CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 02 - in effect as of: 1 July 2004)

CONTENTS

SECTION A. General description of project activity

A.1 Title of the project activity:

>>
Bundled wind power project in Chitradurga (Karnataka in India) managed by Enercon (India)Ltd.

A.2. Description of the project activity:

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The project activity involves the development and operation of grid-connected wind based electricity generation facilities with aggregate installed capacity of 16.8 MW, located within a wind park. The individual sub-projects for this project activity are as follows:

Sl.No.	Owner	Project Capacity (MW)	Commercial Operation Date (COD)
(a)	Enercon Wind Farms (India) Ltd.	4.2 4.2	Sept 2001 Jun 2002
(b)	CEPCO Industries Limited	3.0. 5.4	May 2001 Aug 2001

The objective of the project activity is to construct, operate, maintain and aggregate wind power projects within the same wind park at Chitradurga in the Indian state of Karnataka to provide reliable, renewable power to the Karnataka Electrical Grid to reduce greenhouse gas emissions from reliance on fossil fuels. The project will lead to reduced greenhouse gas emissions because it will be displacing electricity from fossil fuel based electricity generating systems.

The electricity generated from this wind park is supplied using internal electrical lines to a common local sub-station using local transmission lines. Thus, though the project activity has sub-projects (individual wind farms) of smaller capacities, they share common facilities within a common wind park, and hence such sub-projects have been bundled in the project activity, and not dealt as separate small-scale projects.

The aggregate 16.8 MW project activity comprises of 28 numbers of Enercon-made wind converters, with each machine having a capacity of 600kW. The planned annual output of the wind farm is 42.50 million kW hours (kWh). The turbine supplier is Enercon (India) Ltd (EIL) and is also the operations and maintenance contractor. The generated electricity is being supplied to Karnataka Power Transmission Company Limited ("KPTCL") grid under long-term power purchase agreement (PPA). The purpose of the project is to harness renewable resources in the region, and country, and thereby displacing non-renewable natural resources thereby ultimately leading to sustainable economic and environmental development. The project activity includes development, design, engineering, procurement, finance, construction, operation and maintenance of wind energy based electric generating stations supplying electricity to the KPTCL grid.

The project activity will displace energy that is dispatched at the operating margin (largely thermal energy) and also delay any planned expansion of the Karnataka grid generation capacity by its equivalent size.

The project activity meets several sustainable development objectives including:

- contribution towards the objective of Government of India and Government of Karnataka of 10% of incremental capacity from renewable sources;
- contribution towards meeting the electricity supply deficit in Karnataka;
- expansion and diversification in the fuel mix of the Karnataka sector that is susceptible to variation in hydrology;
- CO_2 abatement and reduction of greenhouse gas emissions through development of renewable technology;
- contribution to improved service delivery to a limited extent (how can we demonstrate this, as we are only the generator and not the supplier);
- improvement in the micro-economic efficiency of the sector through various innovations incorporated in the project activity;
- reducing the average emission intensity (SO_x, NO_x, PM, etc.), average effluent intensity and average solid waste intensity of power generation in the system;
- conserving natural resources including land, forests, minerals, water and ecosystems;
- developing the local economy and create jobs and employment, particularly in rural areas, which is a priority concern for the Government of India;
- building capacity and empowerment of vulnerable sections of the rural communities in the vicinity of the project; and
- increasing income security of vulnerable sections of the society through redistribution benefits on account of the economic activities associated with the project.

A detailed discussion of the project's contribution to sustainable development has been included in Annex 5.

A.3. Project participants:

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The Project Participants include Enercon Windfarm (India) Ltd, Enercon (India) Ltd and CEPCO Industries Limited. Enercon Windfarm (India) Ltd is supported by Enercon (India) Ltd. and Enercon GmbH, Germany. Enercon (India) Ltd. shall be the lead and nodal entity for all communication with CDM–EB and the Secretariat. Enercon (India) Ltd. has supplied the equipment and is the O&M contractor. Shareholding for the project is 74% Enercon GmbH and 26% Enercon India.

Enercon (India) Ltd. shall be the lead and nodal entity for all communication with CDM – EB and Secretariat. The details of the certified emission reduction (CER) allocation at the point of issuance shall be furnished at the time of PDD registration.

Enercon India Limited (EIL) is an Indo-German joint-venture with Enercon GmbH of Germany. Enercon GmbH is the world's leading supplier of wind turbines, with an 18.5% share (Source: BTM 2002) of the wind power market worldwide. The company has more than 5,882 installations globally, totalling over 4,841 MW across 40 countries. EIL has achieved a market presence in the nascent wind energy development field in India and successfully operated wind farms in the region and country. EIL has 687

wind installations in India including nearly 200 installations in the state of Karnataka. These operations, however, represent a small fraction of the total installed grid capacity, and estimated wind market potential. The grid penetration of for wind energy projects in Karnataka state is only 2.12% (as per MNES Annual Report for 2002-03).

CEPCO Industries Limited is in business since 1956. The company started as a cycle part manufacturers and diversified into promoting commercial complexes and in construction activity since 1979 having their registered office in Delhi. The company is a closely held company. The company on the basis of the Technological advantage of the Enercon machines and based on the track record of Enercon in India, placed order for installing 8.4 MW wind power projects in Karnataka.

EIL has committed to sale the CERs to the IFC – Netherlands Carbon Facility (INCaF) who would, thus, be project participant from Parties in Annex I.

The contact information on primary project participant and the project advisor in the project activity is provided in Annex 1 in this PDD.

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

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A.4.1.1. Host Party(ies):

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The host party to the project activity is the Government of India (GoI).

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

>>
Karnataka State.

A.4.1.3. City/Town/Community etc:

>>
Chitradurga district.

A.4.1.4. Detail of physical location, including information allowing the unique identification of this project activity (maximum one page):

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The project activity is located in the Jogimatti Wind Zone at Chitradurga District in Karnataka, India. Chitradurga is approximately 200 km from Bangalore, the capital of Karnataka. It is located on the Bangalore–Mumbai highway. The existing EIL's wind farms are located between 15°10'N and 15°12'N latitude and 76°38'E and 76°42'E longitude. The nearest railway station is at Chitradurga.

A.4.2. Category(ies) of project activity:

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The project activity is considered under CDM category zero-emissions **'grid-connected electricity generation from renewable sources'** that generates electricity in excess of 15 GWh per year (limit for small scale project). Therefore as per the scope of the project activity enlisted in the 'list of sectoral scopes and related approved baseline and monitoring methodologies (version 02 Mar 05/07:23)', the

project activity may principally be categorized in Scope Number 1, Sectoral Scope - Energy industries (renewable/ non-renewable sources).

A.4.3. Technology to be employed by the project activity:

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The Project Activity involves 28 numbers of Enercon made E-40, 600 kW rated Wind energy Converters (WECs) with internal electrical lines connecting the projects with local evacuation facility including local 11kV / 66 kV substation and a 32 km long 66 kV Double Circuit line connecting the Wind Park with the local KPTCL 66 kV substation at Ramagiri. The WECs generates 3-phase power at 400V, which is stepped up to 33 KV. The Wind Farms operate as base load units and can operate in the frequency range of 47.5 – 51.5 Hz and in the voltage range of 400 V ± 12.5%. PPAs for 10 years term extendible by another 10 years with mutual consent with Karnataka Power Transmission Corporation Limited has been agreed upon.

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

⇒ Gearless Construction - Rotor & Generator Mounted on same shaft eliminating the Gearbox.
⇒ Variable Speed function ensuring optimum efficiency at all times. Having speed range of 18 to 50 RPM.
⇒ 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 needed due to low speed generator which runs at maximum speed of 50 rpm and uses Air Brakes.
⇒ Three Independent Braking System.
⇒ Generator achieving rated output at only 50 rpm.
⇒ Incorporates lightning protection system, which includes blades.
⇒ Starts Generation of power at wind speed of 2.5 m/s.

EIL has secured and facilitated the technology transfer for wind based renewable energy generation from Enercon GmbH, has established a manufacturing plant at Daman in India, where along with other components the "Synchronous Generators" using "Vacuum Impregnation" technology are manufactured. Moreover, Enercon India Limited has acquired capabilities to export synchronous generators and blades of the wind turbines, is recognized as an export house by the Government of India and has successfully exported wind turbines to Australia.

A.4.4. Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed CDM project activity, including why the emission reductions would not occur in the absence of the proposed project activity, taking into account national and/or sectoral policies and circumstances:

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- In the absence of the project activity, in view of the substantial energy deficit situation in the state of Karnataka, the capacity addition from the CDM project activity would reflect a 'Business As Usual Scenario' for the grid, which has fossil fuel based generating stations connected to it. This means that a 48(a) baseline approach as described in the CDM Guidelines for determining the baseline for the CDM activity can be used, with the baseline being defined, as demonstrated in Section B, as fossil-

fuel energy resources that otherwise would be installed or expanded by the regional power authority during the crediting period in absence of the CDM wind power additions.

- On account of the Project Activity, the power generated by the Wind Power Projects shall result in avoidance of such 'Business As Usual Scenario' (GHG emission in the grid, which would have otherwise occurred, to generate the same power in absence of the project).
- Being a wind power project, the power generation will have net zero GHG emissions.
- The Project contributes towards reducing the demand for fossil fuels and supply gap in the state electricity grid of Karnataka. Further it diversifies the generation mix and aligns itself towards renewable sources. The project is the first commercial grid connected power plant harnessing wind resources in the Karnataka state. The nodal agency Karanataka Renewable Energy Development Agency (KREDL) has been set-up to frame policy for utilizing available renewable sources within the state. Therefore the project activity is in line with the state and sectoral policy to develop and harness more natural non-polluting renewable resources.

A.4.4.1. Estimated amount of emission reductions over the chosen crediting period:

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The project activity expected to generate an average of 42.50 GWh of electricity during each year of the crediting period. The emission rate of the selected baseline grid (Karnataka state) where the project activity will occur, would displace fossil fuel based electricity generation to the extent of the electricity generated by this wind project (956 tons of eqCO_2 per GWh of electricity produced). Therefore, the total estimated emission reductions achieved during each year of the crediting period is 40,020 tons of CO_2, aggregating to 400,205 tons during 10-years.

A.4.5. Public funding of the project activity:

There is no Official Development Agency funding to be used for the project activity. The total project cost is estimated at Rs. 883 million. For project financing, the Indian Renewable Energy Development Agency (IREDA), under the Ministry of Non-Conventional Energy Sources (MNES) provides long-term finance for implementing non-conventional energy projects, and the Project Activity has secured a loan from IREDA to the extent of Rs 424 million. This loan, however, is not ODA.

The project proponent proposes to identify potential participants in due course and it is as yet not known if any public funding shall be sought. In case public funding is sought, the proponent shall duly ensure that it is additional to an ODA.

SECTION B. Application of a baseline methodology

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

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The approved baseline methodology **ACM0002** has been used to determine the baseline emissions and emission reductions due to the project activity. The title of this baseline methodology is "Consolidated baseline methodology for grid-connected electricity generation from renewable sources".

B.1.1. Justification of the choice of the methodology and why it is applicable to the project activity:

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This CDM project is wind based renewable energy source, zero emission power project connected to the KPTCL grid. The state body governing the generation and dispatch of electricity from the grid connected power plants under the grid's jurisdiction.

The 48(a) baseline methodology approach can be applied to the project activity because:

⇒ sufficient information exists to demonstrate in a transparent and conservative manner that Enercon Wind Farm is subject to prohibitive barriers, and its registration as a CDM project would enable it to overcome those barriers;
⇒ sufficient information exists to demonstrate in a transparent and conservative manner that the type of activity undertaken in the Enercon Wind Farm project is not common practice at the present time;
⇒ Enercon Wind Farm (project activity) will displace fossil fuel based electricity that would otherwise be provided by the operation and expansion of the Karnataka state grid; the extent of the Karnataka state grid can be clearly identified and the required data is available; and
⇒ the Karnataka state power sector is not dominated by generating sources with zero or low operating costs such as hydro and nuclear, and their contribution is less than 50% of the total grid generation.

B.2. Description of how the methodology is applied in the context of the project activity:

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The baseline methodology approach 48(a) called "**existing actual or historical emissions, as applicable**" has been applied in the context of the project activity. The approach selected in the baseline methodology checks the additionality of the project activity and determines the baseline emission factor for selected baseline scenario. The details are discussed below.

1. Demonstrating the additionality of the project

This project activity will be defined as additional[1] if anthropogenic emissions of GHGs by sources are reduced below those that would have occurred in the absence of the registered CDM project activity.

Within the scope of the adopted baseline methodology, additionality has been demonstrated by crossing certain barriers as per the following steps, which are organised below as per the CDM Meth Panel guidelines[2] as explained in the baseline methodology adopted for this project activity.

Steps for Additionality Check	Demonstration of crossing Additionality Check Steps	Conclusion
Step 0: Preliminary screening based on the starting date of the project activity. Has construction of the project already started? If yes, is there verifiable	✓ Yes, the construction of the project activity has started after January 2000, and the project is operation at present. ✓ EIL had gained awareness regarding carbon credit opportunities in 2000 through various seminars and conferences. It also began to apprise its customers of the emerging carbon opportunities. In late 2001, EIL decided to participate in CERUPT tender, and has managed to win it. This provided a positive boost to Enercon's assessment of	The project activity has crossed step 0 of additionality demonstration, and can move to step 1.

[1] As per 17/cp.7.

[2] As per "Annex 1: Tool for the demonstration and assessment of additionality".

Steps for Additionality Check	Demonstration of crossing Additionality Check Steps	Conclusion
evidence to justify that CDM was seriously considered at the start of the project?	the feasibility of the CDM revenues. ✓ The EIL management had taken a decision to move ahead with the project, after considering CDM benefits under the Kyoto Protocol. There is documentary evidence to such decision that could be verified by the validator.	
Step1: Identification of alternatives to the project activity consistent with current laws and regulations		
Sub-step 1a. Define Alternatives to the project activity	✓ A practical alternative to the project activity is to use a higher GHG intensive fuel like coal for power generation, in keeping with the existing/ prevalent trend and prevailing practice in the Karnataka state, or capacity additions to the existing thermal power plants (constitutes >50% of generation in the recent past).	
Sub-step 1b. Enforcement of applicable laws and regulations	✓ Electricity generation from wind farm is not a legal requirement or a mandatory choice. There are state and sectoral policies, primarily framed to encourage wind based power project to attract more private investment as there are many anticipated risks under the project and requires good amount of equity to be involved. ✓ The Indian Electricity Act of 2003 does not restrict or empower any authority to restrict the fuel choice for power generation. In addition, it may be noted that the draft National Electricity Policy (revised in August 2004) asserts 'coal would necessarily continue to remain the major fuel'. ✓ The applicable environmental regulations do not restrict the use of wind energy for power generation. ✓ There is no legal requirement on the choice of a particular technology for power generation.	The project activity has crossed step 1 (1a and 1b) of additionality demonstration, and can move to either step 2 or step 3 or both. In the present case, step 3 has been opted for.

Steps for Additionality Check	Demonstration of crossing Additionality Check Steps	Conclusion
Step 3: Barrier analysis	*The project activity faces the following barriers that would have prevented its implementation, but do not prevent implementation of the identified alternative to the project.* ✓ Investment barriers, which the project activity needed to overcome are: o EIL has tried but has not been able to secure long-term project finance on a non-recourse / limited recourse basis. Financing provided by the IREDA is available for a term of 10 years but is significantly above market interest rates and has been aligned with market rates only recently. IREDA specially formed for providing finance for non-conventional energy projects does not provide financing on a non-recourse / limited recourse basis. In spite of the reforms introduced in the power sector due to several years of their experience with the state-owned utilities, no financial institutions (including IREDA) for financing wind power projects is willing to take exposure to the investment risks, and hence it is not difficult to see why securing financing on non-recourse / limited recourse was difficult. o The policy continues to change to the detriment of the wind power project developer, and there are even more prohibitive barriers due to the policies of the off-taker and the regulator in the Karnataka state. o At Rs. 3.49 per kWh as stipulated in the old Karnataka policy, the tariff for generation from wind would be higher than any other source that KPTCL buys from but not significantly higher than, for example, tariff of nuclear power plants which is Rs. 3.20 per kWh. Though PPA provides for Rs 3.49 as per the notification issued by the Ministry of Non-Conventional Energy Sources (MNES), the tariff allowed and admitted by KPTCL is less than the PPA rate. o Further KPTCL compares the wind energy tariff with depreciated conventional coal based power plants and thus try to push the wind power tariff down. Thus the tariff determined and admitted by the KPTCL is much less than the normative tariff resulting in very low Debt Service Cover for the project activity. o The wheeling charges have been increased from 2% to 10%. As a result, the net benefit of captive generation is around Rs. 3.00 to Rs. 3.25 per kWh.	The project activity has crossed step 3 of additionality demonstration, and can move to step 4.

<table>
<tr><th>Steps for Additionality Check</th><th>Demonstration of crossing Additionality Check Steps</th><th>Conclusion</th></tr>
<tr><td></td><td>✓ <u>Technological barriers:</u>
o EIL has secured and facilitated technology transfer for wind based renewable energy generation from Enercon GmbH, and has established a manufacturing plant at Daman in India.

✓ <u>Barriers due to prevailing practice:</u>
o Out of the total wind farms installed in the country, 80% are for captive use and 20% are grid connected. In Karnataka, the scenario is almost same as in the rest of the country. EIL is one of the few developers who have been developing grid connected wind farm projects through SPVs in order to show that such investments could be done on stand-alone basis. This is opposite to the normal trend of investments in wind power plant which tends to be for captive purpose, in smaller size, quite often with one of the objectives being tax planning and financed on balance sheet.</td><td></td></tr>
<tr><td>Step 4:
Is the project common practice?</td><td>✓ Wind based power projects are set up in only six states in India (as shown below), with lowest penetration rate of 0.96% in Andhra Pradesh to highest penetration rate of 10.66% in Tamil Nadu. The grid penetration level in Karnataka is also low at 2.12%. Thus, similar project activities exist only in some states of the country, and the project acitivity is not a common practice.

<table><tr><th>State</th><th>Grid penetration[3]</th></tr><tr><td>Andhra Pradesh</td><td>0.96%</td></tr><tr><td>Gujarat</td><td>1.95%</td></tr><tr><td>Karnataka</td><td>2.12%</td></tr><tr><td>Maharashtra</td><td>2.64%</td></tr><tr><td>Rajasthan</td><td>1.35%</td></tr><tr><td>Tamil Nadu</td><td>10.66%</td></tr></table></td><td>The project activity has crossed step 4 of additionality demonstration, and can move to step 5.</td></tr>
<tr><td>Step 5:
Impact of CDM registration</td><td>✓ The impacts of CDM registration include, inter alia, access to CDM revenues, access to new technologies, institutional capacity building, etc.

✓ In September 2003, the Karnataka Electricity Regulatory Commission (KERC) allowed the Karnataka Power</td><td></td></tr>
</table>

[3] Wind installed capacity divided by total capacity available/allocated to the respective state power sector. The installed capacity of wind has been taken as on 31.3.03 from MNES Annual Report 2002-03. The total capacity available/allocated to respective state power sector has been taken as on 31.1.2003 from Ministry of Power Annual Report 2002-03.

Steps for Additionality Check	Demonstration of crossing Additionality Check Steps	Conclusion
	Transmission Corporation Limited (KPTCL), the off-taker, to get a 70% share of CDM revenues as part of approval of PPAs. CDM revenues are therefore a key consideration to development of wind power projects in the state. ✓ Registering the project activity as a CDM activity provides a significant amount of revenue, improving the project's cash flow and hence its bankability. The IRR with CDM revenue works out to 13% instead of 12% without the revenues. A 16% return on equity has been a typical benchmark in the electricity utility industry. However, for this wind project, IRR based on a 10 year cash flow is estimated at 12% without CER revenue and 13% with CER revenue. Thus the cost of debt in case of EIL at Karnataka can be extrapolated as 10.5%. The CDM revenues will assist the investor in realizing returns commensurate the risks in development and operations of the project. It will also assist in off-setting the extra costs that the developer had to bear to facilitate the investments.	

2. Define the baseline scenario and calculate the baseline emission rate

2.1 Baseline Scenario

The baseline scenario is that the Karnataka electricity grid generates electricity by operation of existing grid connected power plants and by addition of new generation sources. The baseline emissions are calculated using approved baseline methodology ACM0002 recommended by the CDM Meth Panel. The baseline information is provided under **Annex 3**. The details of the calculations are provided under **section E**. The calculations for the CM is based on data collected from authenticate official sources only, such as the Central Electricity Authority (CEA).

In order to understand the baseline scenario, the following information is provided below that provides information on the power generation portfolio in the Karnataka grid. The installed capacity as on 31 January 2004 is as follows: (all figures in MW).

Particulars	Coal	Gas	Diesel	Hydro	Wind	Nuclear	Total
State sector plants	1,470	0	128	2,908	3	0	4,508
Private sector plants	260	220	107	31	122	0	740
Central sector plants	544	0	0	0	0	130	674
Total Installed Capacity (MW)	**2,274**	**220**	**235**	**2,939**	**125**	**130**	**5,922**
% of Total Installed Capacity	**38.4**	**3.7**	**4.0**	**49.6**	**2.1**	**2.2**	**100.0**

It is clear that the grid profile is dominated by hydro based power plants (49.6%) followed by coal (38.4%). Other thermal power plants constitute only 12%, with gas (3.7%) diesel (4%) and nuclear

energy based power plants constitute 2.2%. Thus, wind based power projects constitute only about 2.1% of the grid power.

Also, it may be noted from information published by the CEA, that the average must-run low-cost generation in Karnataka (hydro and nuclear) during years 2002-03, 2003-04 and 2004-05 was 44.68% of the total power generation during such period.

Based on the above considerations, Karnataka grid has been selected as the baseline.

2.2 Baseline emission rate calculation

The first contribution to the baseline emission calculation is the project's impacts on the operating margin (affecting the operation of power plants on the grid). The impact on the operating margin accounts for the fact that the system operator will adjust the output of other existing plants on the system in response to the output of the project activity.

The second contribution is on the build margin (delaying or avoiding the construction of future power plants). This second contribution accounts for the fact that even a small project is likely to delay the commissioning of new generation sources, if not directly displace a specific other new generating source. In fact, this delay effect is a reasonable assumption where (a) there is a planned or unplanned sequence of new facilities to be built, and (b) the timing of construction is affected by the need to balance supply and demand, either through maintaining the reserve margin above a threshold level. In fact, this delay effect can be expected to effect total emissions at the build margin to a degree that is comparable in magnitude to the effect on the project's effect on emissions at the operating margin.

The process for considering these two contributions to the baseline emissions and estimating the emission rate of the displaced electricity is as follows.

Step 1. Calculating the Operating Margin emission factor

The "Simple OM" method has been selected as per guidelines provided in ACM0002, since low-cost/must run resources (hydro, wind and nuclear) constitute less than 50% of average total grid generation the Karnataka grid, not including low-operating cost and must-run power plants.

The operating margin emission factor **($EF_{OM,y}$)** is calculated using the generation-weighted average emissions per electricity unit of all generating sources serving the system, with a 3-year average, based on the recent statistics available at the time of PDD submission.

Step 2. Calculate the Build Margin emission factor

A mix sample of plants that reasonably represents recent trends in electric sector expansion approximates the system build margin. The proposed mix is 20% of most recent plants commissioned in the Karnataka grid has been taken for calculation of the baseline build margin emission factor **($EF_{BM,y}$)**.

Step 3. Calculate a baseline emission factor EF_y

The baseline emission factor has been calculated as the weighted average of the Operating Margin emission factor **($EF_{OM,y}$)** and the Build Margin emission factor **($EF_{BM,y}$)** where equal weights have been provided as default.

No leakage has been considered in the calculation, as per recommendations of the ACM0002. Therefore, the emission reductions are actual baseline emission (BEy), since the project activity is based on wind resources and will not have any project emissions.

Step 4. Justify conservatism of baseline methodology in the case of the project

To be conservative in estimating emission reduction and baseline emission rate calculation, following measures has been taken:

- The selected methodology suggests exclusion of low cost must run power plants from the baseline grid when these resources constitute less than 50% of the total generation of the grid.
- For calculating baseline this project proposes to use a 50:50 default weighting of the build and operating margins, i.e. combine margin.
- Electricity exports are included in electricity generation data used for calculating and monitoring the baseline emission rate to avoid potential over estimation.
- Project output has been considered to remain constant and it has been proposed that no capacity addition to the same project within the same project site will be considered as part of CDM project.
- The data has been collected from the official sources only and any sort of extrapolation has been explicitly avoided.
- To calculate the emissions of the existing power plants, the default carbon emission factors for fossil fuels as provided by IPCC have been applied (IPPC, 1996).

B.3. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity:

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In the absence of the project activity, the GHG emissions to generate and supply the same amount of power would be:

- ✓ baseline expressed in tons of CO_2 x Quantum of power generated and supplied to the grid by the project activity, and
- ✓ whereas, in the case the project activity operates the GHG emissions to generate the same amount of power will be ZERO.

B.4. Description of how the definition of the project boundary related to the baseline methodology selected is applied to the project activity:

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The project boundary encompasses the physical, geographical site of the 16.8 MW project sited at the project location specified in Section A.4.1.4 above. It would include the wind turbine installations and pooling and KPTCL sub-stations.

B.5. Details of baseline information, including the date of completion of the baseline study and the name of person (s)/entity (ies) determining the baseline:

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Dr. P Ram Babu of PricewaterhouseCoopers (P) Limited, whose contact information is set out in Annex 1, has assisted the Sponsor in determining the baseline methodology.

The baseline study was completed on 9 September 2003.

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:

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The initiation date of the Project Activity is November 2000, being the date of the purchase order issued by CEPCO Industries for 5.4 MW project. This was commissioned in May 2001. CEPCO has issued the go ahead for their 3.00 MW Project in January 2001 and the same was commissioned during August 2001. The first phase of 4.2 MW out of the 8.4 MW wind power generating facility of Enercon Windfarms (India) Ltd was commissioned in September 2001 and the II phase of 4.2 MW wind power generating facility was commissioned on June 2002.

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

>>
20 years

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

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C.2.1. Renewable crediting period

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

>>

C.2.1.2. Length of the first crediting period:

>>

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>
1 January 2003

C.2.2.2. Length:

>>
10 years

SECTION D. Application of a monitoring methodology and plan

D.1. Name and reference of approved monitoring methodology applied to the project activity:

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Approved monitoring methodology ACM0002 / Version 01 Sectoral Scope: 1, "Consolidated monitoring methodology for zero-emissions grid-connected electricity generation from renewable sources", by CDM - Meth Panel.

D.2. Justification of the choice of the methodology and why it is applicable to the project activity:

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The methodology requires monitoring of the following:

- Electricity generation from the project activity;
- Operating margin emission factor; and
- Build margin emission factor of the grid.

For the project activity to establish its creditable emission reduction, it has to record the actual electricity generation, which would displace equivalent units of electricity at the operating and build margin of the Karnataka grid. Hence, under the monitoring protocol for the project it is required to:

- Monitor and record the actual units of electricity generation by the wind farms; and
- Calculate and record the emission rate of the Karnataka grid.

Therefore, with the given requirements of the wind farms CDM project and the selected monitoring methodology, it is justified that the applied monitoring methodology (ACM002) for zero-emissions grid-connected electricity generation from renewable sources is the correct choice for the monitoring plan of the CDM project.

D.2. 1. Option 1: Monitoring of the emissions in the project scenario and the baseline scenario

D.2.1.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

Not applicable as the project is a zero-emissions grid-connected electricity generation from Wind energy – a renewable source

D.2.1.2. Description of formulae used to estimate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

>>

Not applicable

D.2.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHGs within the project boundary and how such data will be collected and archived :

ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
D5–1	Power	Generation for all generating units	MU	The data will be collected on an annual basis from national grid	Paper	Till completion of crediting period		
D5- 2	Emission Rate	Emission factor of power plants in national grid	$KgCO_2/kwh$	The data will be collected on an annual basis from national grid	Paper	Till completion of crediting period		

D.2.1.4. Description of formulae used to estimate baseline emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

>>

The emission factor *EFy* of the grid is represented as a combination of the Operating Margin and the Build Margin. If we set the emission factor of associated method as *EF_OMy* and *EF_BMy*, the *EFy* is given by:

$$EFy = w_{OM} * EF\_OMy + w_{BM} * EF\_BMy \text{……..(1)}$$

with respective weight factors w_{OM} and w_{BM} (where $w_{OM} + w_{BM} = 1$), and by default, are weighted equally ($w_{OM} = w_{BM} = 0.5$).

The Operating Margin emission factor *EF_OMy* is defined as the generation-weighted average emissions per electricity unit of all generating sources serving the system, including zero- or low-operating cost power plants (hydro, geothermal, wind, low-cost biomass, nuclear and solar generation), based on the latest year statistics data and are derived from the following equation:

$$EF\_OMy = [\sum_i Fi,y*COEFi] / [\sum_j GENj,y] \text{ ……..(2)}$$

where *TEMy* and *TGENy* are the total GHG emissions and electricity generation supplied to the grid by the power plants connected to the grid excluding zero- or low-operating cost sources. *Fi,y* and *COEFi* are the fuel consumption and associated carbon coefficient of the fossil fuel *i* consumed in the grid. *GENj,y* is the electricity generation at the plant *j* connected to the grid excluding zero- or low-operating cost sources.

The CO_2 emission coefficient $COEF_{i,j}$ is obtained as:

$$COEF_{i,j} = NCV_{i,j} * EFCO_{2,i} * OXID_i \text{…….(3)}$$

where:

$NCV_{i,j}$ is the net calorific value (energy content) per mass or volume unit of a fuel i,

$OXID_i$ is the oxidation factor of the fuel (see page 1.29 in the 1996 Revised IPCC Guidelines for default values),

$EFCO_{2,i}$ is the CO2 emission factor per unit of energy of the fuel i.

The Build Margin emission factor *EF_BMy* 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 20% of the generating units built (summation is over such plants specified by k):[2]

[2] The project participant is to demonstrate which is appropriate for the proposed project to the Operational Entity, otherwise, more conservative one is selected.

$$EF\_BMy = [\sum_i Fi,y*COEFi] / [\sum_k GENk,y] \text{……...(4)}$$

as the default method. The summation over *i* and *k* is for the fuels and electricity generation of the plants mentioned above. If the project participant can demonstrate a more accurate sampling method (to the Operational Entity), such a sample can be applied to this part of the methodology.

D. 2.2. Option 2: Direct monitoring of emission reductions from the project activity (values should be consistent with those in section E).

D.2.2.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

	Data	Source	Data	Measured	Recorded	Proportion	How	Comment

D.2.2.2. Description of formulae used to calculate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.):

>>

D.2.3. Treatment of leakage in the monitoring plan

D.2.3.1. If applicable, please describe the data and information that will be collected in order to monitor leakage effects of the project activity

ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

There is no leakage to this project

D.2.3.2. Description of formulae used to estimate leakage (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

>>
Not applicable.

D.2.4. Description of formulae used to estimate emission reductions for the project activity (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

>>
The emission reductions *ERy* by the project activity during a given year *y* is [1]

ERy = EGy * EFy …….(5)

where *EGy* is the electricity supplied to the grid, *EFy* is the GHG emission factor of the grid as calculated below (CO_2 emission factor can be used if effects of other GHGs are demonstrated to be negligible).

D.3. Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored		
Data	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
D2–1	Low	This data will be directly used for calculation of emission reductions. Sales record to the grid and other records are used to ensure the consistency.
D2- 2	Low	These data are used to check whether the applicability conditions are met.
Others	Low	Default data (for emission factors) and IEA statistics (for energy data) are used to check the local data.

D.4 Please describe the operational and management structure that the project operator will implement in order to monitor emission reductions and any leakage effects, generated by the project activity

>>
The project will be operated and managed by Enercon India who is also the project proponent. Enercon India will ensure the safe operation and a project manager will be allocated with the responsibility for safe operation of the wind farms and employees working in the farms and generation unit. The wind

[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.

power project will abide by all regulatory and statutory requirements as prescribed under the state and central laws and regulations. To ensure such performance Enercon India as mentioned above will monitor all its activities and performance related to emission, discharge and solid waste generation if any. Enercon India will install meters and where ever possible online monitoring systems to be able to measure and calculate actual creditable emission reduction in the most transparent and relevant manner. Installed meters will be calibrated according to the maintenance schedule programmed at the start of the operation and refreshed according the plants performance requirement. All the monitoring data will be recorded and kept under safe custody of the power plant manager and or the board members. Also any change within the project boundary, such as change in spare and or equipments will be recorded and any change in the emission reduction due to such alteration will also be studied and recorded.

Enercon India will generate electricity as mentioned to the capacity and for any addition will inform the relevant authority and take permission prior to execution. Such addition will not be considered as any part of the wind power project and thus no benefits will be claimed under the same project. Such project can be qualified as another CDM project.

Although it is being anticipated that there won't be any leakage of the wind power project, however, if any such condition arises, and leakage effect is found due to wind power project, such leakage will be accounted accordingly as mentioned in the chosen applied baseline methodology.

D.5 Name of person/entity determining the monitoring methodology:

>>

Dr. P Ram Babu of PricewaterhouseCoopers (P) Limited, whose contact information is set out in Annex 1, has assisted the Sponsor in determining the monitoring methodology.

SECTION E. Estimation of GHG emissions by sources

E.1. Estimate of GHG emissions by sources:

>>

Using the ACM0002 methodology that is recommended by the CDM Meth Panel, the projected GHG emission reductions for the CDM activity are determined.

The project activity is a wind based power generation project, hence there will be no GHG emissions of from the project activity. Therefore, no calculation is required here.

E.2. Estimated leakage:

>>

Leakage is defined as the net change of anthropogenic emissions by sources of GHGs that occur outside the project boundary, which can be measured and directly attributed to the CDM project activity.

No leakages were identified due to the project activity. Therefore, no calculation is required here.

E.3. The sum of E.1 and E.2 representing the project activity emissions:

>>

Zero.

E.4. Estimated anthropogenic emissions by sources of greenhouse gases of the baseline:

>>

The anthropogenic emissions in the baseline are 56,580 tCO_2 each year during years 2003 – 2012.

E.5. Difference between E.4 and E.3 representing the emission reductions of the project activity:

>>

The total emission reductions are 565,800 tCO_2.

E.6. Table providing values obtained when applying formulae above:

Particulars	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Total
Baseline (tCO2/GWh)	1283	1283	1283	1283	1283	1283	1283	1283	1283	1283	
Enercon WindFarm India Limited											
Generation (GWh)	24.50	24.50	24.50	24.50	24.50	24.50	24.50	24.50	24.50	24.50	
CEPCO India Limted											
Generation (GWh)	19.60	19.60	19.60	19.60	19.60	19.60	19.60	19.60	19.60	19.60	
Total Generation (GWh)	**44.10**	**44.10**	**44.10**	**44.10**	**44.10**	**44.10**	**44.10**	**44.10**	**44.10**	**44.10**	
Emission Reduction (tCO2)	**56580**	**56580**	**56580**	**56580**	**56580**	**56580**	**56580**	**56580**	**56580**	**56580**	**565800**

SECTION F. Environmental impacts

F.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

>>

Thirty categories of activity with a certain investment criteria are required to undertake an Environmental Impact Assessment (EIA) under The Environmental Impact Notification of Government of India. This Project Activity is not covered under this notification. Nevertheless, the project sponsors have undertaken an Environmental Impact Assessment prior to validation of the project. The copy of the EIA is available for review.

To conduct this Environment Impact Assessment (EIA), Enercon (India) Limited, Mumbai appointed M/s CARE Sustainability, Navi Mumbai. The consultant conducted a Rapid EIA study and produced report on same - Environmental Impact Assessment for Wind Energy Farms at Chitradurga, Karnataka. However EIA of this project is not essential to obtain the environmental regulatory clearances.

It should be noted here that EIA is not a regulatory requirement in India for wind energy projects, but the project sponsors still conducted the EIA to study if any irreversible and unacceptable impacts on the environment resulted and would result from the project activity.

The EIA also ruled out any trans-boundary impacts.

Summary of findings from the study:
The environmental impact assessment study includes identification, prediction and evaluation of potential impacts of the CDM activities (i.e. the generation of electricity through wind energy converters (WEC), its evacuation and transmission to the KPTCL at Chitradurga on terrestrial and aquatic environment within the study area.

Summary Report of EIA Study has been attached at end of this project design document.

F.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 environmental impacts of the project are not considered significant. The EIA for this project is not required as per existing regulations in the host country, i.e., India.

SECTION G. Stakeholders' comments

>>

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

>>
Enercon (India) Limited identified local communities, NGOs, state government and governmental agencies, employees, contractors, labuors, and shareholders as the most important stakeholders with an interest in the CDM project activity. Accordingly, Enercon (India) Limited sent out a notice to representatives of various stakeholder groups, with a brief on the project, informing them of the proposed meeting on 24th June 2004 at Enercon (India) Limited, Blade Refurbishment Plant, Almangala, Chitradurga, and requesting each stakeholder group to send representatives to the said meeting at the appointed hour.

Members Present:

Representatives from the Villages:

Mr. Mallappa, Ex Chairman, Gram Panchayat, Aimangala

Mr. J. Veeranna, Member, Zilla Panchayat, Seegehatti, Hiriyur
Mr. Chandraiah, Teacher, Aimangala
Mr. Chikkanna, Aimangala
Mr. G. Thippeswamy, Kallatti
Mr. G. M. Thuimmegowda, Kallatti
Mr. Ajjana, Kallatti
Mr. A. Thippeswamy, Kallatti
Mr. Shivanna, Kallatti
Mr. Anjappa, Kallatti
Mr. Anjaneya, Chitradurga
Mr. Mahesh, Aimangala
Mr. Afsar, Chitradurga

Representatives from Enercon (India) Ltd.

Mr. C. B. Poonacha, Manager, Security and Administration
Mr. C. Rakesh, Dy. Manager, Liasoning
Mr. L. Shivkumar, Sr. Engineer, Projects
Mr. M. Naveen Kumar, Asst. Officer, Administration

Representatives from Care Sustainability

Dr. (Mrs.) Suju George, Managing Director
Mr. Srinivas Rao, Head, Environmental Services

G.2. Summary of the comments received:

>>
The Agenda of the Meeting was set as below:

1. Welcome Address and Introduction
2. Project Profile
3. Description about Wind Energy, CDM, Environmental & Social Issues.
4. Queries and Responses from the Proponent and Stakeholders
5. Vote of Thanks
6. Summation of the concerns expressed by the stakeholder groups and the commitments to address the concerns made by TPGL by the Chairperson.
7. Preparation and circulation of draft Minutes of the Meeting and signing of the MOM.

⇒ Mr. C. B. Poonacha, Manager (S&A), EIL, Chitradurga invited Mr. Mallappa to Chair the session and Mr. J. Veeranna as Chief Guest.

⇒ In the Welcome Address, Mr. C. B. Poonacha introduced in brief the purpose of the meeting, the efforts of Enercon at Chitradurga, the benefits of Wind Mills & Wind Energy and the increase in employment opportunities to the local village people due to manpower requirement for windmills projects. He also spoke about the improvement in social and economic growth of the villagers by having Eco friendly projects like Wind Power. He informed the stakeholders about the efforts of Enercon (India) Ltd., which has taken up many welfare activities in villages viz. construction of roads, schools, temples and the company's plan to take up Free Medical Camps, Food and Books supply for poor students in villages etc.

⇒ Mr. L. Shivakumar had briefed the villagers about the project . He described the stakeholders regarding the contribution of EIL to the Karnataka Power Grid and also ongoing projects of EIL in and around Chitradurga.

⇒ Mr. L. Shivakumar gave a brief description about the benefits of Wind Energy. He gave an idea to the stakeholders about the difference between the polluting conventional thermal power generation using coal and non-conventional renewable energy resources like Wind Energy. He also explained the stakeholders regarding the Green House Gas Emissions, Global Warming and potential natural disasters. He summarized the Kyoto protocol, Clean Development Mechanism, and its benefits to the Country.

⇒ After the brief address, opinions, suggestions and enquiries from the Stakeholders were sought.

⇒ The meeting was concluded with the Vote of Thanks by Mr. Naveen Kumar.

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

>>

Summary of the question answer and discussion round has been attached to this PDD as Annex 6 Public Consultation Meeting for Wind Farm Projects as Clean Development Mechanism Projects in Chitradurga District, Karnataka State.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

PRIMARY PROJECT SPONSOR

Organization:	Enercon India Limited
Street/P.O.Box:	Kolsite House, Plot No. 31, Shah Industrial Estate, Veera Desai Road,
Village:	Andheri (West)
District:	Mumbai
State/Region:	Maharashtra
Postfix/ZIP:	400 053
Country:	India
Telephone:	+91-22- 5673 0085
FAX:	+91-22-5673 0092
E-Mail:	ymehra@enerconindia.net
URL:	
Represented by:	
Title:	Managing Director
Salutation:	Mr.
Last Name:	Mehra
Middle Name:	
First Name:	Yogesh
Department:	CEO
Mobile:	
Direct Fax:	+91-22-5673 0092
Direct Tel:	+91-22- 5673 0085
Personal E-Mail:	ymehra@enerconindia.net

Annex 1 contd…

Organization:	Enercon Wind Farm (India) Limited
Street/P.O.Box:	Kolsite House, Plot No. 31, Shah Industrial Estate, Veera Desai Road,
Village:	Andheri (West)
District:	Mumbai
State/Region:	Maharashtra
Postfix/ZIP:	400 053
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Telephone:	+91-22- 5673 0085
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Represented by:	
Title:	Managing Director
Salutation:	Mr.
Last Name:	Mehra
Middle Name:	
First Name:	Yogesh
Department:	CEO
Mobile:	
Direct Fax:	+91-22-5673 0092
Direct Tel:	+91-22- 5673 0085
Personal E-Mail:	ymehra@enerconindia.net

Annex 1 contd…

Organization:	CEPCO Industries (P) Limited
Street/P.O.Box:	8 Balajee Enclave, Guru Ravidas Marg,
Village:	Kalkaji,
District:	New Delhi
State/Region:	Delhi
Postfix/ZIP:	110 019
Country:	India
Telephone:	+91-11- 2644 0701
FAX:	+91-11- 2646 9371
E-Mail:	cepco@vsnl.com
URL:	
Represented by:	
Title:	Director (Finance & Admn)
Salutation:	Mr.
Last Name:	Agarwal
Middle Name:	
First Name:	Rohit
Department:	Director
Mobile:	
Direct Fax:	+91-11- 2646 9371
Direct Tel:	+91-11- 2644 0701
Personal E-Mail:	cepco@vsnl.com

Annex 1 contd…

Organization:	The Netherlands represented by its Ministry of Housing, Spatial Planning and the Environment acting through the IFC-Netherlands Carbon Facility ("INCaF") and INCaF's trustee.
Street/P.O.Box:	2121 Pennsylvania Ave NW
Building:	
City:	Washington
State/Region:	DC
Postfix/ZIP:	20433
Country:	USA
Telephone:	202 473 4194
FAX:	202 974 4404
E-Mail:	carbonfinance@ifc.org, mparaan@ifc.org
URL:	www.ifc.org/carbonfinance
Represented by:	
Title:	Program Manager
Salutation:	Mr.
Last Name:	Widge
Middle Name:	
First Name:	Vikram
Department:	Carbon Finance, Environmental Finance Group, Environment and Social Development Department
Mobile:	
Direct FAX:	
Direct tel:	202 473 1368
Personal E-Mail:	carbonfinance@ifc.org

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no ODA being used to fund the project activity. The proponent proposes to identify potential participants in due course and it is as yet not known if any public funding shall be sought. In case public funding is sought, the proponent shall duly ensure that it is additional to any ODA.

Annex 3

BASELINE INFORMATION

SIMPLE OPERATING MARGIN

Power Plants	Type of FUEL	Generation April'02 - Mar'03 (GWh)	Emission Coefficient ($tCO_2/10^3$ tonnes)	GHG Intensive Fuel Used (10^3 tonnes)	Emission Rate (tCO_2)	Generation April'03 - Mar'04 (GWh)	Emission Coefficient ($tCO_2/10^3$ tonnes)	GHG Intensive Fuel Used (10^3 tonnes)	Emission Rate (tCO_2)
TORANGALLU IMP	Coal	872.00	1924.10	771.72	1484866.95	766.00	1924.10	513.22	987486.93
TANIR BAVI	Coal	1280.00	1924.10	1132.80	2179621.20	1631.00	1924.10	1092.77	2102599.46
RAICHUR	Coal	10290.00	1924.10	9106.65	17522111.09	11400.00	1924.10	7638.00	14696280.69
YELHANKA (DG)	Diesel	715.00	3177.20	141.57	449796.20	384.00	3177.20	76.03	241568.87
BELLARY DG	Diesel	64.00	3177.20	12.67	40261.48	42.00	3177.20	8.32	26421.60
BELGAUM DG	Diesel	355.00	3177.20	70.29	223325.39	235.00	3177.20	46.53	147835.12
MALLARPUR	Hydro	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HARANGI	Hydro	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BHADRA	Hydro	18.00	0.00	0.00	0.00	11.00	0.00	0.00	0.00
MANI DPH	Hydro	18.00	0.00	0.00	0.00	11.00	0.00	0.00	0.00
JOG	Hydro	146.00	0.00	0.00	0.00	160.00	0.00	0.00	0.00
KADRA	Hydro	238.00	0.00	0.00	0.00	223.00	0.00	0.00	0.00
GERUSUPPA	Hydro	297.00	0.00	0.00	0.00	358.00	0.00	0.00	0.00
MUNIRABAD	Hydro	47.00	0.00	0.00	0.00	41.00	0.00	0.00	0.00
KODASALI	Hydro	218.00	0.00	0.00	0.00	214.00	0.00	0.00	0.00
SIVASAMUNDRUM	Hydro	14.00	0.00	0.00	0.00	79.00	0.00	0.00	0.00
GHAT PRABHA	Hydro	59.00	0.00	0.00	0.00	62.00	0.00	0.00	0.00
KALINADI	Hydro	1812.00	0.00	0.00	0.00	1718.00	0.00	0.00	0.00
LIGANAMAKKI	Hydro	111.00	0.00	0.00	0.00	120.00	0.00	0.00	0.00
KALINADI SUPA	Hydro	257.00	0.00	0.00	0.00	241.00	0.00	0.00	0.00
SHIVPURA	Hydro	67.00	0.00	0.00	0.00	54.00	0.00	0.00	0.00
VARAHI	Hydro	844.00	0.00	0.00	0.00	721.00	0.00	0.00	0.00
SHIMSAPURA	Hydro	57.00	0.00	0.00	0.00	57.00	0.00	0.00	0.00
SHAHPUR	Hydro	22.00	0.00	0.00	0.00	22.00	0.00	0.00	0.00
SHARAVATHY	Hydro	2950.00	0.00	0.00	0.00	3316.00	0.00	0.00	0.00
MADHAVAMANTRI	Hydro	0.00	0.00	0.00	0.00	13.00	0.00	0.00	0.00
ALMATTI DPH	Hydro	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NARAYANPUR	Hydro	36.00	0.00	0.00	0.00	38.00	0.00	0.00	0.00
KAIGA	Nuclear	3317.00	0.00	0.00	0.00	3123.00	0.00	0.00	0.00
		13576.00		Total Emissions	21899982.31	14458.00			18202192.66

Average OM	April'02 - Mar'03	1613.14

Average OM	April'03 - Mar'04	1258.97

Specific Fuel Consumption during 2002-03

		Data Source
Coal & Lignite	0.885	Performance Review of Thermal Power Stations 2003-04 Section-9 Page no.1
Diesel	0.198	All India Electricity Statistics, General Review 2003-04; Page 116
Gas (Natural Gas, Naptha an	0.278	All India Electricity Statistics, General Review 2003-04; Page 116

Average OM =	1175.76

Specific Fuel Consumption during 2003-04

		Data Source
Coal	0.67	Performance Review of Thermal Power Stations 2003-04 Section-9 Page no.1
Lignite	1.1	Performance Review of Thermal Power Stations 2003-04 Section-9 Page no.1
Diesel	0.198	All India Electricity Statistics, General Review 2003-04; Page 116
Gas (Natural Gas, Naptha an	0.278	All India Electricity Statistics, General Review 2003-04; Page 116

Specific Fuel Consumption during 2004-05

		Data Source
Coal	0.67	Performance Review of Thermal Power Stations 2003-04 Section-9 Page no.1
Lignite	1.1	Performance Review of Thermal Power Stations 2003-04 Section-9 Page no.1
Diesel	0.198	All India Electricity Statistics, General Review 2003-04; Page 116
Gas (Natural Gas, Naptha an	0.278	All India Electricity Statistics, General Review 2003-04; Page 116

NB: The Weight to Volume Ratio for the diesel is considered as 1.0
The Weight to volume Ratio for the Gas is considered as 1.0
Please ref to the site http://cea.nic.in/Rep_fuels_gen.pdf for furthe

Build Margin Calculations

Recent Project Additions to Karnataka Grid

Project/ Plant	Utility	Capacity (MW)	Date of commissioning	Generation (GWh)	Fuel Consumption (000 Tonnes)	Emission Rate	Grid Emission Factor
Raichur Thermal Unit 7	KPCL THERMAL	210.00	10-Dec-02	1287.72	1139.63	2192767.05	**1390.21**
Kappatguda East	Karnataka	2.47	31-Jul-02	5.40		0.00	
Jamkhandi Sugars	Karnataka	6.50	31-Mar-02	39.86		0.00	
MADHAVAMANTRI	BHORUKA	3.50	31-Mar-02	12.26		0.00	
Deedee Enterprises	Karnataka	0.60	31-Mar-02	2.10		0.00	
Sharavathi Tail Race	Karnataka	60.00	30-Mar-02	210.24		0.00	
Raitha Sahakari Sugars	Karnataka	3.00	31-Dec-01	18.40		0.00	
Topaz	Karnataka	0.60	31-Dec-01	1.31		0.00	
TOTAL				**1577.29**		**2192767.05**	**1390.21**

Combined Margin Calculations

COMBINED MARGIN	
OM (tCO_2/GWh)	**1175.76**
BM (tCO_2/GWh)	**1390.21**
CM (tCO_2/GWh)	**1282.98**

Type of FUEL	Net Calorific Value* (TJ/ 10^3 tonnes)	Carbon Emission Factor* (t C/ TJ)	Fraction of Carbon Oxidised - Oxidation Factor**	Emission Coefficient (tCO_2/ 10^3 tonnes)
Diesel***	43.33	20.2	0.990	3177.2
Natural Gas***	48.15	15.3	0.995	2687.7
Coal****	19.98	26.8	0.980	1924.1
Lignite****	9.8	27.6	0.980	971.9

Notes:
* Default values obtained from Table 1-2 of Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Workbook
** Default values obtained from Table 1-4 of Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Workboo
*** Default values obtained from Table 1-3 of Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories:
**** Default values obtained from Table 2.4 of IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories.

Annex 4

MONITORING PLAN

The general conditions set out for metering, recording, meter readings, meter inspections, Test & Checking and communication shall be applicable for both electrical energy and gas, where relevant and applicable.

Metering: The Delivered Energy shall be metered by the Parties at the high voltage side of the step up transformer installed at the Project Site.

Metering Equipment: Metering equipment shall be electronic trivector meters of accuracy class 0.2% required for the Project (both main and check meters). The main meter shall be installed and owned by the Company, whereas check meters shall be by the Corporation. Dedicated core of both CT's and PT's of required accuracy shall be made available by the Company to Corporation. The metering equipment shall be maintained in accordance with electricity standards. Such equipment shall have the capability of recording half-hourly and monthly readings. The Company shall provide such metering results of the Corporation. The meters installed shall be capable of recording and storing half hourly readings of all the electrical parameters for a minimum period of 35 days with digital output.

Meter Readings: The monthly meter readings (both main and check meters) shall be taken jointly by the parties on the first day of the following month at 12 Noon. At the conclusion of each meter reading an appointed representative of the Corporation and the Company shall sign a document indicating the number of Kilowatt-hours indicated by the meter.

Inspection of Energy Meters: All the main and check energy meters (export and import) and all associated instruments, transformers installed at the Project shall be of 0.2% accuracy class. Each meter shall be jointly inspected and sealed on behalf of the Parties and shall not be interfered with by either Party except in the presence of the other Party or its accredited representatives.

Meter Test Checking : All the main and check meters shall be tested for accuracy every calender quarter with reference to a portable standard meter which shall be of an accuracy class of 0.1%. The portable standard meter shall be owned by the Corporation at its own cost and tested and certified at least once every year from an accepted laboratory standard meter in accordance with electricity standards. The meters shall be deemed to be working satisfactorily if the errors are within specifications for meters of 0.25 accuracy class. The consumption registered by the main meters alone will hold good for the purpose of billing as long as the error in the main meters is within the permissible limits.

If during the quarterly tests, the main meter is found to be within the permissible limit of error and the corresponding check meter is beyond the permissible limits, then billing will be as per the main meter as usual. The check meter shall, however, be calibrated immediately.

If during the quarterly tests, the main meter is found to be beyond permissible limits of error, but the corresponding check meter is found to be within permissible of error, then the billing for the month up to the date and time of such test shall be as per the check meter. There will be a revision in the bills for the period from the previous calibration test upto the current test based on the readings of the check meter. The main meter shall be calibrated immediately and billing for the period thereafter till the next monthly meter reading shall be as per the calibrated main meter.

If during the quarterly tests, both the main meters and the corresponding check meters are found to be beyond the permissible limits of error, both the main meters shall be immediately calibrated and the correction applied to the reading registered by the main meter to arrive the correct reading of energy supplied for billing purposes for the period from the last month's meter reading upto the current test. Billing for the period thereafter till the next monthly reading shall be as per the calibrated main meter.

If during any of the monthly meter readings, the variation between the main meter and the check meter is more than the permissible limit for meters of 0.2% accuracy class, all the meters shall be re-tested and calibrated immediately.

Interconnection and Metering Facilities: The Company shall provide dedicated core for the check metering.

Communication Facilities: The Company shall install and maintain at its cost communication facilities such as fax and telecommunication facilities to the Project to enable receipt of data at Corporation's Load Despatch Centre.

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Annex 5

Project's contribution to Sustainable Development

The wind power project contributes to the sustainable development of the region and country, through a profitable operation of the units and thereby creation of sustainable shareholder, economic, social and environmental value.

The strategic objectives identified by the project to achieve the stated goals include increased share of renewable energy in the Indian Context more specifically through a focus on wind energy, increased rural incomes, reduced vulnerability and empowerment of the vulnerable sections of society. More specifically, the project shall contribute to the sustainable development of the region and country by addressing the following broad issues:

1.0 Policy and Development

a) The wind power project is situated in rural area thereby creating employment opportunities in the rural areas in operation and maintenance of the Wind Turbine Generators. Creation of employment opportunities in rural areas has long been recognized as a major concern for sustainable development and to stem the mass exodus from rural to urban areas. This concern, has formed the cornerstone of most of Government of India's rural development programmes. To that extent, the activity directly addresses a core national concern.

b) The wind power project is in keeping with the policies of MNES and Government of Karnataka. It contributes towards the achievement of the stated target of Government of Karnataka (GOK), to raise the share of renewable energy to 10% of total energy consumed in Karnataka by 2010.

c) Southern region, at the end of the 9^{th} plan, was expected to have an energy surplus of 2.7%. In light of the likely shortfall of the plan targets by nearly 30%, the state is likely to have an energy deficit at the end of the 9^{th} plan, as opposed to the surplus that was projected. The project, though in a small measure, shall contribute to mitigation of the shortfall.

d) The wind power project is located at several rural locations, thereby contributing to reducing the T&D losses to some extent. The T&D losses in Karnataka, as per 16^{th} CEA Survey report, was projected to decrease to 18.90 by 1999-00 but the actual as per the KPTCL annual report for the year 1999-00 was 38%. This issue of serious concern is, t, addressed by this project to a limited extent.

e) The wind power project, shall contribute to reduction in T&D losses and makeup of supply deficit, thereby it shall contribute to improved service delivery as regards consumers of power in the state.

2.0 Environment

a) The bridging of supply shortfall shall be by the use of a non-polluting and renewable resource. The fact that wind power has nearly no climate change implication, is of particular importance.

b) Wind energy contributes to reduction in specific emissions (emissions of pollutant/unit of energy generated) of pollutants for the country as a whole.

c) Wind Energy uses a renewable resource, thus contributes to resource conservation.

d) Wind Power projects address the increasingly insurmountable problem of solid waste disposal encountered by most of the other sources of power, as they generate nearly no solid waste.

e) Large coal based power plants have a water consumption rate of 130.8 m^3/day/MW installed capacity. This diverts an increasingly scarce resource to energy generation and the consequent pollution, which is avoided in wind energy generation.

f) Noise pollution is often associated with Wind Turbine Generators. This is not the case with the Wind Turbine Generators installed under this project predominantly on account of the fact that these are gearless WECs.

g) There is considerable wind resource in Karnataka which has not been harnessed. According to the 2003 Annual Report of Ministry of Non Conventional Energy Sources, the gross wind power potential in Karnataka is around 6,620 MW and the technical potential has been assessed to be 1,120 MW (taking into consideration the grid constraints), whilst the installed capacity as on September 2003 is only around 124 MW. This Project acts as a catalyst towards sustainable wind energy development in the state of Karnataka.

h) The wind farm is located in a region, which is not on any notified migratory route of migratory birds.

i) Traditionally, the land has been used for grazing cattle and collection of firwood. In light of the fact that the land requirement for installation of WECs is very small, no significant impact on the existing resource use pattern is expected.

j) In addition to (i) above, the promoters intend to, to the extent feasible, promote availability of firewood and fodder grass to the local community.

k) The installation of this wind farm on the hilltop/ridge requires laying of kuchcha (uncarpeted) approach roads. These approach roads act as firelines.

l) The approach roads shall also enhance access to previously inaccesible areas, which facilitates better management of the resources in such areas as also improved fire fighting capability in instances of uncontrolled fires.

m) An Initial Environmental Assessment has been undertaken prior to validation of the project.

3.0 Socio-economic

The wind power project is proposed in a state, which is rated amongst the leaders as regards socio-economic development. This is reflected in the states sex ratio which stands at 964 as compared to national sex ratio of 933, the literacy rate of 58%, particularly the female literacy rate of 50%, is better than the national rates of 55% & 50% respectively. Moreover, Chitradurga District where the project is proposed has a sex ratio of 955 and literacy rate of 65% and 48% for male and female respectively. The sex ratio in rural Chitradurga is 956 while the literacy rate rate is 63% and 44% for male and female respectively. On these indicators though the proposed site is better than the national average, it is located in a relatively under developed area of the state.

a) The project is expected to directly create an annual employment opportunity for 30-35 persons during the operation stage.

   The average rural main employment rate at 39.9% for the district is higher than the average of Karnataka, which is at 38.66% and higher than the national average of 33.20% also. It is pertinent to mention that where 34.39% of rural main workers in Karnataka are Agricultural labourers while about 48.82% of the rural main workers in the district are agricultural labourers. This occupation besides being periodic employment presents significant income insecurity on account of numerous risks. Thus secure employment or stable income opportunity on account of the in the wind farm contributes significantly to enhanced income security in the region.

b) Increased income security shall contribute to the empowerment of the most vulnerable sections of the society. The setting up of the unit shall provide some amount of income security to agricultural laborers in the regions.

   It is also pertinent to mention, that a higher proportion at 61.07% of the agricultural labourers and 72% of the marginal labourers are women. Though the wind farm does not employ women but employment of men facilitates transition of marginal labourers to main labour category and improvement in the income security for the same.

c) Since agricultural labourers and marginal labourers are comprised primarily of persons from the vulnerable sections of society, this employment opportunity, though small, shall contribute to empowerment of vulnerable sections.

d) Increased availability of electrical energy shall in the long run reduce dependence on bio-mass based energy sources for domestic consumption. Besides GHG implications, this haspositive implications for health as Indoor air pollution annually kills 150,000 women in India.

e) It is expected that the wind power project shall result in widening of the skill base of the local community. Several O&M work are proposed to be outsourced to local contractors and the local labour and workmen shall thus acquire new skills through a type of “on the job training”.

f) This exposure, together with an increased income potential in construction, operation and maintenance of an operating facility, shall result in capacity development of all persons involved in these phases of the project.

g) It is pertinent to mention that since most of the labour shall be drawn from the pool of agricultural and marginal labourers, which are comprised primarily of the vulnerable sections of the society, this capacity development shall result in empowerment of the vulnerable section.

h) A stakeholder consultation is proposed together with an Initial Environmental Examination prior to commissioning of the project.

i) The increased activity and income on account of the project shall result in several redistribution benefits and cropping up of allied services.

4.0 Technological Development

a) The WECs proposed to be used are specifically designed for the wind regimes prevalent in India.

b) The WECs proposed to be used in the power project have a microprocessor controlled rotor pitching facility which aligns and adjusts the rotor blade's pitch precisely (continuous any angle pitching) depending on wind speed to maximize conversion of wind energy. Most of the conventional WECs used in the country only provide for pitching in or pitching out of the rotor blades (only extreme positions and no intermediate positions are possible), thus the PLF of such WECs is much lower than the WECs used herein.

c) The micro-processor controlled pitching facility provides the added advantage of WEC braking by pitching out the blades whereas in conventional WECs hydraulic braking is required. Hydraulic braking results in higher wear and tear as compared to rotor pitch based braking.

d) The WECs are operated by softwares, which reduce the response time as regards pitch angle adjustment as also hub direction alignment with wind direction. This improves the PLF of the WECs.

e) The Conventional wind power project in the country use the 5D distance (where D is the coverage diameter) between machines and 7D distance between rows as a thumb rule for micro siting of WECs in a wind farm.

Annex 6

Public Consultation Meeting for Wind Farm Projects as Clean Development Mechanism Projects in Chitradurga District., Karnataka State

Venue: Enercon (India) Limited, Blade Refurbishment Plant, Almangala, Chitradurga.

Date: 24th June 2004

Enquiries from the Stakeholders sought are as follows.

Questionnaire	Stakeholders Responses
Suggestions and Opinions	From the of the Chairperson, Mr. Mellappa, Chairman of Village Panchayat has made clear about the benefits like electricity supply and employment opportunity to the villagers.
	Mr. J. Veeranna, Panchayat Member is of the opinion that the Wind Mills are helpful in growth of the region's power supply and the employment opportunities and in no way affect the rainfall. Neither does the project have any negative effects on social and economic life. Rather it is helpful in increasing employment opportunities in villages.
	Mr. Chandraih, Retd. Teacher from Aimangala said that there is no harm to the society by such Wind Mills and it eradicates the power shortage of our Country and employment problems in villages.
Have Wind Mills created any problem to the migration of Animals or Birds?	There is no incidence of any migration of Birds or Animals in the area.
Have the local people felt any sort of Noise pollution by the operations of the windmills?	There is no noise nuisance as windmills are on hilltops and are far away from the villages.
Is there a problem of water draining, erosion of soil due to windmills?	Stakeholders are of the opinion that due to rainwater draining out of the hills there is very small amount of soil erosion from the sides of the roads. However, the same is not of much significance.
Are windmills creating loss of Mineral resources?	There is no scope for such loss as the installation of windmills does not call for any major use of soil unlike mining activity.
Have you observed problem of grazing of animals?	Grazing problem has not occurred in the area. The cattle are grazing in Hill areas as usual.
Has the generation of electricity from windmills resulted in improvement of crop production?	Stakeholders are of the opinion that earlier Low voltage was a major problem for pumping the water from the borewell. The generation from the windmills has stabilized the voltage levels which has helped in timely supply of water for the crops which in turn has improved the production of crops.
Have you observed any deforestation problems due to wind energy converters? Any loss of medicinal plants?	No. The human life is not affected and there are no plants as such which have economic importance. However, afforestation is required to increase forest areas. Mr. Poonacha has informed that the Management has taken up several plantation jobs in hill areas where the windmills exist and also are on the job of creating ecofriendly atmosphere.

Questionnaire	Stakeholders Responses
Any problems the stakeholders are facing in general?	The Stakeholders are of the opinion that some portions of the road got damaged due to heavy vehicles movement of wind energy M/cs.
During construction and erection activities any damages or accidents occurred?	Till date there are no such incidents and blasting operations are being conducted with utmost care and supervision.
