CLEAN DEVELOPMENT MECHANISM
SIMPLIFIED PROJECT DESIGN DOCUMENT
FOR SMALL-SCALE PROJECT ACTIVITIES (SSC-CDM-PDD)
Version 02

CONTENTS

Revision history of this document

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

SECTION A. General description of the small-scale project activity

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

“Bundled 3.0 MW Wind Energy Project in Tamilnadu”
Version: 1.0
Date: 01/09/2006

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

The purpose of this project activity is to generate elctrical power using wind energy, through operation of wind turbines Tamilnadu state of India. The project activity comprises of 6 numbers of Vestas Made V39-500 kW rated wind turbines installed at two locations (Radhapuram & Serdamangalam villages) in Tirunelveli District of Tamilnadu state, India. The electricity generated from this project activity is supplied to the local grid using state transmission lines, metered at the project site, which helps partially improves the power demand – supply scenario in the state of Tamilnadu.

Wind Energy projects are environmentally positive as there are no emissions of greenhouse gases. The project reduces greenhouse gas (GHG) emission by displacing equivalent electricity generation in the Southern Grid (SR) of India, which predominantly uses fossil fuels in grid-connected power stations. Power generation in SR grid power stations lead to emission of ~ 0.909 tCO2e /MWh[1] of net electricity produced.

The project is being developed by a consortium of 3 private sector companies as a pilot for future investments if the project proves successful and various regulatory and sectoral policy hurdles are overcome. The project conceptualises selling of electricity to the grid.

Capacity	Site location	Ownership	Date of Commissioning
2 X 0.5 MW	Radhapuram	M/s Manilal Dayalji & Co.	02/03/2006
2 X 0.5 MW	Serdamangalam	M/s Manilal Dayalji & Co.	21/03/2006
1 X 0.5 MW	Radhapuram	M/s Bhagyodaya Agencies	13/02/2006
1 X 0.5 MW	Radhapuram	M/s Niharika Commercials Ltd.	13/02/2006

Total WTGs = 6
Total Capacity = 3 MW

The project classifies as Small Scale as per CDM Guidelines (Renewable energy project activity with a capacity < 15 MW).

Sustainable Development:

Proposed CDM project activity has following sustainable development aspects:

[1] Combined Margin (CM) for the SR grid; for details refer section B.5 of the document

1. The project activity provides direct and indirect job opportunities to the local population during erection and operation of the windmills. Employment generation shall help poverty alleviation of local community; infrastructure development for the project will also help improve basic amenities to community leading to improvement in overall living standard of the local population.
2. The generation of electricity by the project activity will improve availability of electricity to the state grid and also it will provide more opportunities for industries to invest in Tamilnadu.
3. The wind energy based electricity generation replaces fossil fuel burning in the electricity system and thus reduces GHG emissions in the atmosphere. The project activity is an environment friendly electricity generation system with no significant impact on the environment.
4. Use of renewable energy source (wind energy) also helps in conservation of natural resources (like coal) in the country.

A.3. Project participants:

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity (ies) Project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Government of India (Host Party)	♦ M/s Manilal Dayalji & Co ♦ M/s Bhagyodaya Agencies ♦ M/s Niharika Commercials Ltd.	No

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

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

A.4.1.1. Host Party(ies):

India

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

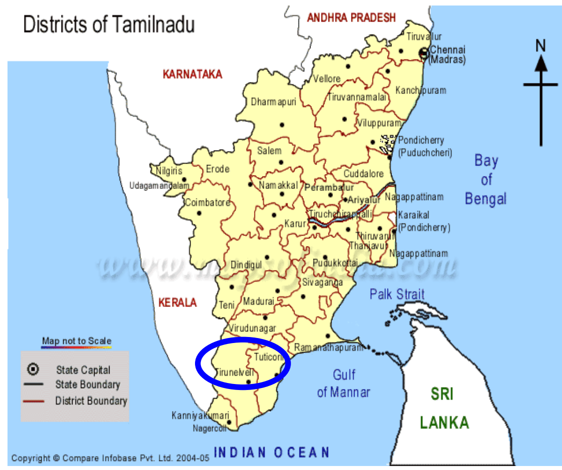
State: Tamilnadu

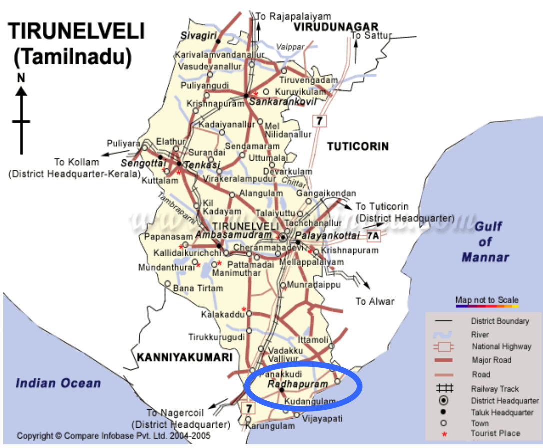
A.4.1.3. City/Town/Community etc:

Capacity	Site location	Ownership
2 X 0.5 MW	Radhapuram	M/s Manilal Dayalji & Co.
2 X 0.5 MW	Serdamangalam	M/s Manilal Dayalji & Co.
1 X 0.5 MW	Radhapuram	M/s Bhagyodaya Agencies
1 X 0.5 MW	Radhapuram	M/s Niharika Commercials Ltd.

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

The WTGs are located in the south India in the state of Tamilnadu at Radhapuram & Serdamangalam villages of Tirunelveli District. The location is depicted in the maps below -





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

Project Type I–Renewable Energy Projects

Project Category: I.D. "**Grid connected renewable electricity generation**"

Version 9; dated 28 July 2006

The project is a Renewable Energy project with maximum output capacity of 3 MW (<=15 MW) this comes under the Appendix B of the simplified modalities & procedures for small-scale CDM-project activities.

Technology

Wind has considerable amount of kinetic energy when blowing at high speeds. The kinetic energy in wind is converted into mechanical power at wind rotor shaft and power is generated in the connected generator. All the WTGs deployed in the project are from well-known manufacturer, Vestas RRB India Ltd.

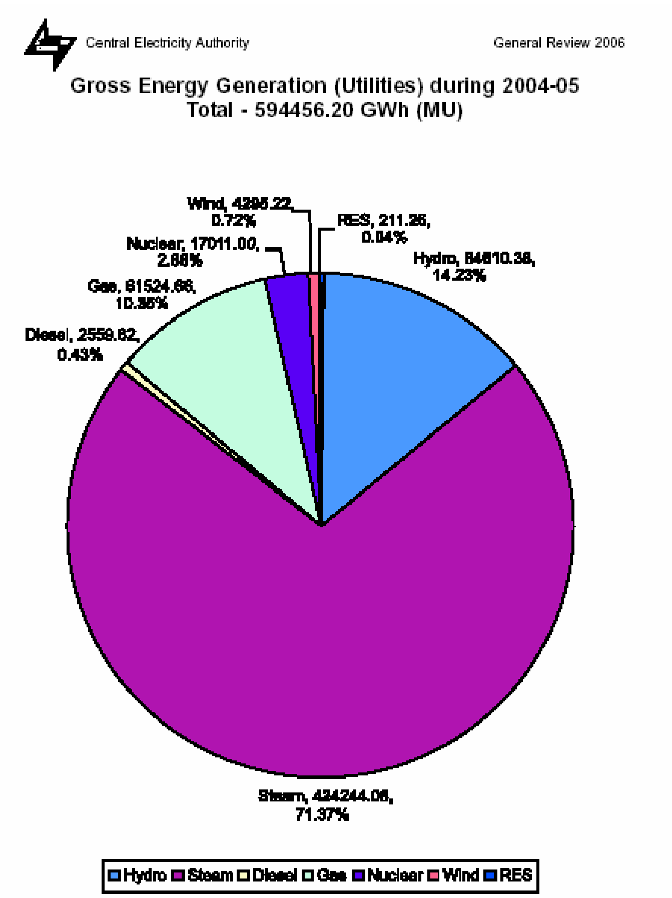
Technical Description:

General	A) Power Regulation B) Hub Weight C) Rotor Speed D) Cone Angle E) Tip Angle F) Cut in wind speed G) Cut out wind speed H) Survival wind speed	Pitch 50m 26 rpm 2degree -1.1deg,-1.4deg,-1.2 deg 4m/s 25m/s 70m/s
Blade	A) No. Of Blades B) Type C) Diameter D) Swept Area E) Length F) Root Chord G) Tip chord H) Twist I) Profile J) Air Brakes	Three Fibre- Glass Reinforced Polyester 47m 1734.1 m square 22.9m 2090mm 297mm 15 deg FFA/NACA 63-600 Full Feathering Blade
Transmission (Gear Box)	A) Type B) Cooler C) Gear Ratio D) No. Of Steps	Planetary (3 stages) 0.3 / 1.7 KW air cooling 1: 58.2 3
Mechanical Brake (Packing Brake)	A) Type B) Control	Disc Fail-Safe Electric
Generator	A) Type B) Rated Power C) RPM D) Voltage E) Rated Current F) Cosine Phi G) Frequency	Single Wound Asynchronous 500KW 1526 rpm 690 volt 470 A 0.89 50 Hz
Yawing	A) Type B) Speed C) Yaw System	Active yaw/ wind Vane 0.5 deg/s Slewing system with gear motor yawing
Tower	A) Type B) Height (optional) C) Material D) Sections	Lattice /Tubular 48.1m Steel 6/4

Control System	A) Type B) Phase Compensation	Microprocessor 250K Var Capacitor Banks
Weights	A) Rotor with Blades B) Tower	7200 Kg 24000 Kg
Necelle Cover	A) Material	Fibre- Glass reinforced Polyester

A.4.3. Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed small-scale project activity, including why the emission reductions would not occur in the absence of the proposed small-scale project activity, taking into account national and/or sectoral policies and circumstances:

Power generation in the Southern Region (SR) grid is primarily based on coal based power plants, which contributes ~71% while diesel and gas contributing 11% while wind power including other non-conventional energy contribute less than 1% of the total annual generation in the SR grid. In the absence of the proposed project activity equivalent power would have been generated in grid connected power stations and no emission reduction would have taken place.



Ref: http://www.cea.nic.in/power_sec_reports/general_review/0405/ch3.pdf

The project proponents have shown their interest towards environmental protection by this project as power generated using wind energy does not emit any greenhouse gases. But investment in wind power is not financially attractive on its own and faces many barriers against its implementation. However taking into account the economic value of CERs from the project activity, proponents could mitigate risks involved and have decided to go ahead with the project.

Total anticipated reductions in tonnes of CO2 equivalent: 65370 tCO2e *(for 10 years- fixed crediting period)*

A.4.3.1 Estimated amount of emission reductions over the chosen crediting period:

Total power supplied to grid is calculated by adding up power export from each wind turbine at the two sites. This total power supplied to grid is used to calculate emission reductions from the project activity.

Emission Reduction Estimation	
Years	**Annual Estimation of emission reduction in tonnes of CO2e**
2006-2007	6537
2007-2008	6537
2008 -2009	6537
2009-2010	6537
2010-2011	6537
2011-2012	6537
2012-2013	6537
2013-2014	6537
2014-2015	6537
2015-2016	6537
Total estimated reductions for crediting period (tonnes of CO2e)	65370
Total number of crediting years	10 years
Annual average over the first crediting period of estimated reductions (tonnes of CO2e)	6537

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

No Public or ODA funding for the project activity.

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

There is no registered small-scale CDM project activity or a request for registration for another small-scale project activity:

- By the same project participants;
- In the same project category and technology/measure; and
- Registered within the previous 2 years; and
- Whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point

It therefore satisfies all conditions listed in "appendix C of the simplified M&P for the small-scale CDM project activities for guidance on how to determine whether the proposed project activity is not a de-bundled component of a larger project activity.

SECTION B. Application of a baseline methodology:

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

Methodology: AMS I.D 'Grid connected renewable electricity generation',
Version 09; dated 28 July 2006

Reference: Appendix B of the simplified M&P for small-scale CDM project activities

B.2 Project category applicable to the small-scale project activity:

Category	Applicability Criteria	Project Status
TYPE ID: ***'Grid connected renewable electricity generation'***	This category comprises renewable energy generation units, such as photovoltaics, hydro, tidal/wave, wind, geothermal, and renewable biomass, that supply electricity to and/or displace electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit.	The project activity is a wind based renewable power generation unit. The project activity displaces predominantly fossil fuel based power generation in SR grid.
	If the unit added has both renewable and non-renewable components (e.g.. a wind/diesel unit), the eligibility limit of 15MW for a small-scale CDM project activity applies only to the renewable component. If the unit added co-fires fossil fuel, the capacity of the entire unit shall not exceed the limit of 15MW.	The installed power generation capacity in project activity is 3 MW (< 15 MW)

Baseline:
As per the methodology AMS I.D; the project activity uses wind to generate power and supplies it to SR grid that is contributed by both fossil and non-fossil power sources. Hence, the applicable baseline, as per appendix B of the simplified modalities and procedures for small scale CDM project activities, is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in kg CO2 eq/kWh) calculated in a transparent and conservative manner as:

A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the approved methodology ACM0002. The procedure followed to calculate combined margin is as follows:

Step I: Calculate the Operating Margin (EF_{OM}) emission factor(s) based on one of the four following methods:

a. Simple OM
b. Simple adjusted OM
c. Dispatch data OM or
d. Average OM

In India due to non-availability of dispatch data, simple OM is used. Simple OM is fixed ex-ante and calculated as the generation-weighted average emissions per electricity unit (tCO2/MWh) of all generating sources serving the system, not including low-operating cost and must-run power plants. In this case generation data for recent most three years is used to calculate OM.

Step II: Calculate Build Margin emission Factor (EF_{BM})

Build margin is the generation-weighted average emission factor (tCO2/MWh) of a sample of power plants. There are two options to calculate Build margin as explained:

Option 1: Calculate the Build Margin emission factor *fixed ex-ante* based on the most recent information available on plants already built for sample group *m* at the time of PDD submission. The sample group *m* consists of either the five power plants that have been built most recently or the power plant capacity additions in the electricity system that comprise 20% of the system generation and that have been built most recently. Project participants should use from these two options that sample group that comprises the larger annual generation.

Option 2: For the first crediting period, the Build Margin emission factor must be updated annually *ex-post* for the year in which actual project generation and associated emissions reductions occur. For subsequent crediting periods, should be calculated *ex-ante*, as described in option 1 above. The sample group *m* consists of either the five power plants that have been built most recently or the power plant capacity additions in the electricity system that comprise 20% of the system generation and that have been built most recently. Project participants should use from these two options that sample group that comprises the larger annual generation.

The approach followed for OM is ex-ante; thereby we choose Option 1 to calculate BM.

Step III: Calculate Baseline emission Factor (EF_{BL}). Emission factor is calculated as weighted average of Operating Margin and build Margin emission Factors.

As in Methodology ACM0002, the weight-age for OM is 0.75 and for BM is 0.25 in case of Wind and Solar energy Projects.

$EF_{BL} = (0.75 \text{ X } EF_{OM}) + (0.25 \text{ X } EF_{BM})$

The operating margin estimates the effect of the project activity on the operation of existing power plants and the build margin estimates the effect of the project activity on the building of future power plants. Combined margin is calculated as weighted average of operating and build margin, which takes into account the trend of the types of power plant coming up in the grid, thus the uncertainties get addressed by taking the said approach for baseline calculation. To establish baseline we must understand key term, which is Grid system.

Grid system

A grid is a system of interwoven pattern of paths, which eases the flow from one point to another in the grid. In electric grid the scale of network and economy involved is mammoth thereby true sense of grid is not depicted but electric grid helps in transmission of electric power to and from different parts, as and when required. In India, electricity network is divided into five regional grids such as northern grid, western grid, southern grid, eastern grid and north- eastern grid. The southern grid consists of Tamilnadu, Kerala, Andhra Pradesh and Karnataka and Union Territory of Pondicherry. Each state has its own load dispatch centre and acts as a separate grid. Power demand of a state is met by state owned generating stations, central government owned generating stations and from independent power producers. The central government allocates power from its generating stations to each state depending upon the requirement.

Sources of Information for establishing the Baseline:

SN	Key Information	Information Source
1	Power generation in states	Southern Region Electricity Board annual reports Central Electricity Authority (CEA) 2002-03, 2003-04, 2004-05
2	Power Generation for wind	MNES annual report
3	Auxiliary Consumption in thermal plants	Performance Review of thermal power Plants
4	Auxiliary Consumption in Hydro Power Generation	CERC data
5	Heat rate in Thermal Power Plants	Performance review of thermal Power Plants, source CEA
6	Heat rate in gas power generation	CERC Data
7	Heat rate of diesel power stations	MNES data
8	Fuel emission factor	IPCC default values

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 small-scale CDM project activity:

Proposed project activity is eligible to use simplified methodologies as -

1. It's a small scale project with a generation capacity of 3MW (<15 MW, according to Paragraph 6 (c) of decision 17 CP.7)
2. It conforms to project category in "Appendix B of the simplified modalities & procedures for small scale CDM-project activities under TYPE ID – 'Grid connected renewable electricity generation', Version 09; dated 28 July 2006
3. It is not a de-bundled component of a larger project activity, as it qualifies guidelines in "Appendix C of the simplified M&P for the small-scale CDM project activities for guidance on how to determine whether the proposed project activity is not a de-bundled component of a larger project activity

Additionality Analysis

In this section the additionality of the project is shown using Attachment A of Appendix B for small-scale project activities. The proposed project would not have occurred due to the following barriers:

Investment barriers

The project activity has high initial capital cost. The total investment made in this project is ~ INR 166 million. Investment analysis of the project activity was conducted with Internal Rate of Return (IRR) as the financial indicator to show that project activity is not financially viable on its own. IRR is one of the known financial indicators used by banks, financial institutions and project developers for making investment decisions. The IRR was then compared with the Required Rate of Return (RRR)[2].

The IRR was estimated with the following data inputs:

Financial Analysis Summary

Total Project Cost	~INR 166 million
Capacity	3 MW
Debt Equity Ratio	70: 30
Interest Rate	9% per annum
Plant Load Factor	28.54%
Operating Period	350 days * 24 hours
Project IRR (Without CDM Benefits)	9.01%
Project IRR (With CDM Benefits)	12.09%
Required Rate Of Return	12.00%
Tariff	Rs 2.70 per unit (as per PPA with TNEB)
Exchange Rate	Rs 58 / Euro
CER Price	13 Euro
CER Value Realization	100%
Income Tax Rate	35.88%
Interest Rate	9% per annum

IRR without CDM benefits is 9.01%[3], which is lower than the Required Rate of Return benchmark of 12.00%, that has been calculated for Wind Power Industry. However considering benefits accruing from CERs sale, IRR improves to 12.09% and makes the project viable[4].

Sensitivity Analysis:
The viability of this project activity has been found sensitive due to variation in PLF and power tariff. The following table shows the variation in Internal Rate of Return (IRR) without CER benefits due to the change in PLF and tariff rate:

Parameters	Variation	IRR	% Change	Remarks
PLF	- 10%	6.91%	- 23.30%	Due to uncertainty about wind density and other factors such as grid availability
	+ 10%	10.96%	21.6%	Still lower than RRR

[2] RRR is a popular financial indicator used by many financial institutions as a benchmark for making investments.

[3] IRR is calculated considering the 80% tax benefit and tax holidays.

[4] The calculation sheet for IRR and RRR shall be made available at the time of Validation.

Tariff	Rs 2.40 (~10% decrease in present tariff of power sale to TNEB)	6.67%	- 25.97%	Governed by TNERC regulations and are beyond the control of project proponents
	Rs 3.00 (~10% increase in present tariff of power sale to TNEB)	13.90%	54.27%	This is highly unlikely

Installation of wind power project is not a financially attractive option as established in above section. The low returns in wind projects are accumulated effect of factors like low PLF, low tariff and high capital cost. The cost of wind power project is even higher than that of conventional power projects based on coal. Apart from high capital cost/MW capacity, plant load factor for wind power projects is ~25% - 30%, which makes capital cost/unit electricity investment very high. At the same time, generation of electricity in a wind farm is highly seasonal and uncertain because of its dependence on climatic conditions, which are beyond the control of project proponents. This makes the project less attractive & financially more risky for the project proponents.

Barrier due to prevailing practice

Low Tariff:
Tariff in Tamilnadu for power purchase from private power producers are governed by regulations from Tamilnadu Electricity Regulatory Commission (TNERC). A comparison with tariff given by other states shows that tariff rates are at the lowest in Tamilnadu for wind. While neighboring state of Karnataka gives Rs. 3.40 per unit export to grid it is only Rs. 2.70 per unit in Tamilnadu. In the state of Maharashtra, power purchase rate for wind power is even higher at Rs. 3.50 per unit. The Indian Wind Energy Association and project developers have urged the Tamilnadu Electricity Regulatory Commission (TNERC) to increase tariff[5] and proposed a tariff between Rs.3.10 to 3.50.

State	**Tariff (in Rs./ kWh)**
Tamilnadu	2.70 (without escalation)
Karnataka	3.40 (without escalation)
Maharashtra	3.50 (with 15 paise escalation/ annum)

The tariff rate established by TNERC is even lower than that proposed by Ministry of Non Conventional Energy Sources (MNES) in India for wind power developers[6]. A comparison below clearly shows this difference. TNERC initially followed MNES guidelines on tariff and fixed Rs. 2.25/ kWh for base year 1995 with an annual escalation of 5%. But after 5 years in September 2001, TNERC diverted from MNES guidelines and fixed Rs. 2.70/ kWh with no annual escalation.

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
MNES	2.25	2.40	2.50	2.60	2.70	2.90	3.00	3.20	3.30	3.50	3.70
TNERC	2.25	2.25	2.25	2.25	2.70	2.70	2.70	2.70	2.75	2.75	2.75

[5] TNERC Orders (Page 21)

[6] www.windpowerindia.com

Unit: Rs./ kWh

The non-supportive tariff policy of TNERC further impacts project's viability and requires additional support of CER backed revenue.

Grid evacuation problem:

Any Grid works on two loads i.e. base load and peak load. Power generation in wind turbines due to its inherent feature depends on climatic conditions and is beyond the control of project proponent. Due to this reason, power from windmills is considered to meet demand only in the event when it could not be met with conventional power sources. In recent times, wind turbines in Tamilnadu have been many times asked to back down[7] as power generation in thermal power stations had been running at their peak resulting in high frequency in the grid. The TNEB at times is not able to evacuate power that the wind units are generating. This leads to low sales realization, which has a negative impact on the IRR of the project.

> *"In the last three to four days, according to the sources, TNEB has asked wind power generators to shut down their turbines for periods ranging from nine hours to 20 hours a day. The Tirunelveli region and Coimbatore district are major wind energy producing centres in Tamilnadu."*
>
> Source: http://www.blonnet.com/2006/05/31/stories/2006053103621900.htm

The problem is more severe due to the fact that this has happened at a time when climatic conditions were most suitable for wind power generation, due to the high speed of wind[8].

> *"The sources say that the electricity board has resorted to this move because of peak generation from thermal stations, resulting in high frequency in the grid. The wind power industry faced a similar problem last year too during the peak season when the Tamilnadu Electricity Board asked them to back down their machines due to evacuation problems."*
>
> Source: http://www.blonnet.com/2006/05/31/stories/2006053103621900.htm

Other Barriers

Managerial Constraints:

The project proponents have never ventured in such a power project activity before. They don't have prior expertise and experience for managing such business. Though wind farms are usually developed and maintained by developers on contract basis, but lack of knowledge about functioning, monitoring and operation of wind power projects is deemed as a major constraint.

Summary

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7 http://www.blonnet.com/2006/05/31/stories/2006053103621900.htm

8 http://www.blonnet.com/2006/05/31/stories/2006053103621900.htm

The proposed project activity faces a number of barriers against its implementation as discussed above and thus is not a business-as-usual scenario. The project activity is additional and project proponents seek CDM backed benefits to mitigate the risks.

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

As per the Appendix B of simplified modalities & procedures for small-scale CDM-project activities, the project boundary is "The project boundary encompasses the physical, geographical site of the renewable generation source."

The project boundary is composed of the Wind Energy Generators and the metering equipment for each generator and substation, grid that is used to transmit.

B.5. Details of the baseline and its development:

Baseline Scenario
The baseline is the kWh produced by the renewable energy-generating unit multiplied by an emission coefficient (measured in kg CO2equ/kWh) calculated in a transparent and conservative manner as:

Establishing Baseline:
As discussed in section B.2, the base line is established using the approach of combined margin. The following steps are followed to calculate combined margin.

Step 1: Calculate approximate Operating Margin
Operating margin emission factor is calculated as the generation weighted average emissions per electricity unit of all generating sources serving the system not including low-operating cost and must run power plants.

Operating Margin emission factor has been calculated using three years vintage data i.e. 2002-03, 2003-04, and 2004-05.

Southern Grid Power Generation [2004-05]

Source	MoU	Thermal	Diesel	Gas	
Gross Generation	MU	97964.3	2364.1	12276.6	
Net Generation	MU	90018.2	2293.2	11966.5	104278.0
Heat Rate	kcal/kWh	2490.0	2062.0	2000.0	
Fuel CV	kcal/kg	3820.0	10186.0	10350.0	
Fuel Consumption	Tonnes per annum	63856336.8	478582.0	2372289.9	
Total Emissions	tCO2/ annum	96187754.9	1497326.0	5738481.7	103423562.7
Emission Factor-OM	tCO2/ MWh	**0.992**			

Southern Grid Power Generation [2003-04]

Source	MoU	Thermal	Diesel	Gas	
Gross Generation	MU	96664.0	3225.0	16183.0	
Net Generation	MU	87938.6	3128.3	15770.3	106837.2
Heat Rate	kcal/kWh	2490.0	2062.0	2000.0	
Fuel CV	kcal/kg	3820.0	10186.0	10350.0	
Fuel Consumption	Tonnes per annum	63008733.0	652852.0	3127149.8	
Total Emissions	tCO2/ annum	94910996.6	2042559.6	7564460.0	104518016.3
Emission Factor-OM	tCO2/ MWh	**0.978**			

Southern Grid Power Generation [2002-03]

Source	MoU	Thermal	Diesel	Gas	
Gross Generation	MU	93350.1	4457.0	15138.0	
Net Generation	MU	85119.8	4323.3	14753.2	104196.2
Heat Rate	kcal/kWh	2425.0	2062.0	2000.0	
Fuel CV	kcal/kg	3820.0	10186.0	10350.0	
Fuel Consumption	Tonnes per annum	59260189.1	902251.5	2925217.4	
Total Emissions	tCO2/ annum	89264508.9	2822849.1	7075993.1	99163351.0
Emission Factor-OM	tCO2/ MWh	**0.952**			

So, the Simple OM is taken i.e. **0.974** tCO_2/MWh

Step 2: Calculate Build Margin

Build Margin is the emission factor of the sample group which either comprises of last 5 power plants to the grid or 20% of present generation capacity. In this case 20% of capacity being a bigger sample group will be considered. In this case Build margin is calculated to be 0.716 t CO2/MWh. Calculation is based on following data.

Southern Grid Power Generation [2004-05]

Source	MoU	Thermal	Diesel	Gas	Hydro	Nuclear	Wind	
Gross Generation	MU	23929.8	1796.0	7339.4	3296.5	2926.3	1270.7	
Net Generation	MU	23096.9	1742.3	7252.9	3279.7	2575.1	1270.7	39217.6
Heat Rate	kcal/kWh	2490.0	2062.0	2000.0	0.0	0.0		
Fuel CV	kcal/kg	3820.0	10186.0	10350.0	0.0	0.0		
Fuel Consumption	Tonnes per annum	15598220.4	363572.7	1418241.5				
Total Emissions	tCO2/ annum	23495832.6	1137499.9	3430674.0				28064006.6
Emission Factor-BM	tCO2/ MWh	**0.716**						

Step 3: Calculate Combined Margin

Simple operating margin and build margin gives the value of Combined Margin according to the relation

$EF_{BL} = (0.75 \times EF_{OM}) + (0.25 \times EF_{BM})$

As described in Methodology ACM0002, the weight-age for OM is 0.75 and for BM is 0.25 in case of Wind and Solar energy Projects.

Factor	**Value**
Simple OM	0.974
Build Margin	0.716
Combined Margin	0.909

Developed by:
Jatin Mirani
Bhagyodaya Agencies (Also a project participant)
Shraddha Complex
G E Road
Raipur (C.G.) – 492 001
Ph: +91-7722-237395
Mobile: +91 9425204964
Email: jatinmirani@gmail.com

Date: 20/08/2006

SECTION C. Duration of the project activity / Crediting period:

C.1. Duration of the small-scale project activity:

C.1.1. Starting date of the small-scale project activity:

26/11/2005

C.1.2. Expected operational lifetime of the small-scale project activity:

20 years

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

Fixed Crediting period

C.2.1. Renewable crediting period:

NA

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:

Date of Registration (Tentative: 01/11/2006)

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 small-scale project activity:

Methodology: AMS I.D 'Grid connected renewable electricity generation',
Version 09; dated 28 July 2006/Scope 1

Reference: Appendix B of the simplified M&P for small-scale CDM project activities

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

The project is a renewable energy project generating electricity (Type ID) – the monitoring methodology and baseline are selected here as suggested in the document 'Simplified Modalities and Procedures for Small-Scale CDM project activities'

Monitoring shall consist of metering the electricity generated by the renewable technology.

D.3 Data to be monitored:

ID number	Data type	Data variable	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
GENi	*Electricity*	*Electricity generated in each Wind Energy Generator (i) i.e. delivered to grid*	*KWh*	*Measured (m)*	*Monthly*	*Continuously*	*Electronic*	*Monthly TNEB certificate for electricity supplied to the grid by wind farm will be used for this variable. The reading from common meter as well individual meters is used by TNEB personnel to calculate electricity from each WTG.*

D.4. Qualitative explanation of how quality control (QC) and quality assurance (QA) procedures are undertaken:

ID Number	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
1	*L*	*The data can be very accurately measured. Tower wise electricity generation is measured using WTG meter. Electricity exported to grid is measured using TNEB meter installed on uploading station, this reading is taken monthly by joint team of O&M team at wind farm and TNEB personnel. The meter at the uploading station will be two-way meter and will be in custody of State electricity board.* *TNEB issues monthly certificate for actual power exported by each WTG on the wind farm, This reading is derived using above meters. Reading recorded in this certificate would be used for actual estimations.*

D.5. Please describe briefly the operational and management structure that the project participant(s) will implement in order to monitor emission reductions and any leakage effects generated by the project activity:

The wind turbines in the project activity are connected to the grid. Following is the monitoring plan for plant operation, maintenance and data recording in the project activity -

Responsibility
Project proponent has come in contract with M/s Asian Wind Tech – Consultants & Services, for providing monitoring and O&M services at the two wind sites. M/s Asian Wind Tech has deployed their personnel on both the sites who have been trained for this purpose. Reports on turbine operations and maintenance etc. are sent to project proponents on daily basis. They also coordinate with site developers M/s Vestas for preventive maintenance of wind turbines as per predefined schedules. Logbooks are maintained on preventive maintenance and operation of turbines.

The direct responsibility of WTG maintenance, daily WTG wise power generation data collection & reporting, monthly joint meter reading of common meter with SEB personnel are with manufacturer itself. WTG manufacturer is an ISO 9001:2000 certified company and has standard procedures for O&M, training, emergency situations, meter calibration etc.

Report generation on monitoring:

There are energy meters installed on each wind turbine, which are used to monitor tower wise power generation. O&M team personnel of project developer maintain these meters. Turbines at a location are connected to one energy meter installed and maintained by Tamilnadu Electricity Board (TNEB). A daily generation report is prepared which is sent to project proponent.
After verification of the data and due diligence on correctness, an annual report on power generation is prepared by the project proponent and record to this effect is kept for future verification.

Archiving of data
Data shall be kept for two years after the crediting period (total 12 years)

Calibration of instruments:
Tower wise meter is of high accuracy level, and is checked for accuracy on a regular basis. TNEB meter testing is done by a separate division of electricity board, which takes care of meter testing in the event of any abnormality observed.

Internal audit
CDM audits shall be carried out to check the correctness of data monitored by the internal team entrusted for the work. Report on internal checks done, faults found and corrective action taken shall be maintained and kept for external checking.

D.6. Name of person/entity determining the monitoring methodology:

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SECTION E.: Estimation of GHG emissions by sources:

E.1. Formulae used:

E.1.1 Selected formulae as provided in appendix B:

NA

E.1.2 Description of formulae when not provided in appendix B:

E.1.2.1 Describe the formulae used to estimate anthropogenic emissions by sources of GHGs due to the project activity within the project boundary:

Since, the proposed project activity is a renewable energy project, which generates electricity using wind power; no anthropogenic emissions by sources of greenhouse gases within the project boundary are identified.

E.1.2.2 Describe the formulae used to estimate leakage due to the project activity, where required, for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities

No anthropogenic greenhouse gases by sources outside the project boundary that are significant, measurable and attributable to the project activity are identified. Hence, no leakage is considered from the project activity. In addition, project proponents confirm that the renewable energy technology is not equipment transferred from another activity. Hence, no leakage calculation is required.

E.1.2.3 The sum of E.1.2.1 and E.1.2.2 represents the small-scale project activity emissions:

Nil

E.1.2.4 Describe the formulae used to estimate the anthropogenic emissions by sources of GHGs in the baseline using the baseline methodology for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities:

BEy = EWy X EF/1000

where
BEy - Baseline emissions in year y, tCO_2e
EWy - Energy wheeled to the grid in year y, KWh
EF- Grid emission factor, kg CO_2/KWh

E.1.2.5 Difference between E.1.2.4 and E.1.2.3 represents the emission reductions due to the project activity during a given period:

ERy = BEy

Where;
ERy- Emission reductions in year y, tCO2e

E.2 Table providing values obtained when applying formulae above:

Year	Baseline Emission	Project Emission	Leakage Emission	Emission Reduction
2006-2007	6537	0	0	6537
2007-2008	6537	0	0	6537
2008-2009	6537	0	0	6537
2009-2010	6537	0	0	6537
2010-2011	6537	0	0	6537
2011-2012	6537	0	0	6537
2012-2013	6537	0	0	6537
2013-2014	6537	0	0	6537
2014-2015	6537	0	0	6537
2015-2016	6537	0	0	6537

SECTION F.: Environmental impacts:

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

As per Ministry of Environment & Forest (MOEF) India, Environment Impact Notification S.O.60 (E) dated 27/01/1994 and amendment notice EO Dated 04/07/2005, 32 sectors covered under Schedule 1, which are liable to conduct EIA study. Wind power projects are not covered under Schedule 1 and thus EIA is not required.

SECTION G. Stakeholders' comments:

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

Following stakeholders were identified for the project activity:
1. District authorities
2. Local Community
3. Local Gram Panchayat
4. Tamilnadu Electricity Board (TNEB)

The project activity has obtained all necessary approvals for setting up the power plants, and meets all regulatory requirements as mandated by Government agencies.

District Authority & Gram Panchayat:

Letter was sent to office of District Magistrate and Gram panchayat on August 03, 2006 informing about proposed power project and inviting views on the same.

Local Community:
An advertisement has been published in **"Daily Thandi**", a local circulation in Tamil on August 09, 2006 describing the project activity and asking for views/ suggestions on project activity from all.

One to one interactive sessions were also held (August 2006) with some individuals in that area and same comments were received from them.

G.2. Summary of the comments received:

Summary of comments received:
There has been no power cut since the windmills have been installed. Local community is going to gain from this project, as it would create in-direct employment opportunities for the local community. People have suggested that Project Participants should promote this type of power projects in business community, as this is cleaner method of power generation unlike thermal power plants, which emit smoke and other gases.

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

No adverse comments received on project activity from any of the stakeholders consulted.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No Public Funding for this project.

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