CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006

CONTENTS

A. General description of project activity

B. Application of a baseline and monitoring methodology

C. Duration of the project activity / crediting period

D. Environmental impacts

E. Stakeholders' comments

Annexes

Annex 1: Contact information on participants in the project activity

Annex 2: Information regarding public funding

Annex 3: Baseline information

Annex 4: Monitoring plan

SECTION A. General description of project activity

A.1 Title of the project activity:

>> 31 MW Wind energy project in, India by Grace Infrastructure Pvt Ltd

Version 1.3– 17/07/2009

A.2. Description of the project activity:

>>

This wind energy project structured by Grace Infrastructure Pvt Limited, involves 24 wind mills (WTGs). Grace Infrastructure Pvt Ltd is the project owner and the power generated by the project is exported to the southern electricity grid of India. All the WTGs are connected to the southern grid through the Tamil Nadu Electricity Board (TNEB). The individual WTGs are micro- sited in two locations based on wind availability.

The total Installed capacity of the project is 31 MW, and the expected generation is approximately 72.93 GWh, annually.

The project activity generates and sells electricity to TNEB as under Power Purchase Agreements executed with TNEB. All the WTGs have been commissioned.

The power generated from the project activity wind energy, through wind turbine technology, enables displacement of thermal energy of that quantum and also contributes to delaying the addition of capacity of new thermal power plants.

The Significant Contributions by the project activity towards sustainable development are:

The project activity contributes sustainable development of the region and country, by creating value in the economic, social and Environmental fronts. The various dimensions of the development attempted by the project activity are as under:

Economic Well Being

- Development of Rural / Backward areas
- Most of the sites where these windmills are located are backward areas and the large-scale presence of windmills here increase direct and indirect employment opportunities. Approximately 50 new direct employments have been generated.
- This way, the windmill can contribute to country's rural development programs.
- The increasing demand in energy in the state of Tamilnadu can be met out by the energy share of windmills
- Land Values have considerably increased
- Local trade and commerce activities such as shops , lodging- houses etc have increased
- New business areas like weigh- bridges etc have opened up.

Environment Well Being

- Wind power is a renewable energy and there is no depletion of resources
- There is no emission in wind power
- There is no treated effluent since there is no water consumption
- There is no problem of solid waste handling
- There is not much of noise and heat emissions
- The area around the windmill can be used for plantation. In fact Grace Infrastructure Pvt Ltd has plans to plant Jatropa (Bio-Fuel) in all the sites.

Social Well Being

- Most of the local labour are trained in wind mill operations and maintenance resulting in skill improvement
- Local people are exposed to new technology.
- Life style and culture of the local people have improved
- Transport facilities including roads and rails have improved
- Communication has improved drastically in the villages and in the remote, where the projects are situated.
- The project has brought road and approach paths to those areas.
- The windmill sites and approach paths have facilitated grazing of cattle.

Technological Well Being

- Investment support in WTGs will bring in new international technology in the area of wind power generation.
- Local industries can gear up for providing O&M Support and they can also continuously upgrade their technology.
- In the long run technology improvements in evacuation and transmission also can also be expected.
- The growth in WTG installations can lead to indigenization of spare parts.

A.3. Project participants:

>>

Name of the 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 (Host Party)	Grace Infrastructure Pvt Ltd (Private Entity)	No

The details of individual windmills, which are part of the project activity given in Appendix – 2

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

>>

A.4.1.1. Host Party(ies):

>> The Host party is the Government of India (GOI)

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

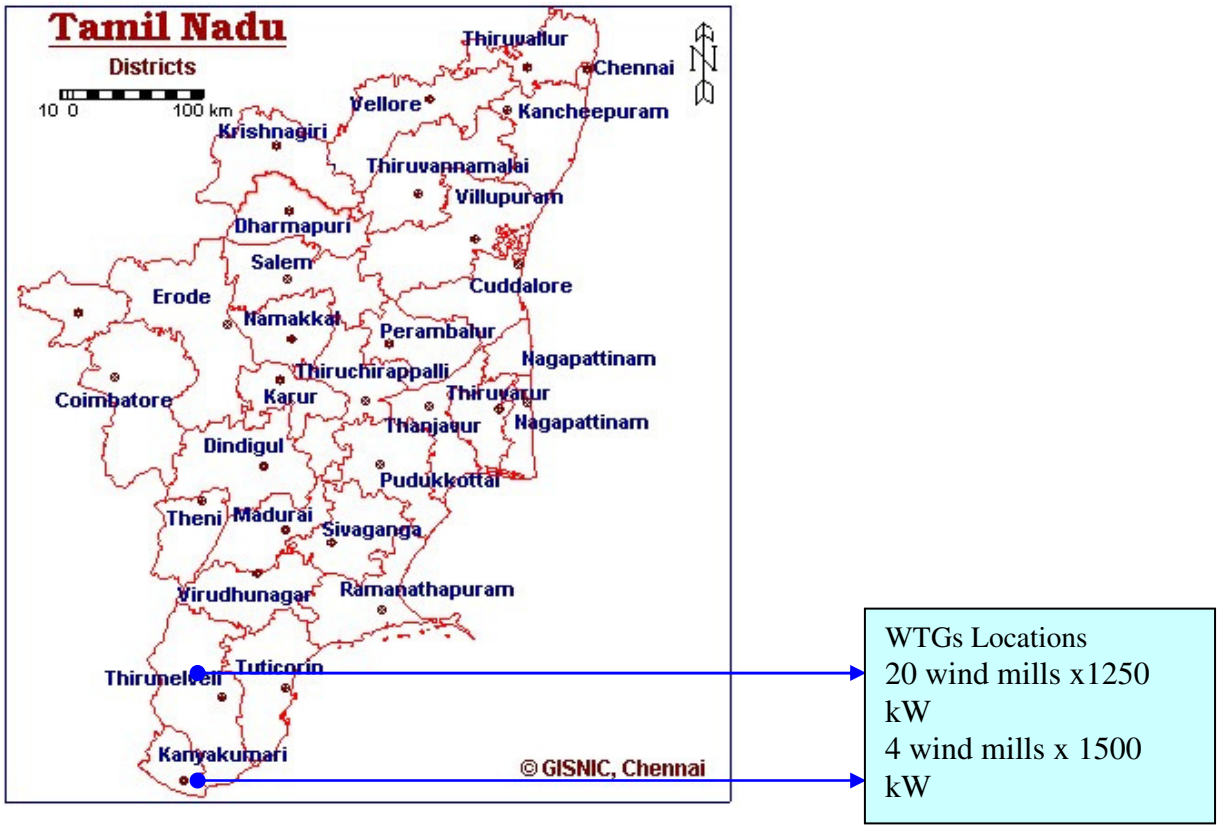
>> Tamilnadu

A.4.1.3. City/Town/Community etc:

>> Kanyakumari, Tirunelveli districts of Tamilnadu

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

>>The WTGs are installed in major locations at districts Tirunelveli and Kanyakumari. These sites in these locations have been selected through the micro-siting studies and data analysis on wind availability, speed of wind, minimum speed etc. All WTGs belonging to the project activities are connected to the same grid namely TNEB, which is part of the southern grid of India. The map showing the locations of WTGs is as follows:



The details of the locations of the WTG, with HT service connection number (for unique identification of location) are shown in Appendix –2.

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

>> The category of the CDM project activity would be –"Grid connected electricity generation from renewable sources"
Scope: 1, Energy industries (renewable - / non-renewable sources)

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

>>
Technology:

Wind energy generation is a clean technology for production of electricity, with no emission of Green House Gases. The project activity has employed Horizontal Axis WTGs of capacities 1250 KW and 1500 KW. All the WTGs deployed in the project activity are from well-known international manufacturers i.e. SUZLON.. All these machines are type tested and approved by the Ministry of Non-Conventional Energy Sources (MNES), Government of India.

This is a green power technology using wind as the prime-mover, which a renewable resource. Both the construction and operation of the project are environmentally friendly, compared with other fossil fuel power plants.

The Technical Components of WTG are as follows:

Main Tower– Metallic tower of height ranging from 75 to 79m (1250kw =74.5m, 1500kw=78.5m)
Nacelle - Houses Main shaft, Gearbox and Generator
Main shaft - Rotated by the Blade connected to gearbox/generator
Gearbox - To step up Generator RPM
Generator - Induction Type generators
Blade - Fibre blades to take off at wind speeds from 2.5m /sec to 4 m /sec
Hub - Connects the blade and main shaft and houses the brakes

A unit system of WTG, consisting of the above subsystems works in conjunction with, LT line and HT lines. The turbines generate power at 400 volts, which is stepped up to 33 KV by the local transformers. The HT transmissions are connected to 110 KV service substations provided by TNEB

The know how for wind turbine generation has been existing in India since 1995 through international companies. The higher capacity machines have been introduced and stabilised since 2003. The Suzlon make (used in this project activity) has international know-how collaboration, and also has strong manufacturing base in India.

The plant load factor of WTG is affected by Wind availability, Wind speed, and Grid Availability. The available locations for the turbines in this project activity do not have very good wind availability as such locations are already occupied and the grid availability is also not very good as evacuation infrastructure is inadequate at the time of investment decision. The average Capacity Utilization Factor (CUF) for all

machines , based on empirical data by the supplier is, approximately in the range of 27 % (For 1250 KW) and 32 % (For 1500 KW). All the WTGs are of Suzlon make**.** The capacity details of the WTGs of this project activity are as given below.

CAPACITY DETAILS OF WTGS		
Capacity in KW	**NO of WTGs**	**Total Capacity in MW**
1250	20	25
1500	4	6
	24	31

A.4.4 Estimated amount of emission reductions over the chosen crediting period:

>>

The estimated amount of emission reduction from the project activity, over the 10 year fixed crediting period is 677280 **tCO_2.** This is for the crediting period of 10 years as shown below:

Years	Annual estimation of emission reductions in tonnes of CO_2e
2009-10	67728
2010-11	67728
2011-12	67728
2012-13	67728
2013-14	67728
2014-15	67728
2015-16	67728
2016-17	67728
2017-18	67728
2018-19	67728
Total estimated reductions (tonnes of CO_2e)	677280
Total number of crediting years	10 Years
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	67728

A.4.5. Public funding of the project activity:

>>

The total funding for the project activity has come from Grace Infrastructure's funds and commercial loans availed by them.

No official development Assistance (ODA) has been used for the project.

SECTION B. Application of a baseline and monitoring methodology

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

>>

Title: Consolidated baseline methodology for grid-connected electricity generation from renewable sources

Reference: ACM0002 Version 7 – 30/11/2007

(http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html?searchon=1&searchmode=advanced)

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

>>

The applicability of the methodology, ACM0002 Version 7 and the justification of the applicability with respect to the project activity are explained below:

This methodology is applicable to grid-connected renewable power generation project activities that Involve electricity capacity additions.	
The methodology is applicable under the following conditions:	
The project activity is the installation or modification/retrofit of a power plant/unit of one of the following types: hydro power plant/unit (either with a run-of-river reservoir or an accumulation reservoir), wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit.	The Project activity is installation of wind power unit.
In case of hydro power plants: – The project activity is implemented in an existing reservoir, with no change in the volume of reservoir. – The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 W/m2. – The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m2.	Not Applicable
The geographic and system boundaries for the relevant electricity grid can be clearly identified and Information on the characteristics of the grid is available;	The geographic and system boundaries of the T.N.E.B grid and Southern Grid are clearly identified and widely used by Electricity administrative and regulatory authorities in India. The information on the characteristics of the grid is publicly available from Central Electricity Authority

Applies to grid connected electricity generation from landfill gas to the extent that it is combined with the approved "Consolidated baseline methodology for landfill gas project activities" (ACM0001); and	Not Applicable
5 years of historical data (or 3 years in the case of non hydro project activities) have to be available for those project activities where modification/retrofit measures are implemented in an existing power plant	Not Applicable
The methodology is not applicable to the following:	
Project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site;	The project activity does not involve fuel switch.
Biomass fired power plants;	The project activity is not bio mass based.
Hydro power plants[3] that result in new reservoirs or in the increase in existing reservoirs where the power density of the power plant is less than 4 W/m2.	The project activity is not hydro based.
If 5 years of historical data (or 3 years in case of non hydro project activities) are not available, e.g. due to recent retrofits or exceptional circumstances, project participants may request a revision to the approved consolidated methodology or submit a new methodology.	Not applicable.

From the above points it can be summarised that the project activity satisfies the applicability condition cited above.

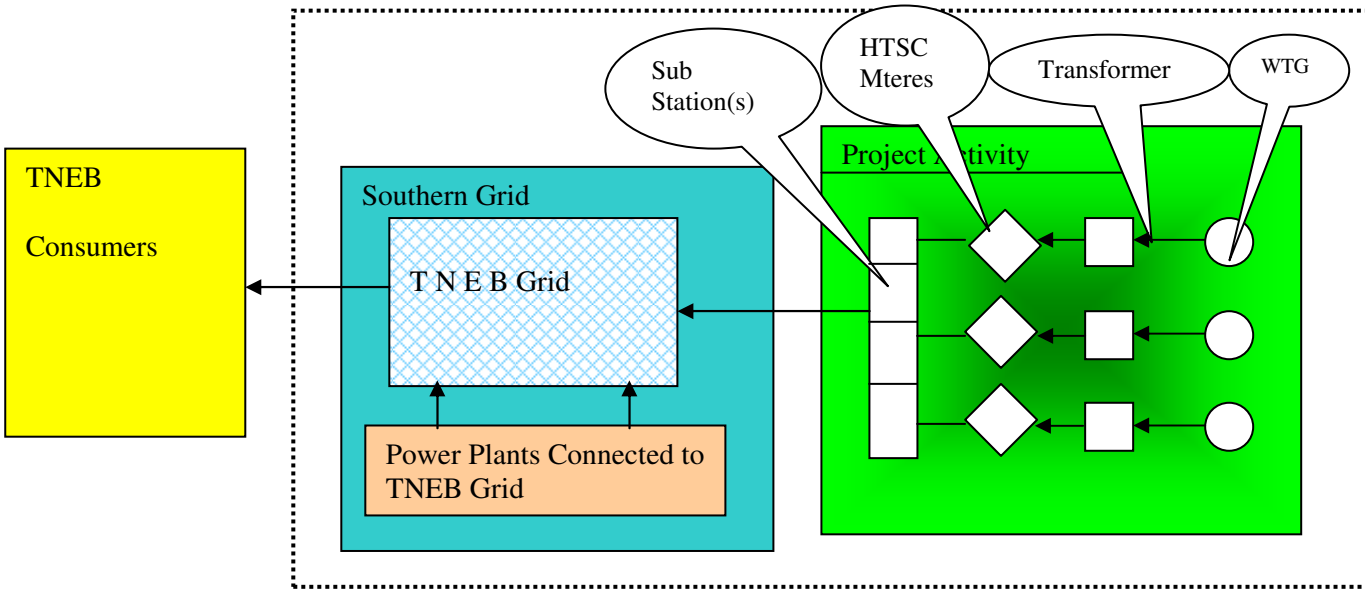
B.3. Description of the sources and gases included in the project boundary

>>

The spatial extent of the project boundary comprises of all the power plants connected to the southern grid of India. The sources and gases included in the project boundary is explained in the following table.

	Source	Gas	Included	Justification / Explanation
Base Line	Emissions from the power plants connected to the southern grid of India	CO_2	Yes	Main source of emission
		CH_4	No	Not considered. This is conservative
		N_2O	No	Not considered. This is conservative
Project Activity		CO_2	No	As per ACM0002 , project emission is not be considered for a wind project
		CH_4	No	As per ACM0002 , project emission is not be considered for a wind project
		N_2O	No	As per ACM0002 , project emission is not be considered for a wind project

The schematic diagram of project boundary is as follows:



B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

>>

Identification of the baseline scenario:

"As the project activity is the installation of a new grid-connected renewable power plant – that is a wind turbine generator – the baseline scenario will identify the following:
Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system"

The parameters accounting for the baseline scenario is explained in the following table:

Parameter	SI Unit	Description
$EF_{grid,CM,y}$	$kgCO_2e/kWh$	Combined margin CO_2 emission factor for grid connected power generation in year y
$EF_{grid,BM,y}$	$kgCO_2e/kWh$	Build margin CO_2 emission factor for grid connected power generation in year y
$EF_{grid,OM,y}$	$kgCO_2e/kWh$	Operating margin CO_2 emission factor for grid connected power

The data used for calculation of combined margin has been based on CO2 Baseline data base Version 3, published by Central Electricity Authority – India. All the references for the data used from the above sources have been given in Annex 3. Also the methods followed to calculate CM is explained in section, 6.1 of the PDD.

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 CDM project activity (assessment and demonstration of additionality):

>>

As the power requirement from the southern states of India, is steadily increasing, in the absence of the project activity, the same amount of power as generated by the project activity would have been generated by southern grid using the existing power plants and similar additions. Since generation of power based on windmill does not have any emission, the generation form the project activity will reduce the emission from the other sources to the southern grid.

Demonstrating the additionality of the project

As per 17/CP.7, a project will be defined additional if the anthropogenic GHG emissions from the source are reduced below that would have occurred in the absence of the registered project activity. Within the scope of the adopted baseline methodology, The additionality of the project activity has been demonstrated and assessed using the latest version of the "Tool for the demonstration and assessment of additionality – Version 5.2 " agreed by the CDM Executive Board.

Step 1- Identification of alternatives to the project activity consistent with current laws and Regulations

Define realistic and credible alternatives to the project activity(s) that can be (part of) the baseline scenario through the following sub-steps:

In this step, Grace is required to define realistic and credible alternatives to the project activity that can be part of the baseline scenario through the following sub-steps:

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

Identify realistic and credible alternative(s) available to the project participants or similar project developers that provide outputs or services comparable with the proposed CDM project activity

Grace is required to identify realistic and credible alternative(s) available to the project participants or similar project developers that provide outputs or services comparable with the proposed CDM project activity.

The following alternatives was considered –

Alternative 1: Implementation of the project activity not undertaken as a CDM project activity

In this alternative, project activity is connected to the Southern regional grid and therefore it displaces an equivalent amount of electricity of the grid mix of the Southern regional grid. Since the project activity has no project emissions this alternative would not generate carbon dioxide. Grace may implement the project activity to generate and sell power to the state grid. This alternative may be part of the baseline; however it is financially less attractive as compared to the standard returns of the similar kind of project activities. The investment analysis has been conducted as per Step 2: Investment analysis of the "Tool for

the demonstration and assessment of additionality – Version 5.2".

Alternative 2: No project activity, continuation of current situation
In this alternative, project activity is not implemented resulting in the continued current grid mix of the state grid i.e. the equivalent amount of energy would have been produced by the project grid electricity system through its currently running power plants and by new capacity additions. An equivalent amount of carbon dioxide would be generated at the thermal power generation end predominantly by fossil fuel based power plants.

Outcome of Step 1a: The "no project activity" wherein the equivalent amount of energy would have been produced by the grid electricity system through its currently running power plants and by new capacity additions (which are mostly thermal) is the most plausible alternative as baseline option for the project. In India, the power off-takes from the power plants is decided based on power plant and T&D availability and not on merit order basis, thus in absence of the wind power project, it is difficult to justify that equivalent amount of units would have been generated by other alternative sources. Thus, suitable grid mix has been selected as baseline option and therefore for calculation of baseline emission.

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

2. The alternative(s) shall be in compliance with all mandatory applicable legal and regulatory requirements, even if these laws and regulations have objectives other than GHG reductions, e.g. to mitigate local air pollution. (This sub-step does not consider national and local policies that do not have legally-binding status.)
3. If an alternative does not comply with all mandatory applicable legislation and regulations, then show that, based on an examination of current practice in the country or region in which the law or regulation applies, those applicable legal or regulatory requirements are systematically not enforced and that noncompliance with those requirements is widespread in the country. If this cannot be shown, then eliminate the alternative from further consideration;
4. If the proposed project activity is the only alternative amongst the ones considered by the project participants that is in compliance with mandatory regulations with which there is general compliance, then the proposed CDM project activity is not additional.

All the above alternatives are in compliance with all applicable legal and regulatory requirements. The implementation of project activity is a voluntary initiative and it is not mandatory or a legal requirement. For power generation, the Electricity Act 2003 does not restrict or empower any authority to restrict the fuel choice, the applicable environmental regulations do not restrict the use of wind energy and there is no legal requirement on the choice of a particular technology.

Outcome of Step 1b: Thus, considering that all the alternatives are in line with the applicable legal and regulatory requirements, the "no project activity" i.e. continuation of current practice where in the equivalent amount of energy would have been produced by the project grid electricity system through its currently running power plants and by new capacity additions is the chosen baseline scenario which would have happened in the absence of the proposed project activity.

Step 1 is satisfactorily passed. Proceed to step 2 (Investment analysis) or step 3. (Barrier analysis).

Step 2 - Investment analysis

Determine whether the proposed project activity is economically or financially less attractive than atleast one other alternative, identified in step 1, without the revenue from the sale of certified emission reductions (CERs).

Sub-step 2a. Determine appropriate analysis method

As per the Tool for demonstration and assessment of additionality –Version 5.2, Simple cost analysis is not applicable as the project activity sells electricity to the grid and obtains economic benefits in the form of electricity tariffs.

Hence, Grace has the option of using either Option II- Investment comparison analysis or Option III Benchmark analysis (as per the Tool for demonstration and assessment of additionality –Version 5.2). Grace proposes to use **Option III – Benchmark analysis** because sufficient information is available for undertaking the same in the public domain. The Project IRR of the project activity serves as a benchmark to assess the financial attractiveness of the project activity. Option III assesses if the project's returns are sufficient for investors to make the initial investment and further bear the associated costs of successfully operating the project activity over the crediting period of the project.

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

It is proposed to use Option III – Benchmark analysis and the financial indicator that is identified is the Project IRR as suggested by the additionality tool. An investment analysis of the project activity was conducted with the post tax project Internal Rate of Return (IRR) as the financial indicator. 'Internal Rate of Return' is one of the known financial indicators used by banks, financial institutions and project developers for making investment decisions. The Benchmark IRR arrived at for the project activity is 14.01%. The justification for the said benchmark is based on the WACC analysis which is presented in the excel worksheet titled "Grace – WACC analysis." A summary of relevant facts, data, and case-specific statistics which were used as the basis for the analysis is presented in the same workbook. The relevant links are given work sheet itself.

Sub-step 2c. Calculation and comparison of financial indicators:

For the investment analysis of this project, all the WTGs have been individually considered. A cash flow period of 20 years has been used for cash flow projections. The financial indicators namely the Equity IRR and Project IRR has been calculated. All relevant costs (including, the investment cost, the operations and maintenance costs), and revenues (excluding CER revenues, but including subsidies/fiscal incentives. where applicable) are included. Non-market cost and benefits are not included because there are no public investors

The following table illustrates the parameters used for the investment analysis. The use of these parameters indicating if they are assumed or based on actual figures is explained in the table.

Notation	Parameter	Description	UOM	Reference
Cost	Project Cost	Total cost of the WTG Installation	Rs in Lakhs	Purchase order for supply and commissioning of WTG to suzlon.
Loan	Loan	Loan Taken from the Bank	Rs in Lakhs	Loan offer Statement from Bank
Equity	Equity	Investment by Project owner(Project Cost-Loan)	Rs in Lakhs	
Loan Yrs	Loan Years	Loan tenured in years	Number	Loan offer Statement from Bank
Loan Repay	Loan Repayment	Loan repaid per year	Rs in Lakhs	Loan offer Statement from Bank
Interest	Interest	% Interest on Loan	In Percentage	Loan offer Statement from Bank.
Maint. Cost	Maintenance Cost	Cost of Maintenance per machine per year	Rs in Lakhs	Contract between Suzlon and Grace.
Insurance	Insurance	Insurance premium payable as % of Investment - Value Taken 0.75%	In Percentage	Based on actual practice
CUF	Capacity Utilization Factor	27% for 1250 kW and 32% for 1500 kW	%	Based on Estimation given by manufacturer of WTG.
Revenue	Revenue	Revenue earned for TNEB for sale of power (Rs 2.70 /kWh)	Rs/Kwh	Power purchase agreement between grace and TNEB
CDM Rev	Revenue from CDM	CDM Revenue Expected	Rs / Kwh	Conservative estimate based on offers
Depreciation	Depreciation	SLM Depreciation – 4.75%	%	As per company auidting policy in accordance with standard acconting practice

Not: 1 Lakh=01.Million

The investment analysis is done for all the 24 machines by grouping them into 5 groups, wherein the investments characteristics for each group is same. The list of all the machines indicating the group is given in Appendix-3. The exact values assumed for all the groups are given in Appendix-3.

Conclusion:

Group	Project IRR%	Benchmark %
G1	10.00	14.01%
G2	10.00	14.01%
G3	8.27	14.01%
G4	8.27	14.01%
G5	8.47	14.01%
Minimum %	8.27	14.01%
Maximum %	10.00	14.01%
Average %	9.00	14.01%

The investment analysis work sheets for the individual groups have been presented.

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

Sensitivity analysis has been conducted considering the following critical parameters.

- Generation
- Tariff rate
- O &M

Generation (which depends on wind speed, wind availability and grid availability) is the factor, which will critically influence the investment analysis. All the individual WTGs groups have been subjected to sensitivity analysis by varying the generation, tariff and O&M +/- 10 % . As the estimated PLF has been taken on the higher side, the possibility of increase in generation by 10 % is very remote. However this range has been taken for conservative purpose. The sensitivity analysis was not considered for the other critical factors such as investment and interest etc since they are based on actual. The individual analysis for all the groups shows the results on IRR after sensitivity analysis is as follows:

Group	Base IRR	Tariff		Generation		O&M	
		-10%	+10%	-10%	+10%	-10%	+10%
G1	10.00	7.64	12.31	7.64	12.31	10.34	9.66
G2	10.00	7.64	12.31	7.64	12.31	10.34	9.66
G3	8.27	6.05	10.42	6.05	10.43	8.64	7.89
G4	8.27	6.05	10.42	6.05	10.43	8.64	7.89
G5	8.47	6.24	10.62	6.24	10.63	8.81	8.12
Min	8.27	6.05	10.42	6.05	10.43	8.64	7.89
Max	10.00	7.64	12.31	7.64	12.31	10.34	9.66
Avg	9.00	6.72	11.22	6.72	11.22	9.36	8.65

Outcome of Step 2:

From the above discussion it is clear that– all the sub groups of the project, have IRR (Project IRR) that is less than the relevant Benchmark figure 14% and this conclusion is not sensitive to critical assumptions in the investment analysis. Thus the sub groups of this project activity, without CDM revenue, are not financially attractive. Steps 2a, 2b, 2c are passed satisfactorily. Proceed to step 4

Step 4. Common practice analysis

Requirement

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

1. Provide an analysis of any other activities implemented previously or currently underway those are similar to the proposed project activity. Projects are considered similar if they are in the same country/region and/or rely on a broadly similar technology, are of a similar scale, and take place in comparable environment with respect to regulatory framework, investment climate, access to technology, access to financing, etc. Other CDM project activities (registered project activities and project activities which have been published on the UNFCCC website for global stakeholder consultation as part of the validation process) are not to be included in this analysis. Provide documented evidence and, where relevant, quantitative information. On the basis of that analysis, describe whether and to which extent similar activities have already diffused in the relevant region.

Sub-step 4b. Discuss any similar options that are occurring:

2. If similar activities are widely observed and commonly carried out, it calls into question the claim that the proposed project activity is financially unattractive (as contended in Step 2) or faces barriers (as contended in Step 3). Therefore, if similar activities are identified above, then it is necessary to demonstrate why the existence of these activities does not contradict the claim that the proposed project activity is financially unattractive or subject to barriers. This can be done by comparing the proposed project activity to the other similar activities, and pointing out and explaining essential distinctions between them that explain why the similar activities enjoyed certain benefits that rendered it financially attractive (e.g., subsidies or other financial flows) and which the proposed project activity cannot use or did not face the barriers to which the proposed project activity is subject.

3 Essential distinctions may include a serious change in circumstances under which the proposed CDM project activity will be implemented when compared to circumstances under which similar projects where carried out. For example, new barriers may have arisen, or promotional policies may have ended, leading to a situation in which the proposed CDM project activity would not be implemented without the incentive provided by the CDM. The change must be fundamental and verifiable.

Outcome of step 4

a. Analyse other activities similar to the project activity

The activities similar to the project activity are the number of windmills installed in the Tamilnadu Region.

The following table shows the installation of WTG project in Tamilnadu, from the year 1992-93 to 2006-07

State	Tamil Nadu
Year	Capacity - MW
Up to March 1992	22.31
1992-3	10.855
1993-4	50.555
1994-5	190.865
1995-6	282.02
1996-7	119.42
1997-8	31.143
1998-9	17.765
1999-2000	45.675
2000-1	41.895
2001-2	44.25
2002-3	133.6
2003-4	371.225
2004-5	678.735
2005-6	857.523
2006-7	577

Source: http://www.teda.gov.in/page/growth%20of%20wind%20mills.pdf

It is to be noted that India had signed the Kyoto Protocol in the year 2002 and subsequently there was the introduction of Electricity Act 2003. Based on the above data it is clear that there has been a wind power capacity addition of about 2618 MW in the period 2002-2007 of which 1549 MW are CDM project activities Most of these projects in the period have been structured as CDM Projects as per the details given below:

Total Installed capacity (MW)	2618
Projects Registered and under Validation in CDM (MW)	2009

(Source for UNFCCC: – http://cdm.unfccc.int/Projects/registered.html
http://cdm.unfccc.int/Projects/validation.index.html)
(The detailed list is provided to DOE)
Even in the remaining of the projects, majority of the projects are seeking carbon revenues either as CDM projects. These projects are in the initial stages. This data is not readily available as many of them are in the pre-GSP stage. So it can be seen that it is not a common practice to put together a wind project without considering carbon revenue.

Thus based on the above it can be inferred that the project activity is not a common practice and CDM revenues are the major contributor in promoting wind power projects.

Sub-step 4b: Discuss any similar options that are occurring:
This has already been described in the sub step 4a above. The approval and registration of the proposed project activity as a CDM project would lead to additional revenue thereby improving the returns from

the project activity alleviating investment and regulatory policy risk to a certain extent. The successful registration also provides an incentive for other entrepreneurs to invest in wind power projects. Thus the CDM revenue acts as a risk mitigation tool in overcoming barriers and imparting viability to the project.

Sub-steps 4a and 4b are satisfied. It can be seen that the project activity is additional.

Impact of CDM registration

Based on the discussions with various experts GRACE INFRASTRUCTURE PVT LTD arrived at a rate of 6 Euros for estimating CDM benefit. Accordingly the same number is used to demonstrate the impact of CDM revenue.

The following table shows, how the CDM Revenue helps in improving the IRR of the sub projects. Although the bench mark is not crossed for some projects even after the CDM Revenue, the additional revenue improves the IRR significantly to influence a favourable decision for investment. The following table shows the summary of impact of CDM revenue on IRR.

	Project IRR	
Group	IRR Before CDM	IRR After CDM
G1	10.00	11.65
G2	10.00	11.65
G3	8.27	10.09
G4	8.27	10.09
G5	8.47	10.50

Serious CDM Consideration

Grace infrastructure which is part of the Leo Group Pondicherry, India. Leo Group has already participated in a bundled CDM Project activity (UNFCCC Ref.No:1049) and the same was hosted for public comments during 30 Dec 05 - 29 Jan 06 and the same was registered only on 4th June 2007.

Considering the further investment (proposed CDM project) in the wind mills Leo Group has decided to setup a separate entity which is in the name of Grace Infrastructure in the year 2004, and planned to be completed installation in three phases. The various activities pertaining to this project activity along with time reference is given below.

Event	Date
Formation of Grace infrastructure	17/06/2004
Board Meeting on Grace CDM Project	21/06/2004
Review for Project Scheduling- Initial	28/07/2004
Initial correspondence with consultants request for proposals	11/08/2004
Project Starting Date – date of PO	11/08/2004

Construction staring date	07/09/2004
Commissioning date of first WTG	12/10/2004
Planned Date of completion of Phase I	31/03/2005
Actual Date of completion of Phase I	20/07/2005
Review for Project Scheduling – I	29/07/2005
Clarifications to consultants on capacity of project	19/08/2005
Communication to consultant still the capacity is not fixed	14/12/2005
Planned Date of completion of Phase II	31/03/2006
Actual Date of completion of Phase II	20/03/2006
Review for Project Scheduling – II	31/03/2006
Communication to consultant that the capacity is fixed	24/04/2006
Contracting Process Started with URS for PDD and CDM project structuring	20/05/2006
Preparation of PIN by the consultant	20/06/2006
Contracting With URS	01/01/2007
Planned Date of completion of Phase III	31/03/2007
Discussion With the DOEs- TUV Nord , BVQI	01/04/2007
Actual Date of completion of Phase III	08/04/2007
PDD Version 1	30/06/2007
Discussion With the DOEs, DNV, SGS and TUV Nord.	29/09/2007
Enquiry for proposals by Urs on behalf of Grace Infra structure	30/09/2007
Local stake holder comments	01/10/2007
Tentative quotes from DOEs	08/10/2007
Clarification with DOEs	17/10/2007
Application for Host Country Approval	22/10/2007
Interview for Host Country approval	21/11/2007
Proposals from TUV Nord	5/12/2007
Contract with TUV Nord	13/12/2008
Host Country Approval	17/03/2008
Initial Submission of PDD to DOE	5/2/2008
Hosting for Public comments	16/05/08 to 15/06/08

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

>>

Approach

Based on ACM0002 / Version 7, Existing actual or historical emissions, as applicable – is used for this project activity.

Base Line Scenario

Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system" – Version -01.1 .

The baseline emissions are calculated based on the net energy supplied to the grid (in kWh/year), and an emission factor for the displaced grid electricity (in kg CO_2 e/kWh).

$BE_y = EG_y * EF_y$

Where

EG_y = the net electricity exported to the grid system during the year *y*
EF_y = the emission factor of the grid to which the project exports electricity

The emission factor (EF_y) is calculated as a combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) factors according to the following steps outlined in methodology tool, "Tool to calculate the emission factor for an electricity system".

Central Electricity Authority (CEA) (which is an official source of Ministry of Power, Government of India) have calculated baseline emission factors for various grids in India and made them publicly available i.e "**CO_2 Baseline Database**" **Version 3.0** at

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

The summary information on this Baseline is provided in Annex 3. This tool to calculate the emission factor for an electricity system provides procedures to determine the following parameters:

Parameter	SI Unit	Description
$EF_{grid,CM,y}$	$kgCO_2e/kWh$	Combined margin CO_2 emission factor for grid connected power generation in year y
$EF_{grid,BM,y}$	$kgCO_2e/kWh$	Build margin CO_2 emission factor for grid connected power generation in year y

$EF_{grid,OM,y}$	$kgCO_2e/kWh$	Operating margin CO_2 emission factor for grid connected power

The data used for calculation of CM has been based on CO2 Baseline data base Version 3, published by Central Electricity Authority – India. All the references for the data used from the above sources have been given in Annex 3.

The step prescribed by the tool has been adhered to.

STEP 1. Identify the relevant electric power system.
The project electricity system for this project activity is taken as the southern regional grid as this has been delineated in the publications by the host country.

STEP 2. Select an operating margin (OM) method.
The tool specifies that any one of the following methods can be used for calculation OM.

a) Simple OM, or
(b) Simple adjusted OM, or
(c) Dispatch Data Analysis OM, or
(d) Average OM.
The simple OM method is chosen since the low cost/must run resources constitute less than 50% of the total generation by the plants in the southern grid as demonstrated in the tables and figures below

The analysis of southern grid, providing the share of low cost/must run resources is given below:

Share of Must-Run (Hydro/Nuclear) (% of Net Generation)						
	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	25.9%	25.7%	26.1%	28.1%	26.8%	28.1%
East	10.8%	13.4%	7.5%	10.3%	10.5%	7.2%
South	28.1%	25.5%	18.3%	16.2%	21.6%	27.0%
West	8.2%	8.5%	8.2%	9.1%	8.8%	12.0%
North-East	42.2%	41.7%	45.8%	41.9%	55.5%	52.7%
India	19.2%	18.9%	16.3%	17.1%	18.0%	20.1%

Source – Central Electricity Authority - General Review 2005 – http://www.cea.nic.in/

Based on the above analysis, as the low-cost must run resources are less than 50 %- the simple OM method is used for the project activity. CO2 Baseline data base Version 3, from which the data has been used, uses the same basis.

STEP 3. Calculate the operating margin emission factor according to the selected method.
The operating margin based simple OM (Ex-ante option); emission factor is calculated as follows

$$EF_{grid,OMsimple,\ y=} \quad \sum_{i} FC_{i,m,y.} \cdot NCV_{i,y.} \cdot EF_{CO2,i,y}$$

$$\sum EG_{m,y}$$

Where:

$EF_{grid,OMsimple,y}$	=	Simple operating margin CO_2 emission factor in year y (tCO_2/MWh)
$FC_{i,m,y}$	=	Amount of fossil fuel type i consumed by power plant / unit m in year y (mass or volume unit)
$NCV_{i,y}$	=	Net calorific value (energy content) of fossil fuel type i in year y (GJ / mass or volume unit)
$EF_{CO2,i,y}$	=	CO_2 emission factor of fossil fuel type i in year y (tCO_2/GJ)
$EG_{m,y}$	=	Net electricity generated and delivered to the grid by power plant / unit m in year y (MWh)
m	=	All power plants / units serving the grid in year y except low-cost / must-run power plants / units
i	=	All fossil fuel types combusted in power plant / unit m in year y
y	=	Tthe three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option)

The Operating Margin (including imports) calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO2/MWh) of all generating power plants serving the system, not including low-cost / must-run power plants / units using the CEA[1] data base for the Southern Grid (for the years 2004-05, 2005-06 and 2006-07) the value is 1.003019583 $kgCO_2$ e/ kWh.

STEP 4. Identify the cohort of power units to be included in the build margin (BM).
The power units that have to be included in this sample, have to be of the most recent power plants, consisting of the larger of (i) the five power plants that have been built most recently; or (ii) the capacity additions that represent 20% of the system generation that have been built most recently. In India, the latter approach generally yields the larger sample and hence must be followed. CDM projects must be excluded from the build margin, as long as the build margin does not contain generation units older than 10 years.

For vintage Option 1 of the tool is used. That is for the first crediting period, the build margin emission factor is calculated ex-ante based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor will be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period will be used. This option does not require monitoring the emission factor during the crediting period. CO2 Baseline database Version 3, from which the data has been used, uses the same basis for identifying the power units.

STEP 5. Calculate the build margin emission factor.

[1] Source: CDM Carbon Dioxide Baseline Data base, Version 3.0, December'07 (www.cea.nic.in)

The build margin emissions factor is the generation-weighted average emission factor (tCO_2/MWh) of all power units m during the most recent year y for which power generation data is available, calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum EG_{m,y} \times EF_{EL,m,y}}{\sum EG_{m,y}}$$

Where:

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

Build Margin emission factor is determined as below:

Build Margin (BM)	**0.705459702**	$kgCO_2$ e/ kWh

Source: CDM Carbon Dioxide Baseline Data base, Version 3.0, December'07 (www.cea.nic.in)

STEP 6. Calculate the combined margin (CM) emissions factor.
The combined margin emission factor is calculated as follows:

$$EF_{grid,OM,y} = EF_{grid,OM,yX} \times w_{OM} + EF_{grid,BM,yb} \times w_{BM}$$

Where:

$EF_{grid,BM,y}$	=	Build margin CO_2 emission factor in year y (tCO_2/MWh)
$EF_{grid,OM,y}$	=	Operating margin CO_2 emission factor in year y (tCO_2/MWh)
w_{OM}	=	Weighting of operating margin emissions factor (%)
w_{BM}	=	Weighting of build margin emissions factor (%)

As the tool provides for wind and solar projects, the default weights are as: $W_{OM} = 0.75$ and $W_{BM} = 0.25$ (owing to their intermittent and non-dispatch able nature), this project activity uses the weights as $W_{OM} = 0.75$, $W_{BM} = 0.25$

Combined Margin (CM) Simple average of OM and BM	**0.9286296125**	kg CO_2 e/ kWh

As per ACM0002 version 7, no leakage has been considered for the calculation of emission factor. The summary of calculations of OM, BM and CM are shown in Annex-3.

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

(Copy this table for each data and parameter)

Data / Parameter:	**EF_y**

Data unit:	$kgCO_2$ e/ kWh
Description:	$CO_{2\ emission}$ factor for southern grid of India
Source of data used:	Based on ACM0002, "Tool to calculate the emission factor for an electricity system", EFy is calculated as the weighted average of OM Emission factor and BM emission factor.
Value applied:	**0.9286296125**
Justification of the choice of data or description of measurement methods and procedures actually applied:	The calculation of **EF** $_Y$ is based on $EF_{OM,\ y}$ and $EF_{BM,\ y,}$ as per on ACM0002, which is an approved methodology.
Any comment:	Detailed information is available in CO2 Base Line by CEA

Data / Parameter:	$EF_{OM,y}$
Data unit:	$kgCO_2$ e/ kWh
Description:	Operating Margin Emission Factor for southern grid of India
Source of data used:	Central Electricity Authority - CO_2 Base Line Data Base
Value applied:	**1.003019583**
Justification of the choice of data or description of measurement methods and procedures actually applied:	The calculation $EF_{OM,\ y,\ as}$ per on ACM0002, which is an approved methodology.
Any comment:	Detailed information is available in CO2 Base Line by CEA

Data / Parameter:	$EF_{BM,y}$
Data unit:	$kgCO_2$ e/ kWh
Description:	Build Margin Emission Factor for southern grid of India
Source of data used:	Central Electricity Authority - CO2 Base Line Data Base
Value applied:	**0.705459702**
Justification of the choice of data or description of measurement methods and procedures actually applied:	The calculation $EF_{BM,y}$, as per on ACM0002 , which is an approved methodology
Any comment:	Detailed information is available in CO2 Base Line by CEA

B.6.3 Ex-ante calculation of emission reductions:

>>

Base Line Emission Factor: (EFy)

Operating Margin of southern Grid of India - EFOM, $y_=$ 1.003019583 $kgCO_2$ e/ kWh

Build Margin of southern Grid of India - EFOM, $y_=$ 0.705459702 $kgCO_2$ e/ kWh

Emission Factor of Southern Grid of India - EF_y = **0. 9286296125** $kgCO_2$ e/ kWh

Base Line Emissions: (BEy)

BEy = EGy * EFy
= 72934017 kWh * **0. 9286296125** $kgCO_2$ e/ kWh
= 67728 tCO2e

Project Emissions:

Based on ACM0002, the project emission is 0.

Leakage

Based on ACM0002, there is no leakage for this project activity.

Emissions Reduction

For a given year, the emission reductions contributed by the project activity (ERy) is calculated as follows:
ERy = BEy - PEy – Ly

ERy = BEy

Where

ERy	Emission reductions for the year
EGy	Electricity Generated for the year
BEy	Base Line Emissions
PEy	Project Emissions for the year
Ly	Leakage for the year

The emission reductions will be calculated based of actual net electricity supplied to the grid, using the baseline emission factor presented above.

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

>>

Year	Estimation of Project activity Emissions (Tonnes of CO_2 e)	Estimation of Baseline Emissions (Tonnes of CO_2 e)	Estimation of Leakage Emissions (Tonnes of CO_2 e)	Estimation of Emissions Reduction (Tonnes of CO_2 e)
2009-10	0	67728	0	67728
2010-11	0	67728	0	67728
2011-12	0	67728	0	67728
2012-13	0	67728	0	67728
2013-14	0	67728	0	67728
2014-15	0	67728	0	67728
2015-16	0	67728	0	67728
2016-17	0	67728	0	67728
2017-18	0	67728	0	67728
2018-19	0	67728	0	67728

Total (tonnes of CO_2 e)	0	677280	0	677280

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

B.7.1 Data and parameters monitored

Data / Parameter:	EG_y
Data unit:	Kwh
Description:	Net electricity exported to the Southern grid of India
Source of data to be used:	Actual measurement records (From TNEB energy meter reading at sub station) Energy Export from TNEB Meter reading Energy Import from TNEB Meter reading
Value of data applied for the purpose of calculating expected emission reductions in section B.5	72934017
Description of measurement methods and procedures to be applied:	Measured by 0.5 Class Meter – (accuracy ±0.5%) Energy Export from TNEB Meter reading Energy Import from TNEB Meter reading Net generation = (Export-Import) To be certified by TNEB Statement Monthly Measurement by TNEB Retention of Data : 2 Years after crediting period
QA/QC procedures to be applied:	QA/QC of Monitoring Equipment Calibration procedure: Electricity meter is calibrated by the TNEB as per TNEB Procedure
Any comment:	Detailed Monitoring plan is discussed in B7.2 and Annexure-4

B.7.2 Description of the monitoring plan:

>>

The Management Structure for monitoring emission reductions would provide for:

- Operation and Maintenance
- Maintenance of Meters and Calibration
- Calculation of Emission Figures
- Local Environmental Care
- Changes in project boundary
- Documents and Records
- Periodic Review meetings

- Grace will appoint a Site Engineer with the responsibility of operation, maintenance and safety of WTGs.
- The project sponsor will abide by all regulatory and statutory requirements as prescribed under the state and central laws and regulations
- The generation from the WTGs will be monitored by the meter, which is owned by TNEB. The TNEB meter , called HTSC meter will be available one for every WTG. Each HTSC meter will be identified by a unique identification number. There is no case of two or more WTGs connected to a joint meter.
- Meters shall meet the Indian and regional electricity authority's standards (with set calibration schedules).
- The generation for the purpose of emission reduction calculation will be based on the TNEB meter, which is government owned and maintained.
- This meter measure both Kwh exported and Kwh imported.
- All the monitoring data will be recorded and kept under safe custody of the Site Engineer
- Also any change within the project boundary, will be recorded and informed to TNEB (as per PPA), and also to Grace Infrastructure Pvt Ltd.

Measurement Frequency:

Frequency of measurement by TNEB – Once in a month. The generation records certified by TNEB are received once a month and filed. In paper form. It is also stored in electronic form.
Calibration of the Energy Meter - This is carried out by TNEB (As per Government Norms)
No leakage is applicable for this project activity.

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

>>
M. Raja Chidambaram of URs Productively has assisted the project sponsor in determining the application of base line study and monitoring methodology whose contact details are as below:

M. Raja Chidambaram
Director
URs Productively
ursraja@vsnl.com

Date of completion of Baseline study: 31/01/2008
The above entity is not a project participant

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:

>>
11/08/2004 (The date of issues of Purchase order for supply of WTG)

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

>>
Expected lifetime of the project activity is 20 years

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:

>> Not Applicable

C.2.1.2. Length of the first crediting period:

>> Not Applicable

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>01/11/2009 or the registration date which ever is later.

C.2.2.2. Length:

>>10 Years

SECTION D. Environmental impacts

>>

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

>>

As per the host country's existing Laws, Environmental Impact Assessments do not apply to wind mill installations. As per the Schedule 1 of Ministry of Environment and Forests (Government of India), notification dated January 27, 1994, - 30 activities are required to undertake environmental impact assessment studies. (Ref: Environment Impact Assessment Notification S.O 60(E), dated 27/01/99 incorporating amendments upto 13/06/2002) (.http://envfor.nic.in/legis/eia/so-60(e).pdf)

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 environmental impacts are not significant hence this is not applicable.

SECTION E. Stakeholders' comments

>>

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

>>

The project participants along with the consultants arranged for an initial meeting with the local stake holders. In that meeting the basics of the project activity and the expected environmental and social impacts of the project activity were discussed. The local stake holders were encouraged to discuss their concerns regarding the project activity. For this purpose a questionnaire with covering note giving all the details of the project was distributed and sufficient time was given for the people to respond. The questionnaire addressed the following relevant issues.

- Environmental Issues
- Employment Issues
- Noise problems
- water problems
- Vibration problems
- Problems due to Installation
- Issues related grazing of cattle
- Benefits from the wind Mill
- Comments and suggestions

The specimen copy of the questionnaire and the covering note were submitted to the DOE.

E.2. Summary of the comments received:

>>

The overall opinion expressed through the questionnaire was based on the experience of the local stakeholders with the already existing windmills. The response for the questionnaire has been received form the people who live in an around the villages. Sufficient time had been given to the respondents to provide the response. The overall response was that the impact of windmills in the locality will be of positive nature. Following are the summary of the discussion:

- Environmental Issues: Windmills will only improve the environment.
- Employment Issues: Based on the paste experience the employment potential has increased due to wind mill installation. Moreover farmers have been able to get good price for the land.
- Noise problems: The noise problem is not significant.
- Water problems: Windmills have not affected the water availability.
- Vibration problems: The vibration problem is not significant
- Problems due to Installation: Safety Considerations must be adhered to.
- Issues related grazing of cattle: The approach roads may help cattle
- Benefits from the wind Mill: Good employment, Good price for lands, Good availability of power, Attention to infrastructure

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

>>

As there has been no negative observation this is not required.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Grace Infrastructure Pvt Ltd
Street/P.O.Box:	A -5 Industrial Estate
Building:	
City:	Thatanchavady
State/Region:	Pondichery
Postfix/ZIP:	605009
Country:	India
Telephone:	+91-413-2248225
FAX:	+91-413-2249154
E-Mail:	mail@fastenex.co.in
URL:	
Represented by:	L.M.Shah
Title:	Managing Director
Salutation:	Mr.
Last Name:	
Middle Name:	
First Name:	L.M. Shah
Department:	L
Mobile:	
Direct FAX:	+91-413-2249154
Direct tel:	+91-413-2248225
Personal E-Mail:	mail@fastenex.co.in

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding has been made use of, for this project activity

Annex 3

Base Line Information

COMBINED MARGIN - CM		
OM ($kgCO_2$ e/ kWh)	1.003019583	**Reference : CENTRAL ELECTRICITY AUTHORITY: CO_2 BASELINE DATABASE Version 3 Baseline Methodology ACM0002/ Ver 7**
BM ($kgCO_2$ e/ kWh)	0.705459702	
CM ($kgCO_2$ e/ kWh)	0. 9286296125	

(Weight of 75% taken for Operating margin and weight of 25% taken for Build Margin)

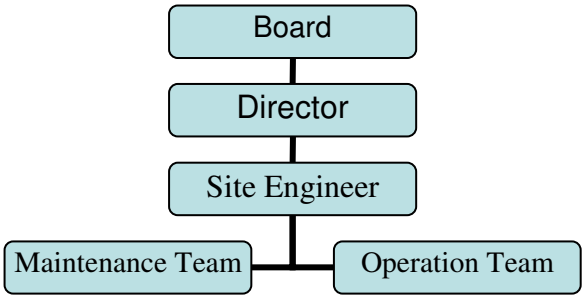
Annex 4
MONITORING INFORMATION

The monitoring plan proposed for the project activity will be centrally executed by GRACE INFRASTRUCTURE PVT LTD. The monitoring plan will cover these following aspects.

1. Management Structure:
2. `Operation and Maintenance
3. Maintenance of Meters and Calibration
4. Calculation of Emission Figures
5. Changes in project boundary
6. Documents and Records
7. Periodic Review meetings

1. Management Structure

The monitoring activity will be centrally executed by GRACE INFRASTRUCTURE PVT LTD. The organization structure -for monitoring will be as follows:



1. SYSTEMS AND PROCEDURES

Detailed systems and procedures will be documented and maintained to implement the monitoring Plan. Following are general guidelines for metering and monitoring, for all these activities detailed procedures will be maintained.

2. OPERATIONS AND MAINTENANCE

Identification of WTGs

Each WTG, which is part of the project activity, will be uniquely identified. This will be painted in each machine and maintained in all records.

The site engineer will be responsible for operation and maintenance. The Operation and maintenance activities will include:

- Ensuring Preventive Maintenance
- Ensuring Break Down Maintenance
- Machine operation including resetting
- Recording Generation

Data capturing for the above will be done using log sheets..

3. MAINTENANCE OF METERS AND CALIBRATION

Metering:

The energy meter that measures the export of electricity is installed and maintained by TNEB. Each WTG is provided with an individual meter and the meter is unique . There are no joint meters. This meter measures both Kwh exported and Kwh imported.

Metering Equipment:

Metering equipment shall be electronic trivector energy meter of accuracy class 0.5% required for the project. The meter shall be installed and owned by TNEB.

Joint Meter Reading:

The monthly meter reading is being taken jointly by the Parties (TNEB and Owner) on the fixed day of the following month, as per the procedure of TNEB. At the conclusion of each meter reading, an appointed representative of the TNEB and the company shall sign a document indicating the number of the kilowatt-hour indicated by the meter. The meter reading will be used for recording electricity generation. The meter readings will record both export and , Import . Net export is calculated as :
Net Export = Export - Import

Emission reduction calculation is based on KWh generation accepted by TNEB.

Calibration and Maintenance of Meter:

The calibration and maintenance of the meter will be responsibility of TNEB. The calibration of the energy meter will be done as per the guidelines / procedure followed by TNEB. This will be carried out once in five years.

Calculation of Emission Figures

Grace Infrastructure Pvt Ltd will be responsible to calculate the emission figures.

Calculation of emission figures will be based on the recorded generation for a period and the emission factor recorded in the PDD.

TNEB Monthly statements will be used as records of generation. This is in paper form . This will be maintained in electronic form also.

Changes in Project Boundary

Changes in Project boundary in any event will be monitored and recorded by Grace Infrastructure Pvt Ltd.

Documents and Records

- Daily Working Details of WTGs (Including Down time and grid non-availability time .)
- Monthly generation details(Statement provided by TNEB)
- CERs Computed on a yearly basis

Periodic Review Meetings

Grace Infrastructure Pvt Ltd will conduct periodic Review meetings once in three months .All project related matters will be discussed with a structured agenda, and action plans will be identified. The minutes of the meetings are recorded.

Appendix –1 Abbreviations

ABBREVIATIONS	MEANING
ACM	Approved Consolidated Methodology
BM	Build Margin
CDM	Clean Development Mechanism
CEA	Central Electricity Authority
CER	Certified Emission Reduction
CM	Combined Margin
CO2	Carbon Dioxide
DOE	Designated Operational Entity
DSCR	Debt Service Coverage Ratio
EB	Executive Board
EIA	Environmental Impact Assessment
EMS	Environmental Management System
GHG	Green House Gases
HTSC	High Tension Service Connection
INR	Indian Rupees
IPCC	Inter Governmental Panel on Climatic Change
IPP	Independent Power Producers
IRR	Internal Rate of Return
KW	Kilowatt
MNES	Ministry of Non-Conventional Energy Sources
ODA	Official Development Assistant
OM	Operating Margin
PPA	Power Purchase Agreement
QA / QC	Quality Assurance / Quality Control
TNEB	Tamilnadu Electricity Board
TNERC	Tamil Nadu Electricity Regulatory Commission
WTG	Wind Turbine Generator

Appendix – 2 – WTG Identification, Location and HTSC Number

Grace Infrastructure Private Limited								Longitude			Latitude		
S.No	Loc No	S.C. No	S F No	Cap	Location	Group	D O C	deg	min	sec	deg	min	Sec
Tirunelveli District													
1	K 59	1028	394p&395/12	1250	Balabathiramapuram	G1	12-10-2004	9	1	36	77	33	46
2	K 56	1027	392/2	1250	Balabathiramapuram	G1	12-10-2004	9	1	27	77	33	53
3	K 55	1049	384/1	1250	Balabathiramapuram	G1	22-12-2004	9	1	26	77	33	35
4	K 115	1183	350/5P	1250	Vadakkukavalakuruchi	G1	25-03-2005	8	57	51	77	35	16
5	K 114	1217	350 / 1b,1c,1d&1e	1250	Vadakkukavalakuruchi	G1	29-03-2005	8	58	1	77	35	16
6	K 117	1181	372/1b	1250	Vadakkukavalakuruchi	G2	25-03-2005	8	57	29	77	35	16
7	K 163	1268	85/1	1250	Ukkirankottai	G2	31-03-2005	8	55	49	77	35	38
8	K 162	1267	47/1	1250	Ukkirankottai	G2	31-03-2005	8	55	58	77	35	52
9	K 167	1320	93/1A	1250	Ukkarankottai	G2	07-07-2005	8	55	49	77	36	12
10	K 166	1335	165/1C	1250	Ukkarankottai	G2	20-07-2005	8	55	39	77	36	0
11	K 74	1557	48/4P	1250	Sundankuruchi	G3	13-02-2006	8	58	9	77	39	44
12	K 98	1592	217	1250	Mel Illandakulam	G3	07-03-2006	8	56	29	77	40	5
13	K 79	1591	52/1	1250	Sundankuruchi	G3	07-03-2006	8	58	26	77	39	39
14	K 105	1620	344 /1A	1250	Vadakkukavalakuruchi	G3	20-03-2006	8	58	9	77	35	2
15	K 102	1618	334/1A	1250	Vadakkukavalakuruchi	G3	20-03-2006	8	58	1	77	34	43
16	K 132	1617	43/1B 1A	1250	Kavalakuruchi	G4	20-03-2006	8	56	41	77	34	56
17	K 106	1619	347/1P	1250	Vadakkukavalakuruchi	G4	20-03-2006	8	57	57	77	35	1
18	K 113	1621	341	1250	Vadakkukavalakuruchi	G4	20-03-2006	8	58	14	77	35	16
19	K 112	1622	49/2	1250	Vadakkukavalakuruchi	G4	20-03-2006	8	58	29	77	35	22
20	K 137	1616	440/1	1250	Kadanganeri	G4	20-03-2006	8	55	12	77	35	4
Kanyakumari District													
1	R 139	2365	58/4&5P	1500	Thiruvambalapuram	G5	08-06-2007	8	15	22	77	43	28
2	R 106	2366	74/3P	1500	Udayathur	G5	08-06-2007	8	17	34	77	44	44
3	R 141	2373	659P	1500	Udayathur	G5	23-06-2007	8	15	43	77	45	57
4	R101	2389	529/1	1500	Udayathur	G5	04-08-2007	8	15	13	77	43	9

Appendix -3: Investment parameters for the WTG- Groups

WTG - Group	Cost	Loan	Equity	Loan Yrs	Loan Repay	Interest	Maint. Cost	Insurance	Land Cost	Machine Cost	Installation	EB Related Expenses
	INR - Million	INR - Million	INR - Million		INR - Million	%	INR - Million	%	INR - Million	INR - Million	INR - Million	INR - Million
G1	279.00	224.00	55.00	7.50	30.00	8.00	5.00	0.75	5	226.5	37.5	10
G2	279.00	173.20	105.80	7.50	23.00	8.00	5.00	0.75	5	226.5	37.5	10
G3	299.50	225.00	74.50	5.00	45.00	8.00	5.00	0.75	7.5	231.475	42.5	18.025
G4	299.50	170.00	129.50	4.00	43.00	9.50	5.00	0.75	7.5	231.475	42.5	18.025
G5	344.00	220.00	124.00	4.50	49.00	12.75	6.00	0.75	7.2	286.238	35.066	15.496