

**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: 25<sup>th</sup> May 2007

**MONITORING REPORT**

**From – 01/04/2004 to 16/07/2007**

**Version 02  
Dated: 18-09-2007**

## **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: 25<sup>th</sup> 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)

<b>Project Type: I</b>	Renewable energy project
<b>Project Category: I D</b>	Renewable electricity generation for a grid
<b>Version:</b>	10 (23 <sup>rd</sup> 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<sub>2</sub>eq 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°57' N
Longitude:	78°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 (23<sup>rd</sup> 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.
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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.
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## 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<sub>2</sub>/yr) =  $\mathbf{EG}_y * \mathbf{EF}_y$

Where

$\mathbf{BE}_y$  = Baseline emissions in year y (t CO<sub>2</sub>).

$\mathbf{EG}_y$  (MWh/yr) = Electricity generated by the project in year y;

$\mathbf{EF}_y$  = Combined margin emissions factor (Baseline emission factor) for the year y (tCO<sub>2</sub>/MWh).

The emission factor  $\mathbf{EF}_y$  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 ( $\mathbf{EF}_{\text{OM},y}$ ) and the Build Margin emission factor ( $\mathbf{EF}_{\text{BM},y}$ ):

$$\mathbf{EF}_y = w_{\text{OM}} \mathbf{EF}_{\text{OM},y} + w_{\text{BM}} \mathbf{EF}_{\text{BM},y}$$

Where the weights  $w_{\text{OM}}$  and  $w_{\text{BM}}$ , are 75% and 25%, and  $\mathbf{EF}_{\text{OM},y}$  and  $\mathbf{EF}_{\text{BM},y}$  are the Operating Margin and Build Margin emission factors respectively calculated in the following paragraph. The emission factor  $\mathbf{EF}_y$  is estimated to be **0.9321 tCO<sub>2</sub>/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:

$$\mathbf{EF}_{\text{OM, simple}, y} = \frac{\sum \mathbf{F}_{i,j,y} \mathbf{COEF}_{i,j}}{\sum \mathbf{GEN}_{j,y}}$$

where

$\mathbf{F}_{i,j,y}$  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.

$\mathbf{COEF}_{i,j,y}$  is the CO<sub>2</sub> emission coefficient of fuel i (t CO<sub>2</sub> / 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

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

The CO<sub>2</sub> emission coefficient  $\mathbf{COEF}_i$  is obtained as

$$\mathbf{COEF}_i = \mathbf{NCV}_i * \mathbf{EF}_{\text{CO}_2,i} * \mathbf{OXID}_i$$

where:

NCV<sub>i</sub> is the net calorific value (energy content) per mass or volume unit of a fuel i,  
 OXID<sub>i</sub> is the oxidation factor of the fuel (see page 1.29 in the 1996 Revised IPCC Guidelines for default values),  
 EF<sub>CO<sub>2</sub>,i</sub> is the CO<sub>2</sub> emission factor per unit of energy of the fuel i.

The EF<sub>OM,y</sub> is estimated to be **1.00349 tCO<sub>2</sub>/MWh** (based on three years average).

The Build Margin emission factor (EF<sub>BM,y</sub>) is calculated as the generation weighted average emission factor (tCO<sub>2</sub>/MWh) of a sample of power plants m, as follows:

$$EF_{BM,y} = \frac{\sum F_{i,m,y} \cdot COEF_{i,m}}{\sum GEN_{m,y}}$$

Where

F<sub>i,m,y</sub> = quantity of fuel i used in plant m (kt/yr) in year y

COEF<sub>i,m</sub> = carbon emissions factor for fuel i in plant m (tCO<sub>2</sub>/kt), taking into account the carbon content of the fuels by power sources and the percent oxidation of the fuel

GEN<sub>m,y</sub> = annual generation from plant j (MWh/yr) in year y

The EF<sub>BM,y</sub> is estimated as **0.71799 tCO<sub>2</sub>/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.

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**Emission reductions:**

The total emission reductions for the monitoring period, starting from 1<sup>st</sup> April 2004 to 16<sup>th</sup> July 2007, are 45584. The emission reduction calculations are shown in the table below.



### Yearly Emission Reductions

<b>S.No</b>	<b>Monitoring period</b>	<b>Emissions reductions</b>
1	15/04/2004 - 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	5132.33
	<b>TOTAL</b>	<b>45584</b>