 5501
Personal E-Mail:	cns@senergyglobal.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

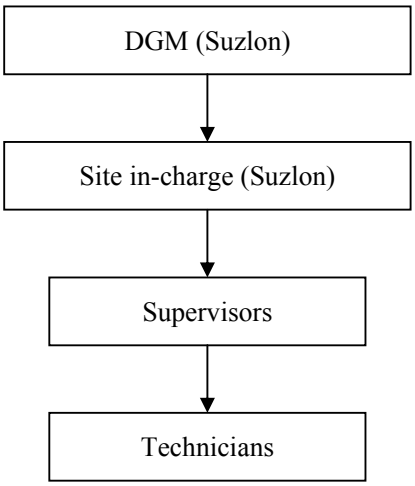
There is no public funding involved in the project activity and the project participants hereby confirm that there is no diversion of overseas development assistance

- - - - -

Annex 3

MONITORING INFORMATION

Operation and Maintenance Structure for the bundled wind energy project



Annex 4

Technical description of the technology utilised in the project

1.25 MW WEG: Technical Description

A direct grid-connected high-speed generator, in combination with the multiple-stage combined spur/planetary gearbox of the Suzlon Megawatt Series, offers greater robustness and reliability than a low-speed generator connected to the electrical grid via AC-DC-AC-inverter systems. High-speed asynchronous generator with a multi-stage intelligent switching compensation system delivers power factor up to 0.99. The generated power is free from harmonics and is grid friendly.

Operating Data:

1. Rotor Height: 64 m
2. Hub Height: 65 m
3. Cut in Speed: 3 m/s
4. Rated Speed: 12 m/s
5. Cut out speed: 25 m/s
6. Survival Speed: 67 m/s

Rotor:

1. Blade: 3 Blade Horizontal Axis
2. Swept Area: 3217 m^2
3. Rotational Speed: 13.9 to 20.8 rpm
4. Regulation: Pitch Regulated

Generator:

1. Type: Asynchronous 4 / 6 Poles
2. Rated Output: 250 / 1250 kW
3. Rotational Speed: 1006 / 1506 rpm
4. Frequency: 50 Hz

Gear Box:

1. Type: Integrated (1 Planetary & 2 Helical)
2. Ratio: 74.971:1

Yaw System:

1. Drive: 4 electrically driven planetary gearbox
2. Bearings: Polyamide slide bearings

Braking System:

1. Aerodynamic Brake: 3 independent systems with blade pitching
2. Mechanical Brake: Hydraulic fail safe disc braking system

Control Unit:

1. Type: Programmable microprocessor based; high speed data communication, active multilevel security, sophisticated operating software, advance data collection remote monitoring & control option, UPS backup, Real time operating indication.

600 KW WEG: Technical Description

Rotor:

1. Diameter : 52 m
2. Orientation : Upwind / Horizontal axis
3. Rotational speed : 24 rpm
4. Rotational direction : Clockwise
5. Rotor blade material : GRP
6. Swept area : 2124 m
7. Hub height : 75 m
8. Regulation : Pitch regulated

Operational Data:

1. Cut in wind speed : 3.5 m / sec
2. Rated wind speed : 12 m / sec
3. Cut off wind speed : 25 m / sec

Gearbox :

1. Type : 3 stage (1 planetary and 2 helical)
2. Nominal load : 660 kW (Mechanical power)
3. Type of cooling : Oil cooling system, forced lubrication

Generator :

1. Type : Asynchronous 4 pole
2. Rotation speed : 1500 RPM
3. Rated output : 600 kW
4. Rated voltage : 690 V
5. Frequency : 50 Hz

Yaw Drive:

1. Yaw drive system : 2 Active electrical yaw motors
2. Yaw bearing type : Polyamide slide bearing

Safety Systems:

1. Brake system : Automatic application by independent synchronous electrical control of the blade pitching in case of:
    - Vibration or shock loading
    - Variation in the rated voltage range
    - Variations in the frequency range
    - Asymmetric phasing
    - Line interruption-with automatic reconnection

Annex 5

WEG SPECIFICATIONS

S. No.	Name of Investor	No. of WTGs	Capacity of each WTG (MW)	Turbine No.	District	Commissioning date
1	**Atul Auto Ltd.**	1	0.6	Sel/600/05-06/0083	Jamnagar	13/1/2006
2	**Rishi Kiran Logistics**	1	1.25	Sel/1250/06-07/0457	Kutch	26/3/2007
3	**Aarvee Denims & Exports Ltd.**	2	1.25	SU/1250/04-05/0058	Kutch	10/7/2006
			1.25	SU/1250/04-05/0059	Kutch	
4	**PBM Polytex Limited**	1	0.6	Sel/600/06-07/0236	Kutch	26/3/2007
5	**Ambuja Intermediates Ltd**	1	1.25	SU/1250/04-05/011	Jamnagar	2/9/2004
6	**Ratnamani Metals & Tubes Ltd.**	2	1.25	SU/1250/04-05/0047	Jamnagar	29/3/2005
			1.25	SEL/1250/05-06/0074	Jamnagar	26/9/2005
7	**Rajratna Metal Industries Ltd**	1	1.25	SU/1250/04-05/0055	Jamnagar	30/3/2005
8	**Terapanth Foods Limited**	1	1.25	SEL/1250/06-07/0203	Kutch	25/10/2006
9	**Friends Salt Works & Allied Industries**	1	1.25	SEL/1250/06-07/0198	Kutch	7/10/2006
10	**Sud Chemie india Pvt.Ltd.**	1	1.25	SEL/1250/06-07/0222	Kutch	30/12/2006
		Total	**13.7**			