6.75 MW Small Scale Grid Connected "Wind Electricity Generation Project" by Tamil Nadu Newsprint and Papers Limited

UNFCCC registration reference number: 1053
Date of registration of project: 25th May 2007

MONITORING REPORT

From – 01/04/2004 to 16/07/2007

Version 01
Dated: 27-07-2007

1. Title of the project activity

6.75 MW Small Scale Grid Connected "Wind Electricity Generation Project" by Tamil Nadu Newsprint and Papers Limited.
PDD Version VI
Dated: March 24, 2007

Date of registration of project: 25th May 2007
UNFCCC registration reference number: 1053

2. Introduction

TNPL has invested in renewable energy based power generation by establishing a wind farm of 6.75 MW installed capacity at Tirunelveli district in the state of Tamil Nadu. This project activity was carried out in two phases. The first phase involved installation of four 0.75 MW WEGs of NEG Micon make; and in the second phase, three 1.25 MW WEGs of Suzlon make were installed.

The project activity will evacuate the renewable power annually (after completion of both phases of the project) to the power deficit southern region grid. The generated electricity will be sold to the Tamil Nadu Electricity Board (TNEB).

Name of Investor

Tamil Nadu Newsprint and Papers Limited

3. Methodology used

Appendix B of the simplified M&P for small scale CDM project activities (UNFCCC, 2003b)

Project Type: I	Renewable energy project
Project Category: I D	Renewable electricity generation for a grid
Version:	10 (23rd December, 2006)

The installed capacity of the project is 6.75 MW, which is less than the limiting capacity of 15 MW and is thus eligible to use small-scale simplified methodologies. Further, the project activity is generation of electricity for sale to state electricity utility utilizing the regional grid system using wind potential. Hence, the type and category of the project activity matches with I.D. as specified in Appendix B of the indicative simplified baseline and monitoring methodologies for small-scale CDM project activities.

4. Abbreviations in the report

CDM – Clean Development Mechanism
PDD – Project Design Document
GHG – Green House Gas / Gases
IPCC – Intergovernmental Panel on Climate Change
SEB – State Electricity Board
TNEB – Tamil Nadu Electricity Board

JMR – Joint Meter Reading
WEG – Wind Electricity Generator

5. General description of the project

5.1 Project Activity

The candidate CDM project will generate electricity from 7 WEGs in the Devarkulam Wind Park. The project activity has been conceived for the sale of generated electricity to state electricity utility. The wind power will be wheeled utilizing the regional grid (Tamil Nadu State Electricity Board), and will be supplied to the local consumers drawing electricity from the local grid. Since wind power is GHG emissions free, the wind power generated will save the anthropogenic greenhouse gas (GHG) emissions generated by the fossil fuel based thermal power stations comprising coal, diesel, furnace oil and gas.

The project activity started in March 2001 and considers the crediting period from 1 April 2004, after the commissioning of all the WEGs. The project estimated to generate approximately 15.62 million kWh per year, contributing an estimated reduction of 144311.68 tCO_2eq over the ten year crediting period of the project from 2004 - 2014. This reduction is the result of displacement of fossil fuel fired power plants that would otherwise have delivered the electricity to Southern Region Grid in the absence of the project activity.

5.2 Technical description of the project

Location of project activity

The wind electricity generators have been installed at Devarkulam wind farm in Tirunelveli District:

State:	Tamil Nadu
District:	Tirunelveli
Town:	Devarkulam
Latitude:	$08^{o}57'$ N
Longitude:	$78^{o}38'$ E
Altitude:	70 m above mean sea level

Technology employed by the project activity

The project activity leads to the promotion of NEG Micon 0.75 MW and 1.25 MW Suzlon Wind Electric Generators (WEGs) into the region, demonstrating the success of wind based renewable energy generation, which is fed into the nearest sub-station (part of the southern regional grid), thus increasing energy availability and improving quality of power under the service area of the substation. Hence, the project leads to technological well being.

The technology employed converts wind energy to electricity using a Wind Electric Generator. The project activity involves implementation and operation of 6.75 MW (0.75 MW x 4 and 1.25 MW x 3) Wind Electric Generators (WEG). The 0.75 MW turbines are of NEG Micon make and 1.25 MW turbines are of Suzlon make.

In 1.25 MW Suzlon WEG, there is a direct grid-connected high-speed generator, in combination with the multiple-stage combined spur/planetary gearbox of the Suzlon Megawatt Series, which offers greater robustness and reliability than a low-speed generator connected to the electrical grid via AC-DC-AC-inverter systems. High-speed asynchronous generator with a multi-stage intelligent switching compensation system delivers power factor up to 0.99. The generated power is free from harmonics and is grid friendly.

The 750 kW WEG from NEG Micon is one of the machines well known for its performance. The 750 kW WEG is a stall regulated machine with a cut in speed of 4m/s and a cut out speed of 25m/s. The WEGs are type tested and certified by DNV A/S.

Technology Transfer

No technology transfer from other countries is involved in this project activity. The supplier and manufacturer of the S-64 turbines, Suzlon Energy Limited, have themselves developed the technology of MW class WEGs in their German R & D centre. NEG Micon also carries out its own R & D and has developed the WEGs themselves. Post installation operation & maintenance will be carried out by the both the agencies.

5.3 Crediting Period

The project activity has sought a 10 year fixed crediting period starting from 1/4/2004.

6. Monitoring methodology & Plan

Title: "Grid connected renewable electricity generation" AMS I D version 10 (23rd December 2006)

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

The parameter to be monitored is Electricity Supplied to the Southern Regional Grid of India (As per D3 of the PDD of the registered project activity)

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)	For how long is archived data to be kept?	Comment
1	Electricity supplied to the regional electricity grid	Electricity	kWh	M	Monthly	100%	Electronic & Paper	Two years beyond Crediting period	The power export and import from the individual WEGs will be monitored

QA/QC procedures undertaken:

Data	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.

1.	Low	The data can be very accurately measured. The meters installed on sub stations (grid interconnection point) will be used to measure mentioned variables on a continuous basis. Every month these meter readings will be recorded by plant personnel, these records will be archived for crosschecking yearly figures. The meters at the sub station will be two-way meters and will be in custody of State Electricity Utility. SEB officials will take the readings in these meters and the same reading will be used to determine the net power exported to the grid and determine the extent of mitigation of GHG over a period of time.

6.1 Calibration / Maintenance of Measuring and Analytical Equipments

The project activity requires evacuation facilities for sale to grid and the evacuation facility is essentially maintained by the state electricity utility (TNEB).

1. The electricity generation measurements are required by the utility and the investors to assess electricity sales revenue and / or wheeling charges. The project activity has therefore envisaged two independent measurements of generated electricity from the wind turbines.
2. The primary recording of the electricity fed to the state utility grid is carried out jointly at the incoming feeder of the state power utility (TNEB). Machines for sale to utility are connected to the feeder.
3. The joint measurement is carried out once in a month in presence of both parties (the developer's representative and officials of the state power utility). Both parties sign the recorded reading.
4. The secondary monitoring, which provides a backup (fail-safe measure) in case the primary monitoring is not carried out, is done at the individual WEGs. Each WEG is equipped with an integrated electronic meter. These meters are connected to the Central Monitoring Station (CMS) of the entire wind farm. The generation data of individual machine can be monitored as a real-time entity at CMS. The snapshot of generation on the last day of every calendar month will be kept as a record both in electronic as well as printed (paper) form.
5. Metering equipment – Metering is carried out through electronic tri vector meters of accuracy class 0.5 (as per the grid code prevailing at the time of installation) required for the project. The meter is installed and owned by TNEB. The metering equipment is maintained in accordance with electricity standards. The calibration is carried out by TNEB officials.
6. Meter Readings – The monthly meter readings at the project site and the receiving station are taken simultaneously and jointly by the parties every month. At the conclusion of each meter reading an appointed representative of the TNEB and the company signs a document indicating the number of kWh exported to the grid.

TNPL has entered into Operation & Maintenance Agreement with the EPC contractors M/s Suzlon Windfarm Services Limited & NEG Micon India Private Limited for carrying out the necessary maintenance of the installations during the designed life of the project. These respective agencies are responsible for the operation and maintenance structure that is implemented in order to monitor emission reductions generated by the project activity. The various O&M activities are as under:

1 Routine Maintenance Services

Routine Maintenance Labour Work involves making available suitable manpower for operation and maintenance of the Equipment and covers periodic preventive maintenance, cleaning and upkeep of the Equipment including -

a) Tower Torquing
b) Blade Cleaning
c) Nacelle Torquing and Cleaning
d) Transformer Oil Filtration
e) Control Panel & LT Panel Maintenance
f) Site and Transformer Yard Maintenance

2 Security Services

This service includes watch and ward and Security of the Wind Farm and the Equipment.

3 Management Services

a) Data logging in for power generation, grid availability, machine availability.
b) Preparation and submission of monthly performance report in agreed format.
c) Taking monthly meter reading jointly with SEB, of power generated at the Wind Farm and supplied to SEB Grid from the meter/s maintained by SEB for the purpose and co-ordinate to obtain necessary power credit report/ certificate.

4 Technical Services

a) Visual inspection of the WTG and all parts thereof.
b) Technical Assistance including checking of various technical, safety and operational parameters of the Equipment, trouble shooting and relevant technical services.

6.2 Environmental Impact

1. The electricity from wind electricity generator has no negative environmental impacts.

2. 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. The details of these activities are available at: http://envfor.nic.in/divisions/iass/notif/eia.htm

3. The proposed project doesn't fall under the list of activities requiring EIA as it will not involve any negative environmental impacts, because the WEGs installed for generation of power use wind (cleanest possible source of renewable energy).

7. GHG Emission Reduction Calculations

7.1 Project Activity Emissions: Nil

Emissions by sources of GHGs due to the project activity within the project boundary are zero since wind power is a GHG emission free source of energy.

7.2 Leakage: Nil

This is not applicable as the renewable energy technology used is not equipment transferred from another activity. Therefore, as per the simplified procedures for SSC project activities, no leakage calculation is required.

There is no alternate fuel which can generate electricity from the installed plant and machinery in absence of wind

7.3 Baseline Emissions

The wind power project uses the Combined Margin methodology as stated in ACM 0002.

The total baseline emissions $\mathbf{BE_y\ (tCO_2/yr) = EG_y * EF_y}$

Where
BE_y = Baseline emissions in year y (t CO_2).
EG_y (MWh/yr) = Electricity generated by the project in year y;
EF_y = Combined margin emissions factor (Baseline emission factor) for the year *y* (tCO_2/MWh).

The emission factor EF_y of the Southern Region Grid is a fixed value over the projects crediting period and is calculated as the weighted average of the Operating Margin emission factor ($EF_{OM,\ y}$) and the Build Margin emission factor ($EF_{BM,y}$):

$$\mathbf{EF_y = w_{OM}\ EF_{OM,y} + w_{BM}\ .EF_{BM,y}}$$

Where the weights w_{OM} and w_{BM}, are 75% and 25%, and $EF_{OM,\ y}$ and $EF_{BM,\ y}$ are the Operating Margin and Build Margin emission factors respectively calculated in the following paragraph. The emission factor EF_y is estimated to be **0.9321 tCO_2/MWh.**

The Operating Margin is the weighted average emissions of all generating sources serving the Southern Grid excluding hydro, geothermal, wind, low-cost biomass, nuclear and solar generation. It is derived from the following equation:

$$\mathbf{EF_{OM,\ simple,\ y} = \frac{\Sigma F_{i,\ j,\ y}\ COEF_{i,\ j}}{\Sigma GEN_{j,\ y}}}$$

where
$F_{i,\ j,\ y}$ is the amount of fuel i (in a mass or volume unit) consumed by relevant power sources j in year(s) y,
j refers to the power sources delivering electricity to the grid, not including low-operating cost and must-run power plants, and including imports to the grid.

$COEF_{i,j\ y}$ is the CO_2 emission coefficient of fuel i (t CO_2 / mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources j and the percent oxidation of the fuel in year(s) y, and

$GEN_{\ j,\ y}$ is the electricity (MWh) delivered to the grid by source j.

The CO_2 emission coefficient $COEF_i$ is obtained as

$$\mathbf{COEF_i\ = NCV_i * EF_{CO2,\ i} * OXID_i}$$

where:

NCV_i is the net calorific value (energy content) per mass or volume unit of a fuel i,
$OXID_i$ is the oxidation factor of the fuel (see page 1.29 in the 1996 Revised IPCC Guidelines for default values),
$EF_{CO2,i}$ is the CO_2 emission factor per unit of energy of the fuel i.

The $EF_{OM,Y}$ is estimated to be **1.00349 tCO_2/MWh** (based on three years average).

The Build Margin emission factor ($EF_{BM,y}$) is calculated as the generation weighted average emission factor (tCO_2/MWh) of a sample of power plants m, as follows:

$$EF_{BM,y} = \frac{\Sigma F_{i,m,y} . COEF_{i,m}}{\Sigma GEN_{m,y}}$$

Where
$F_{i,m,y}$ = quantity of fuel i used in plant m (kt/yr) in year y

$COEF_{i,m}$ = carbon emissions factor for fuel i in plant m (tCO_2/kt), taking into account the carbon content of the fuels by power sources and the percent oxidation of the fuel

$GEN_{m,y}$ = annual generation from plant j (MWh/yr) in year y

The $EF_{BM,y}$ is estimated as **0.71799 tCO_2/MWh** (with sample group m constituting most recent capacity additions to the grid comprising 20% of the system generation).

The baseline emissions are estimated as the product of the electricity generated by the project activity and the Emission factor of the regional electricity grid as calculated above.

Name of Item	GEN
Description	Electricity Quantity – Electricity fed into the Southern grid
Crediting Period	01/04/2004 – 31/03/2014
Method of monitoring	Measured using energy meter
Recording frequency	Continuous
Reporting frequency	Monthly (Jointly by SEB and representative of the investor)
Background data	Joint meter reading available at the site
Archiving mode	Electronic & paper

The project started on 29/03/2001 and the crediting period starts from 01/04/2004.

Report has been prepared by:
Senergy Global Private Limited
9th Floor, Eros Corporate Tower
Nehru Place
New Delhi 110 019
In association with Tamil Nadu Newsprint and Papers Ltd

Emission reductions:
The total emission reductions for the monitoring period, starting from 1st April 2004 to 16th July 2007, are 45585. The emission reduction calculations are shown in the table below.

Monitoring period	Net electricity exported (in kWh)				Total net electricity exported (in kWh)	Baseline Emission Factor (kgCO2e/kWh)	Total emissions reductions (tCO2e)
	Meter 1 (388) (4*750 kW)	Meter 2 (708) (1*1250 kW)	Meter 3 (709) (1*1250 kW)	Meter 4 (710) (1*1250 kW)			
1/04/2004 - 17/05/2004*	445200	214544	213184	215568	1088496	0.9321	1014.6
17/05/2004 - 14/06/2004	1276800	547360	564320	572432	2960912	0.9321	2759.9
14/06/2004 - 15/07/2004	1446600	621666	639522	647424	3355212	0.9321	3127.4
15/07/2004 - 16/08/2004	1502400	693180	662436	699624	3557640	0.9321	3316.1
16/08/2004 - 15/09/2004	1033800	485712	471204	490734	2481450	0.9321	2313.0
15/09/2004 - 15/10/2004	378600	181026	174060	154080	887766	0.9321	827.5
15/10/2004 - 15/11/2004	49800	36828	30996	33084	150708	0.9321	140.5
15/11/2004 - 15/12/2004	121800	64836	57816	60660	305112	0.9321	284.4
15/12/2005 - 16/01/2005	87600	44226	37980	39384	209190	0.9321	195.0
16/01/2005 - 15/02/2005	111000	53388	47466	50166	262020	0.9321	244.2
15/02/2005 - 15/03/2005	49200	31176	25920	28188	134484	0.9321	125.4
15/03/2005 - 15/04/2005	87600	72918	64998	70758	296274	0.9321	276.2
15/04/2005 - 15/05/2005	219000	109494	109764	113004	551262	0.9321	513.8
15/05/2005 - 16/06/2005	835200	400428	412668	418932	2067228	0.9321	1926.9
16/06/2005 - 15/07/2005	1387200	610758	641628	640692	3280278	0.9321	3057.5
15/07/2005 - 15/08/2005	1347000	574128	601848	602064	3125040	0.9321	2912.8
15/08/2005 - 15/09/2005	961800	451260	442404	449280	2304744	0.9321	2148.3
15/09/2005 - 15/10/2005	585600	269370	264600	268398	1387968	0.9321	1293.7
15/10/2005 - 15/11/2005	253200	127044	120546	125712	626502	0.9321	584.0
15/11/2005 - 16/12/2005	40800	21114	15768	19044	96726	0.9321	90.2
16/12/2006 - 16/01/2006	87000	40986	34812	37152	199950	0.9321	186.4
16/01/2006 - 15/02/2006	104400	48672	42354	44730	240156	0.9321	223.8
15/02/2006 - 15/03/2006	40800	12618	16182	16884	86484	0.9321	80.6
15/03/2006 - 16/04/2006	82200	44082	38088	41580	205950	0.9321	192.0
16/04/2006 - 16/05/2006	357600	172746	169668	170946	870960	0.9321	811.8
16/05/2006 - 15/06/2006	1150200	512442	518868	496008	2677518	0.9321	2495.7
15/06/2006 - 15/07/2006	1063800	542952	588150	575946	2770848	0.9321	2582.7
15/07/2006 - 17/08/2006	949200	640224	650304	637092	2876820	0.9321	2681.5
17/08/2006 - 15/09/2006	602400	289962	291870	287154	1471386	0.9321	1371.5
15/09/2006 - 16/10/2006	811800	385236	384894	368406	1950336	0.9321	1817.9
16/10/2006 - 15/11/2006	33600	19998	18108	17748	89454	0.9321	83.4
15/11/2006 - 15/12/2006	82800	42156	35586	35370	195912	0.9321	182.6
15/12/2007 - 18/01/2007	100200	50940	44928	41454	237522	0.9321	221.4
18/01/2007 - 14/02/2007	61200	30798	23976	24696	140670	0.9321	131.1
14/02/2007 - 15/03/2007	73800	30654	33102	26046	163602	0.9321	152.5
15/03/2007 - 16/04/2007	37800	22392	18630	13662	92484	0.9321	86.2
16/04/2007 - 15/05/2007	454800	200628	204624	191718	1051770	0.9321	980.4
15/05/2007 - 06/06/2007	594000	386748	388458	367200	1736406	0.9321	1618.5
16/06/2007 - 16/07/2007	1123800	543744	549720	501966	2719230	0.9321	2534.6
TOTAL							**45585**

Yearly Emission Reductions

S. No	Monitoring period	Emissions reductions
1	1/04/2004 **(*)** – 15/04/2005	14623.96
2	15/04/2005 - 16/04/2006	13209.99
3	16/04/2006 - 16/04/2007	12618.31
4	16/04/2007- 16/07/2007	5133.45
	TOTAL	**45585**

(* Note: The first 15 days of April 2004 was forgone and not considered because the Joint Meter Reading (JMR) was from 15th March 2004 to 15th April 2004 and also it was not possible to segregate the generation data.)