

## **VER Monitoring Report**

### ***13.65 MW Captive Wind Energy Project in Tirunelveli***

Monitoring Period  
**25-03-2004 to 31-12-2007**  
**(Including both days)**

Submitted by

Loyal Textile Mills Ltd  
No. 21/4, Mill Street  
Kovilpatti  
Tamil Nadu - 628501  
India

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## 1. Executive Summary

**Title** : 13.65 MW Captive Wind Energy Project in Tirunelveli  
**Version** : 02  
**Standatd** : VCS 01  
**Category** : 1. Renewable Energy (**Wind**, PV, solar thermal, biomass, liquid biofuels, geothermal, run-of- river hydro) as per VCS 01

### Sectoral Scope:

The VER project activity is a small scale activity as the aggregate capacity is 13.65 MW which is smaller than 15 MW which is the ceiling capacity for a project to be considered under small scale. Therefore, the project activity is a small scale VER activity.

According to the CDM modalities and procedure the project activity falls under:

Scope number	:	1
Sectoral Scope	:	Energy Industries (renewable/non-renewable sources)
VER Standard	:	VCS 01

## 2. Description of the Project Activity

The project activity involves the installation commissioning and operation of wind based electricity generation facilities, with aggregate installed capacity of 13.65 MW for its captive use. The aggregate 13.65 MW project activity comprises of 15 numbers of WEGs, with machine of different capacities of 600, 750, 1250 and 1500kW. The project activity is an initiative of Loyal Textile Mills Limited (LTML) and its sister concern Shri Chintamani Textile Mills Private Ltd. respectively. The generated power is banked and wheeled through the regional grid for captive consumption in Loyal Textile Mills and its units, Loyal Super Fabrics, Valli Textile Mills and its sister concern Shri Chintamani Textile Mills Private Ltd thereby reducing the dependence on the use of power generated from fossil fuels in these plants. The project activity aims to claim the already generated VERs upto the date of verification by the DOE. From this project activity till 31<sup>st</sup> December 2007, the approximate electricity generation recorded is 5, 90, 02,574 kWh and VER generated is 47,202.

## 2.1. Project Location

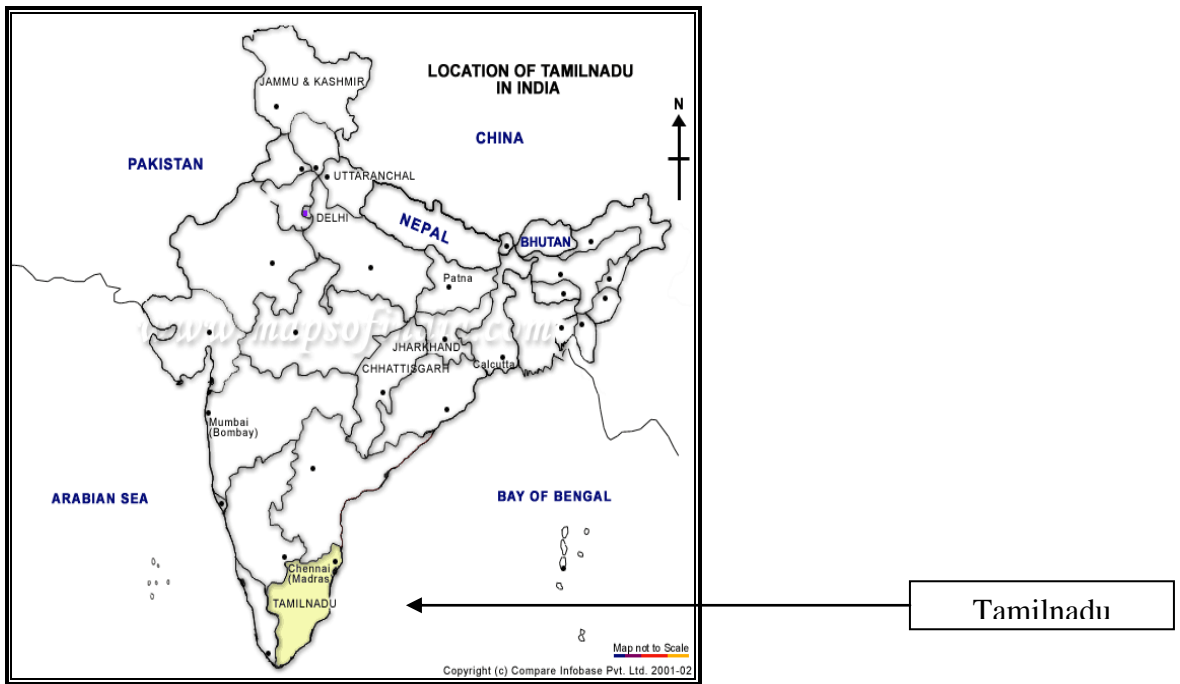
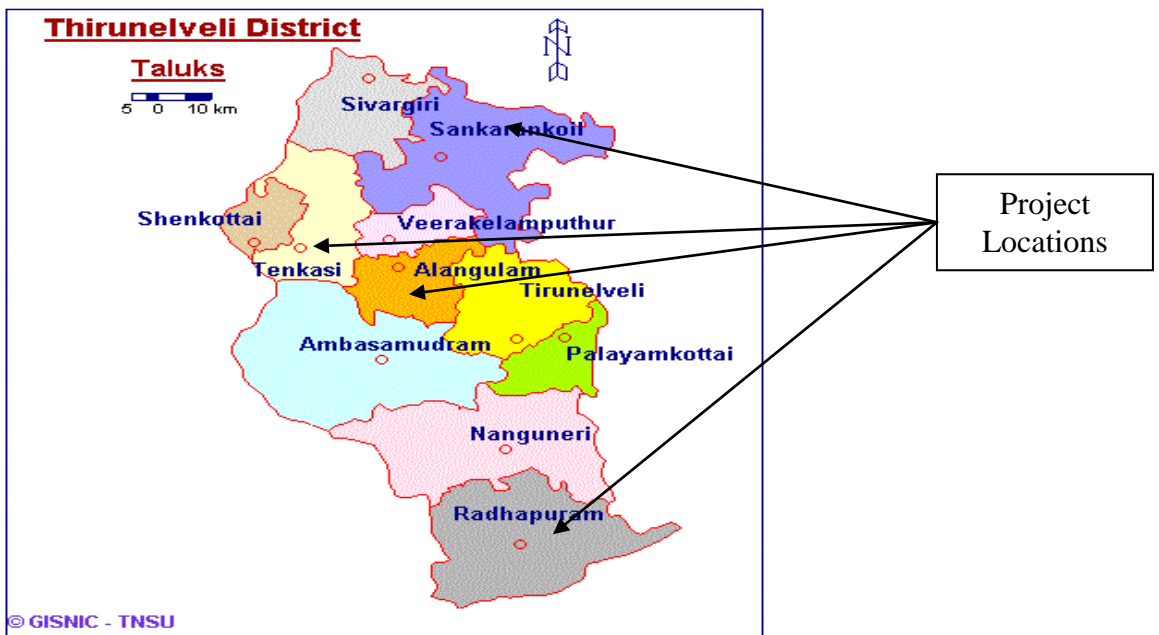


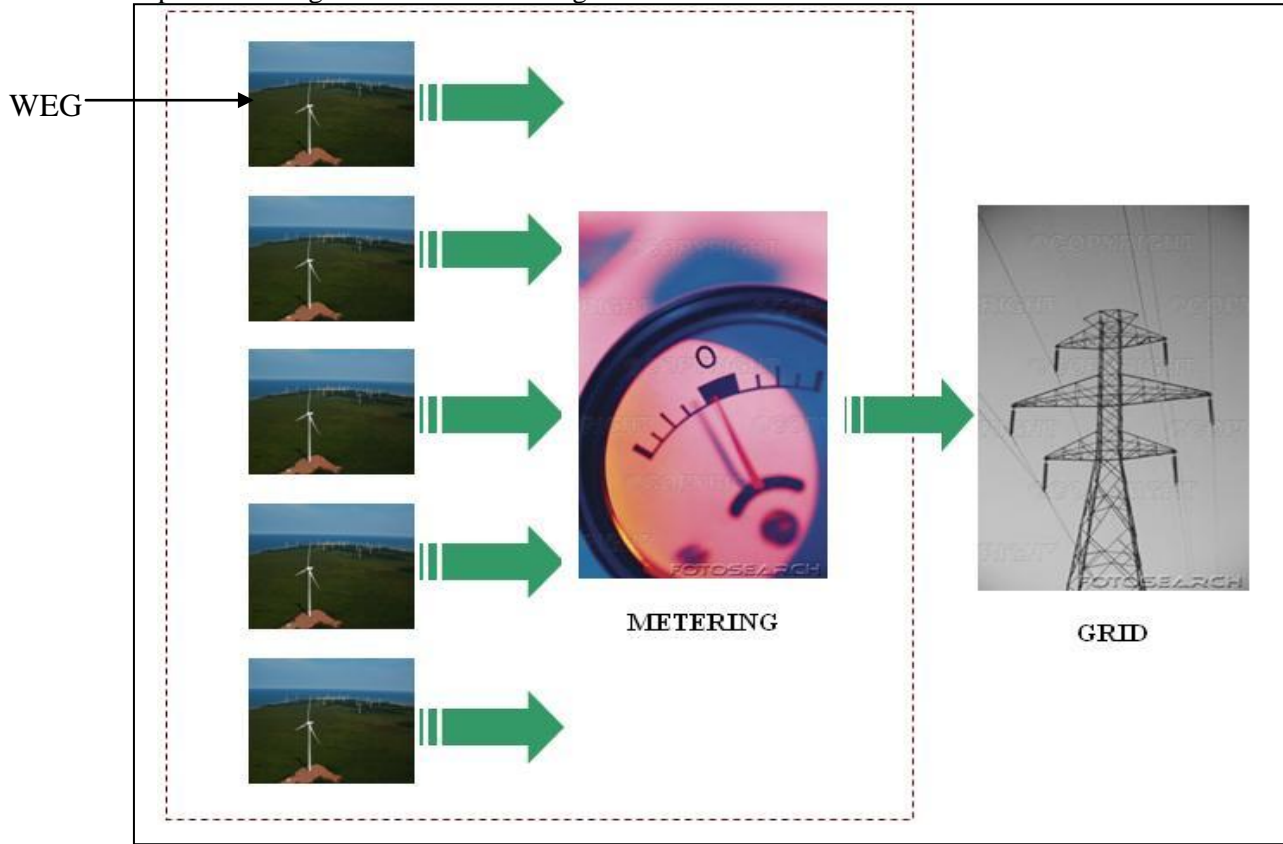
Fig 1: State Location



Refer Annexure – 1 for site numbers and the HTSC numbers of the WEGs

**2.2. Project Boundary**

According to AMS I-D the spatial extent of this project activity includes the project site and all the power plants connected physically to the electricity system that the VER power project is connected to grid. This project wheeling electricity to the southern regional grid and hence the project boundary encompasses the WEG installations and all the power plants feeding into the Southern Regional Grid.



**3. Ownership details of WEG**

Project Proponents	No. of WEG	Capacity/WEG (MW)	Installed Capacity (MW)	Technology Used
Loyal Textile Mills Ltd.	6	0.75	4.5	NEG-Micon
Loyal Textile Mills Ltd.	3	0.60	1.8	Enercon
Chintamani Textile Mills	1	0.60	0.60	Enercon
Loyal Textile Mills Ltd.	3	1.25	3.75	Suzlon
Loyal Textile Mills Ltd.	2	1.5	3.0	Suzlon

#### **4. Sustainability Criteria**

The present project contributes to sustainable development. Government of India has stipulated following indicators for sustainable development in the interim approval guidelines<sup>1</sup> for CDM projects.

##### **4.1. Social well being:**

- The project activity will result in enhanced better livelihood opportunities for the local people.
- It also helps to enhance the skill of labours by training in different technical areas.
- As we can see from the table 1 given below, the project contributes to reduce the power shortage.
- In a smaller way the wind energy power project has helped the state in bridging the demand-supply gap.
- Power generation using wind-energy is free of any GHG emissions. There are also no NOx and SOx emissions in the plant operations.
- Use of renewable energy source (wind energy) also helps in conservation of natural resources (like coal), thereby contributing to energy security of the country.

##### **4.2. Economic well being:**

- The project activity has generated employment in the local area.
- The project activity has led to good investment in a developing region which otherwise would not have happened in the absence of project activity.
- The generated electricity is fed into the regional grid through local grid, thereby improving the grid frequency and availability of electricity to the local consumers (villagers & sub-urban habitants) which will provide new opportunities for industries and economic activities to be setup in the area thereby resulting in greater local employment, ultimately leading to overall development.
- The project activity has also led to diversification of the national energy supply, which is dominated by conventional fuel based generating units.
- Use of renewable energy source (wind energy) also helps in conservation of natural resources (like coal) in the country.

##### **4.3. Environmental well being:**

- Wind power generation is a zero-emission activity and there is no addition of emissions into the atmosphere. Moreover, it reduces the pressure on the fossil fuels for power generation and consequently reducing the emission of greenhouse gases into the atmosphere.

##### **4.4. Technological well being:**

- Increased interest in Wind energy projects will further push innovations efforts by technology providers to develop more efficient and better machinery in future.
- The technology is well proven and safe.

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<sup>1</sup> Ministry of Environment and Forest web site: [http://envfor.nic.in:80/divisions/ccd/cdm\\_iac.html](http://envfor.nic.in:80/divisions/ccd/cdm_iac.html)

In view of the above, the project participants consider that the project activity profoundly contributes to the sustainable development.

## 5. Monitoring Methodology and Monitoring Plan

### Monitoring Methodology:

According to the UNFCCC Guidelines the following methodology is applicable for the present project:

**Title** : “Grid connected renewable electricity generation” (AMS I-D)”  
**Version** : 12  
**Date** : 10<sup>th</sup> August 2007

### Monitoring Plan:

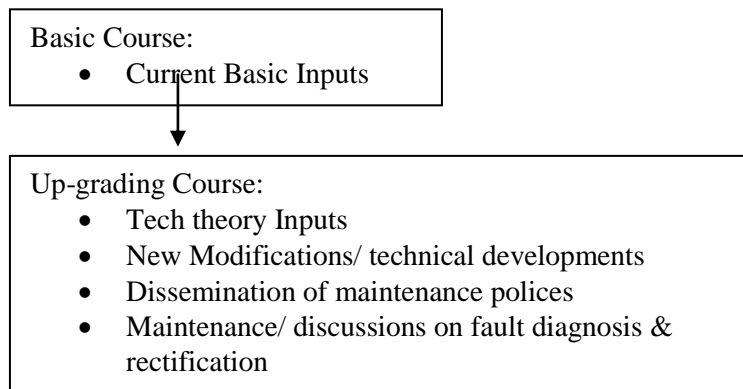
Monitoring had been done with as per the procedures mentioned in the PDD as per the methodology adopted for the project activity.

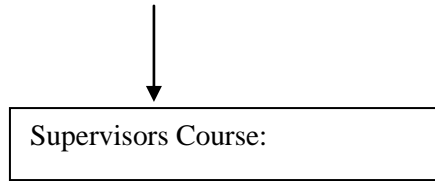
The project is a captive wind energy project. Units of energy (generated from Wind power) wheeled through Regional Grid for captive consumption. The methodology covers the monitoring of net units exported to grid and the other parameters affecting the quantity of power export and CO<sub>2</sub> emissions thereof. The net emission reductions will result from the net units of power available from the wind. The net unit generation can be calculated as:

$$\text{Net generation} = \text{Total Export (kWh)} - (\text{Total Import (kWh)} + \text{Wheeling (kWh)})$$

The WEG suppliers for this project activity Enercon India Pvt. Ltd, Suzlon Energy Ltd., and NEG Micon India Limited provide initial training to the responsible persons to ensure value added services. The training programme covers all aspects of Electrical, Electronics and Mechanical Engineering for the technical personnel and Management capsules for Managerial level.

Basically, training for technicians is conducted on a three tier basis, ensuring graded inputs being provided for them spread out over a period of time, to ensure proper assimilation and development of skill levels commensurate to the knowledge levels and experience gained. Initially when a person joins he is made to undergo the basic course, for duration of around 19 weeks. Thereafter, he returns back for added inputs every three years, till he attains the level of supervisor. A schematic diagram of the training sequence is shown below:





**Sequence of “On the Job Training” (OJT):**

Skill development of inductees will be carried out in three phases, as per details, and in the sequences listed below:

**First line Worker:** As a first line worker, an individual will be progressively cleared to perform the following types of servicing:

- Visual
- Visual plus Grease
- External electrics, from transformer up to sub-station

**Second line Worker:** As a second line worker, an individual will be progressively cleared to perform the following types of servicing:

- Mechanical
- Electrical

**Metering:**

The delivered Energy shall be metered by the parties at the high voltage side of the step up transformer installed at the project site.

**Daily Meter Reading**

Daily energy meter reading for all WEGs will be taken by the maintenance staff, and will be recorded in the generation log, in a controlled format The Daily Generation information will be sent to LTML Head Office at the closure of the business hours on a daily basis.

**Joint Meter Reading:**

The monthly meter reading (both main and check meter) shall being taken jointly by the Parties (TNEB and Owner) on the fixed day of the following month. 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 main meter reading will be used for recording electricity generation. Emission reduction calculation is based on monthly joint meter reading.

The electronic meters installed at the sub stations (grid interconnection point) by the TNEB will be used to measure the electricity supplied to the grid on a monthly basis. Every month these meter readings will be recorded by the officers of the TNEB. These records will be archived for crosschecking yearly figures. The meters at the sub station will be two-way meters and will be owned by SEB. SEB will take the readings from these meters and the same reading may be used to determine the net power wheeled to the user and determine the extent of mitigation of GHG over a period of time.



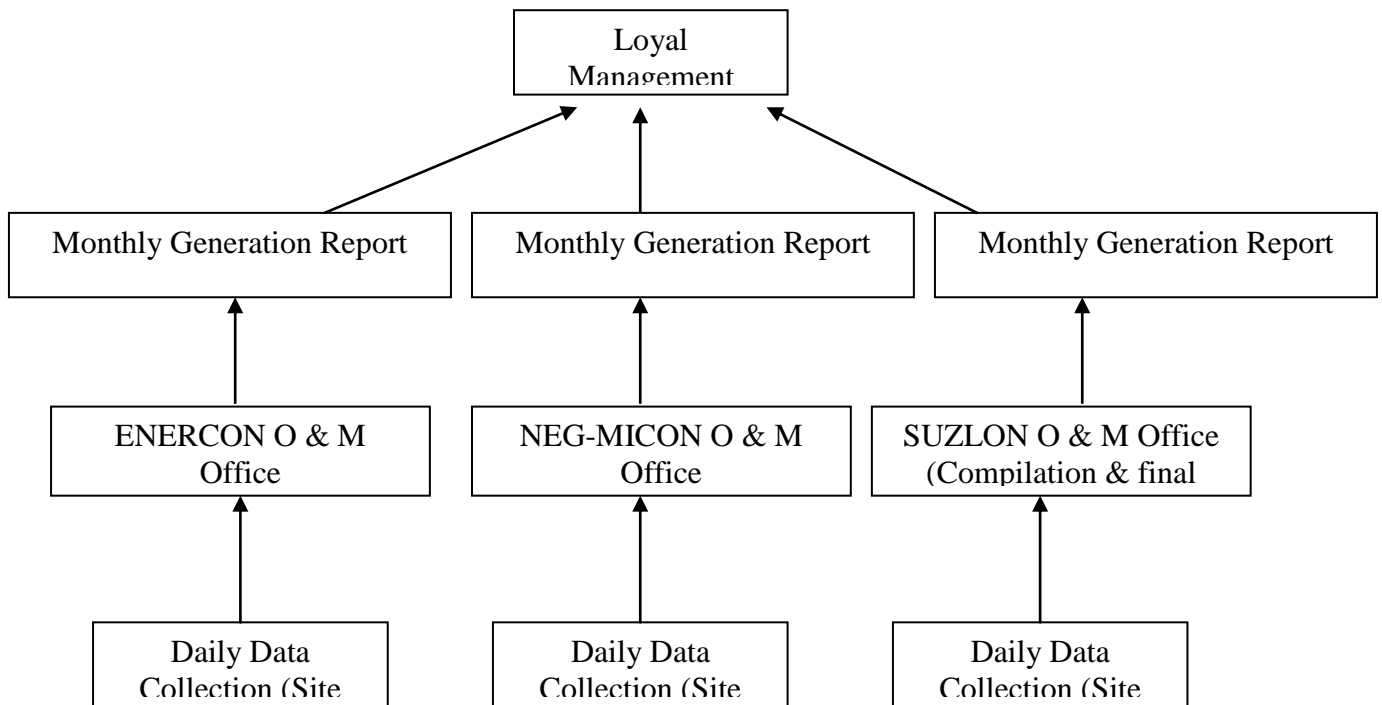
$$\text{Net generation} = \text{Total Export (kWh)} - (\text{Total Import (kWh)} + \text{Wheeling (kWh)})$$

For each WEG monthly billing period is fixed and therefore, might not be the same date for all the WEGs. To calculate generation up to a fixed date of monitoring period, monthly generation data of the last monitoring month for each WEGs shall be taken to calculate the daily average generation and generation for rest of the last day of the monitoring shall be calculated accordingly.

All the technology suppliers NEG Micon, Enercon India Ltd., and Suzlon Energy Ltd. are ISO-14001 certified companies. Moreover, the responsibility of the Operation and Maintenance of the WEGs lie with the respective technology suppliers. Therefore, the maintenance and calibration of monitoring equipments has been followed as per the ISO-14001 standards. However, the final reporting is being done to the project promoter who is responsible for maintaining the records.

**6. Monitoring Organization(s)**

The WEG suppliers for this project activity Enercon India Ltd, Neg MICON and Suzlon Energy Ltd would monitor the power generated by the WEGs with DCS controlled system and data are collected by Site Engineers appointed by service providers. Further the service providers store the data and they forward it to the management on a monthly basis.



## 7. Measures to insure the Accuracy of Results

Following measures are taken to ensure accuracy of readings & the calculations based there on.

The WEG suppliers for this project activity would monitor the power generated by the WEGs with DCS controlled system and data are collected by Site Engineers appointed by service providers. Following are few important points for Operation, Maintenance and calibration of WEGs and Meters:

### Operation & Maintenance of WEGs:

1. Visual maintenance: The visual maintenance is to be carried out 3 months after commissioning of the WEGs. It covers:

- A. Tighten all bolt connections to the required torque
  - Foundation bolts
  - Tower to tower bolt connections
  - Tower –ball bearing slewing rim
  - Break disc-generator rotor
  - Guide plates
  - Generator rotor-rotor hub
  - Rotor hub-blade flange bearing
  - SRB fastening bolts
- B. Hand-tighten all mounted parts for the entire turbine such as fans, motors, control cabinets, handrails, spinner casing, lamps and balancing weights.
- C. Check the oil levels of the yaw and pitch gears and the hydraulic units and top up, if necessary.
- D. Measure generator air gap.

2. Grease Maintenance: the grease maintenance is to be carried out 3 months after visual maintenance. It covers:

- A. All visual maintenance check points to be carried out.
- B. Lubricate nipples in yaw gears
- C. Lubricate the yaw control tothing
- D. Replace the permanent lubricators for the ball bearing slewing rim of yaw

3. Electrical Maintenance: the electrical maintenance is to be carried out 3 months after grease maintenance. It covers:

- A. All visual maintenance check points to be carried out.
- B. General:
  - Check earthing connection of converter component-tower & foundation earth, control cabinet to power cabinet.
  - Check cable connection –transformer cable, control cabinet, power cabinet.
  - Check software updation
  - Check all internal and external lighting of turbine.
  - Check all controllers
  - Checking of all pcb's for updated version & alteration if necessary

- C. Measurement:
    - Measurement of earth resistance
    - Measurement of phase voltage
    - Measurement of sensor distances
  - D. Tests:
  - E. Conduct overspeed switch test
  - F. Conduct battery test
    - Conduct testing of Emergency switches
4. Mechanical Maintenance: The mechanical maintenance is to be carried out 3 months after electrical maintenance. It covers:
- A. All visual maintenance points to be carried out
  - B. All grease maintenance points to be carried out
  - C. Foundation checking completely
  - D. Check oil level of pitch gearbox, yaw gearbox, hydraulic pump and top up to the mark
  - E. Check the main bearing play
  - F. Carryout paintwork
  - G. Cleaning of nacelle, hub & tower from inside
5. 4 yearly mechanical maintenance: 4 yearly mechanical maintenance is to be carried after 4 years completion of operation. It covers:
- A. All visual maintenance points to be carried out
  - B. All grease maintenance points to be carried out
  - C. All mechanical maintenance points to be carried out.
  - D. Oil change
  - E. Generator air gap checking

**Metering:**

The delivered Energy shall be metered by the parties at the high voltage side of the step up transformer installed at the project site.

**Daily Meter Reading**

Daily energy meter reading for all WEGs will be taken by the maintenance staff, and will be recorded in the generation log, in a controlled format The Daily Generation information will be sent to LTML Head Office at the closure of the business hours on a daily basis.

**Joint Meter Reading:**

The monthly meter reading (both main and check meter) shall being taken jointly by the Parties (TNEB and Owner) on the fixed day of the following month. 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 main meter reading will be used for recording electricity generation. Emission reduction calculation is based on monthly joint meter reading.

The electronic meters installed at the sub stations (grid interconnection point) by the TNEB will be used to measure the electricity supplied to the grid on a monthly basis. Every month these meter readings will be recorded by the officers of the TNEB. These records will be archived for crosschecking yearly figures. The meters at the sub station will be two-way meters and will be owned by SEB. SEB will take the readings from these meters and the same reading may be used to determine the net power wheeled to the user and determine the extent of mitigation of GHG over a period of time.

$$\text{Net generation} = \text{Total Export (kWh)} - (\text{Total Import (kWh)} + \text{Wheeling (kWh)})$$

For each WEG monthly billing period is fixed and therefore, might not be the same date for all the WEGs. To calculate generation up to a fixed date of monitoring period, monthly generation data of the last monitoring month for each WEGs shall be taken to calculate the daily average generation and generation for rest of the last day of the monitoring shall be calculated accordingly.

- All the metering instruments used on the sites are calibrated periodically and maintained in good working condition. Respective staff employed maintains records for all the monitored parameters.
- The energy meter is also checked once a year by respective agencies (Tamil Nadu Electricity Board) and then sealed. This meter is the basis of billing by state electricity board to project participant.
- Moreover, all the QA/QC procedures have been defined as per ISO- 14001

## 8. VER (Voluntary Emission Reduction) Calculations

The project activity is a wind energy project that supplies electricity to state grid. Since wind is a renewable resource, the GHG emissions from the project activity are zero. The crediting period here is 25/03/2004 to 31/12/2007. For each WEG monthly billing period is fixed and therefore, might not be the same date for all the WEGs. To calculate VERs up to 31/12/2007, December month generation data for each WEGs has been taken to calculate the daily average generation and generation as well as VERs for rest of the days up to 31<sup>st</sup> December has been calculated accordingly. For the next verification period the extra days which have been taken within this crediting period above the billing days will be deducted at the same average generation figures. The detailed calculation sheet is available for verification purpose.

The project being a small-scale activity the baseline methodology applied is as follows:

**Title** : “Grid-connected renewable electricity generation (AMS I-D)”  
**Version** : 12  
**Date** : 10<sup>th</sup> August 2007

As described in AMS I-D, version 12 small-scale methodology paragraph 8 “For a system where all generators use exclusively fuel oil and/or diesel fuel, the baseline is the annual kWh generated by the renewable unit times an emission coefficient for a modern diesel generating unit of the relevant capacity operating at optimal load as given in Table I.D.1”

**Table I.D.1**  
**Emission factors for diesel generator systems (in kg CO<sub>2</sub>e/kWh\*) for three different levels of load factors\*\***

Cases:	Mini-grid with 24 hour service	i) Mini-grid with temporary service (4-6 hr/day) ii) Productive applications iii) Water pumps	Mini-grid with storage
Load factors [%]	25%	50%	100%
<15 kW	2.4	1.4	1.2
>=15 <35 kW	1.9	1.3	1.1
>=35 <135 kW	1.3	1.0	1.0
>=135 <200 kW	0.9	0.8	0.8
> 200 kW***	0.8	0.8	0.8

\*) A conversion factor of 3.2 kg CO<sub>2</sub> per kg of diesel has been used (following revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories)

\*\*) Figures are derived from fuel curves in the online manual of RETScreen International's PV 2000 model, downloadable from <http://retscreen.net/>

\*\*\*) default values

## 9. Summary of VERs Calculations

Sl. No.	Year	Net Generation (kWh)	Emission Reductions (tCO <sub>2</sub> )
1	2004	7470386.75	5976.00
2	2005	14014761.00	11212.00
3	2006	15340030.00	12272.00
4	2007	22177395.00	17,742.00
<b>Total Emission Reductions (tCO<sub>2</sub>)</b>			<b>47,202.00</b>

## Annexure – I (Unique Identification of the WEGs)

Name of the Sponsor	No. of WEGs	WEG capacity (MW)	Village	Taluk	District	State	Latitude	Longitude
Loyal Textile Mills Ltd.	2	0.75	Pattakuruchi	Tenkasi	Tirunelveli	Tamil Nadu	8.97 <sup>0</sup> N	77.3 <sup>0</sup> E
Loyal Textile Mills Ltd.	2	0.75	Pulliyur	Tenkasi	Tirunelveli	Tamil Nadu	10.63 <sup>0</sup> N	78.83 <sup>0</sup> E
Loyal Textile Mills Ltd.	2	0.75	Ayakudi	Tenkasi	Tirunelveli	Tamil Nadu	10.27 <sup>0</sup> N	77.33 <sup>0</sup> E
Loyal Textile Mills Ltd.	1	0.60	Panagudi	Radhapuram	Tirunelveli	Tamil Nadu	8.19 <sup>0</sup> N	77.34 <sup>0</sup> E
Chintamani Textile Mills Ltd.	1	0.60	Panagudi	Radhapuram	Tirunelveli	Tamil Nadu	8.16 <sup>0</sup> N	77.42 <sup>0</sup> E
Loyal Textile Mills Ltd.	2	0.60	Dhanakarkulam	Radhapuram	Tirunelveli	Tamil Nadu	8.16 <sup>0</sup> N	77.38 <sup>0</sup> E
Loyal Textile Mills Ltd.	2	1.25	Veerakeralampudur	Alangulam	Tirunelveli	Tamil Nadu	8.89 <sup>0</sup> N	77.5 <sup>0</sup> E
Loyal Textile Mills Ltd.	1	1.25	Melillandaikulam	Sankarankovil	Tirunelveli	Tamil Nadu	9.10 <sup>0</sup> N	77.32 <sup>0</sup> E
Loyal Textile Mills Ltd.	2	1.50	Kasthuriengapuram	Radhapuram	Tirunelveli	Tamil Nadu	8.16 <sup>0</sup> N	77.42 <sup>0</sup> E

SR.NO..	VILLAGE	WEG	MODEL	COMMISSIONING DATE	HTSC No.	OWNER	SITE NO.
1	Pattakuruchi	NEG MICON	NM48 / 750	25/03/2004	723	LOYAL	316/3
2	Pattakuruchi	NEG MICON	NM48 / 750	25/03/2004	724	LOYAL	317/1
3	Pulliyur	NEG MICON	NM48 / 750	30/03/2004	774	LOYAL	388
4	Pulliyur	NEG MICON	NM48 / 750	30/03/2004	775	LOYAL	391
5	Ayakudi	NEG MICON	NM48 / 750	21/09/2004	921	LOYAL	74
6	Ayakudi	NEG MICON	NM48 / 750	21/09/2004	922	LOYAL	80
7	Panagudi	ENERCON	E40 / 600	20/08/2004	872	LOYAL	392/2
8	Dhanakarkulam	ENERCON	E40 / 600	29/09/2004	959	LOYAL	1013/2
9	Dhanakarkulam	ENERCON	E40 / 600	29/09/2004	960	LOYAL	1015/4B
10	Panagudi	ENERCON	E40 / 600	20/08/2004	873	CHINTAMANI	383
11	Melillandaikulam	SUZLON	S64 / 1250	22/03/2006	1646	LOYAL	209/1
12	Veerakeralampudur	SUZLON	S66 / 1250	17/03/2007	2197	LOYAL	307/3
13	Veerakeralampudur	SUZLON.	S66 / 1250	17/03/2007	2198	LOYAL	693/1
14	Kasturiengapuram	SUZLON	S82 / 1500	22/05/2007	2356	LOYAL	R224
15	Kasturiengapuram	SUZLON	S82 / 1500	31/08/2007	2393	LOYAL	434/3B(Part)