

Aruppukottai Sri Jayavilas Ltd, Tamilnadu, India.

7.25 MW Wind Energy Project

MONITORING REPORT

VERSION 4 DATED February 25, 2008

FOR THE PERIOD
APRIL 1ST 2006 TO OCTOBER 20TH, 2007
(both days included)
UNFCCC Registration No. 1137

Project Location

Tirunelveli District, Tamil Nadu
India

Registered Office

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Project details:

Aruppukottai Sri Jayavilas Limited, ("Jayavilas"), the project proponent, owns and operates textile mills manufacturing high quality yarn. Jayavilas operates two textile mills with an installed capacity of 90,240 spindles, manufacturing yarn out of cotton. These textile mills consume considerable quantity of electricity for their operations. This electricity was consumed from the fossil fuel dominated state owned electric utility. Realizing the impacts of electricity produced from fossil fuels, Jayavilas has decided to install wind farms to generate and consume "green and clean" electricity for its operations.

The project activity consists of 17 wind turbine generators (WTGs) in Tirunelveli district of Tamil Nadu state in India. The project activity has 5 WTGs of 850 kW and 12 WTGs of 250 kW. All the windmills have been commissioned and the generated electricity from WTGs is connected to state electric utility namely Tamil Nadu Electricity Board (TNEB) and transmitted through state grid for consumption for their textile mills. TNEB delivers the electricity at the consumption point after deducting 5 % of the kWh as Wheeling charges.

The project activity is located in Tirunelveli district in Tamilnadu state in India. Tirunelveli district is located between 8° 8' and 9° 23' of the northern latitudes and 77° 09' and 77°54' of the eastern longitudes. The project activity is about 15 -20 kilometres from Kanyakumari (Cape Comorin), the southern most point of India where three seas namely Bay of Bengal, Indian Ocean and Arabian sea confluence. The nearest big railway station is at Kanyakumari and nearest airport is at Trivandrum at 100 kilometres away.

The table A-1 gives the details of location of wind turbine generators of the project activity. The project activity has 5 WTGs each of 850 kW and 12 WTGs each of 250 kW.

TABLE A-1- DETAILS OF WTGS OF THE PROJECT ACTIVITY

Village name	Number of WTG	Capacity of each WTG	Installed capacity
Pazhavor	6	0.25 MW	1.5 MW
	1	0.85 MW	0.85 MW
Levenjipuram	6	0.25 MW	1.5 MW
	1	0.85 MW	0.85 MW
Thanakkarkulam	1	0.85 MW	0.85 MW
Udayathur	2	0.85 MW	1.7 MW
Total	17		7.25 MW

Technology of 850 kW wind turbine generator

The 850 kW WTGs are of PAWT technology with Gamesa make turbines. These are an advanced version over conventional low capacity WTGs. The towers of these WTGs are 65 metres height. The higher height gives the advantage of capturing higher power at higher height. This height also avoids disturbance from windmills located nearby. These turbines have state of art technology of variable speed and variable pitch with a double fed generator. The 'aerofoil' design of the blade, especially 58 metres rotor, as against conventional 48-50 metres contributes to a larger swept area for energy capture. The design of the blade is suitable for low and medium wind conditions in plain and complex terrain, which suits the region where wind farms are located. The WTG reaches the rated capacity of 850 kW at 10.5 meters itself as against 12 metres as per power curve.

Technology of 250 kW wind turbine generator

The 250 kW WTGs installed in the project activity are of Wincon, Denmark technology and are manufactured by Pioneer Wincon in India. These WTGs are of well established technology with very little maintenance. These WTGs are robust in construction and has a few moving parts as a fixed blade configuration.

The important parts of windmill are:

- i. Main Tower
- ii. Blades
- iii. Nacelle
- iv. Hub
- v. Main shaft
- vi. Gearbox, bearing and housing
- vii. Brake
- viii. Generator

Statement to what extent the Project has been implemented as planned

The Project has been completed as planned and described in the Project Design Document (PDD). The Plant is in operation continuously since commissioning i.e. from 18th March 2006. The project is a registered project activity with UNFCCC and the registration number is 1137.

Project's contribution to sustainable development

A brief description of the contribution of the project activity towards 'Sustainable Development of India' is discussed under.

The project proponent believes that the project activity has contributed to sustainable development in following manners:

- i) Social well being
- ii) Economical well being
- iii) Environmental well being
- iv) Technological well being

i) Social well being

Social well being by providing job opportunities to the local population during erection and operation of the wind farms contributing in poverty alleviation of the local community and development of basic amenities to community.

ii) Economic well being

The wind farms need large area. The cost of land appreciated benefiting the landowners and local community directly. These lands were generally were unproductive. Most of the wind energy potential areas are in remote areas and are largely unfertile. These lands generally command low prices. But due to land demand for wind farms, the land price increased leading to economic well being of the local community. The project activity also contributes in economic well being of the nation's economy by reducing import of coal and other fossil fuel for electricity generation in hard currency.

iii) Environmental well being

Environment friendly electricity generation project with no significant impact on the environment. Additionally, the project activity generates electricity from a renewable source of energy where the source gets replenished and is available for use.

Therefore, the following environmental benefits are derived from the project activity:

- Produces electricity without GHG emissions.
- Produces electricity from a renewable energy source.
- Rural development as the project activity location
- Nil impact on the environment due to the project activity.

iv) Technological well being

The project activity has higher capacity windmills of 850 kW which is technologically advanced to conventional smaller capacities.

Other technological well beings of the project :

- improved power quality in the vicinity
- reactive power control;

- mitigation of transmission and distribution congestion,

All the above are the contributions of the project activity for the sustainable development.

Monitoring Period

The Monitoring period is chosen from 1st April 2006 to 20th October 2007, both days included.

Parameters being monitored

For the Project, the following parameters are being monitored on continuous basis:

ID Number	Data type	Data variable	Data unit	Measured (m), calculated (sc) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/paper)	Comment
1	Electricity (TP _{gross})	Gross electricity generated by the project activity	MWh	m	continuous	100 %	Electronic	Measured in the interconnection point by TNEB and mentioned as "Total Export" in the Monthly Meter Reading Report.
2	Electricity (TP _{imp})	Electricity imported by the project activity	MWh	m	continuous	100 %	Electronic	Measured in the interconnection point by TNEB and mentioned as "Total Import" in the Monthly Reading Report
3	Electricity (TP _{exp})	Net electricity displaced by the project activity	MWh	m	continuous	100 %	Electronic	Measured in the interconnection point by TNEB and mentioned as "Net Generation" in the monthly reading report after deducting the wheeling charges

Emission Reduction Calculations

As per AMS I.D, Version 10, leakage is to be considered only if the energy generating equipment is transferred from another activity or if the existing equipment is transferred to another activity. Since this does not apply for the project activity, there are no leakage issues associated with the project activity and hence no formula is used to estimate leakage due to the project activity.

As per paragraph 9 of AMS I.D, the baseline is the kWh (=MWh) produced by the renewable generating unit multiplied by an emission coefficient measured in kg CO₂ eq/ kWh (=ton CO₂ eq /MWh). Southern regional grid is considered for baseline analysis and calculation of anthropogenic emissions by fossil fuels during power generation.

Emission Reduction by project activity

$$ER_y = (TP_{exp, y} * EF_y) - PE_y - EL_y$$

Where,

ER_y - Emission reductions of the year, "y" by project activity (ton CO₂ eq/year)

TP_{exp, y} - Total electricity displaced by the project activity in the year "y" in MWh.

EF_y - Baseline emission factor (ton CO₂/MWh)

PE_y - Project emissions in the year "y" [= 0]

EL_y - Emissions due to leakage in the year "y" (ton CO₂ eq/year) [= 0]

$$\text{Hence, } ER_y = TP_{exp, y} \times EF_y$$

The baseline emission factor EF_y as per combined margin approach of ACM0002 (as estimated by the Host Party-Central Electricity Authority, Version 2.0) is **0.93 ton CO₂/MWh (=0.93 kg CO₂/kWh)**

Monitoring Data

Electricity Generation, Electricity exported and electricity imported from grid for all the wind mills for the monitoring period is given below. Month wise generation and export details of individual wind mills are given in separate excel spread sheet.

The emission reductions for the monitoring period are as given below:

Month & Year	Gross Electricity Supplied to the Grid	Wheeling Charges	Electricity Imported from the Grid	Net Electricity supplied to the Grid	Emission Factor of the Grid	Emission Reduction
	(MWH)	(MWH) 5%	(MWH)	EG(MWH)	EF(tco2/MWH)	ER (t CO ₂)
Apr-06	64.068	3.203	2.148	58.717	0.930	54.606
May-06	90.468	4.523	0.480	85.465	0.930	79.482
Jun-06	1,798.408	89.920	6.160	1,702.328	0.930	1,583.165
Jul-06	2,158.484	107.924	6.548	2,044.012	0.930	1,900.931
Aug-06	1,788.992	89.450	3.844	1,695.698	0.930	1,577.000
Sep-06	1,321.912	66.096	7.470	1,248.346	0.930	1,160.962
Oct-06	1,440.800	72.040	4.094	1,364.666	0.930	1,269.139
Nov-06	542.602	27.130	7.166	508.306	0.930	472.724
Dec-06	1,109.456	55.473	4.860	1,049.123	0.930	975.685
Jan-07	1,711.112	85.556	2.482	1,623.074	0.930	1,509.459
Feb-07	1,654.636	82.732	1.528	1,570.376	0.930	1,460.450
Mar-07	864.094	43.205	5.572	815.317	0.930	758.245
Apr-07	472.338	23.617	9.416	439.305	0.930	408.554
May-07	725.468	36.273	6.614	682.581	0.930	634.800
Jun-07	1,566.048	78.302	3.290	1,484.456	0.930	1,380.544
Jul-07	1,727.630	86.382	4.346	1,636.903	0.930	1,522.319
Aug-07	2,032.938	101.647	3.430	1,927.861	0.930	1,792.911

Sep-07	1,786.226	89.311	4.548	1,692.367	0.930	1,573.901
8-Oct-07	1,569.676	78.484	4.328	1,486.864	0.930	1,382.784
20-Oct-07	237.902	11.895	3.914	222.093	0.930	206.546
TOTAL	24,663.258	1,233.163	92.238	23,337.857	0.930	21,704.207

Measures to ensure the Results / uncertainty analysis

Training in operation and Maintenance

The WTG suppliers have trained the staff of project proponents in operation, preventive maintenance, trouble shooting, safety etc. At present the WTGs are under operation contract of the WTG suppliers. During this period, the staff of project proponent are further trained in effective operation and maintenance of the WTGs.

Operational and management structure

The Site In-charge is responsible for operation and maintenance of wind turbine generators. The Site In-charge is a qualified electrical engineer with considerable experience in O & M of windmills. He is assisted by operators in day today operations of wind farms.

The Operators record the generation on a daily basis for each service connection. The operators also maintain the records for training, maintenance, break down and calibration of meters.

The readings recorded by the operators are verified by the Site -In charge. The Site In charge reports the cumulative generation to the head office on a weekly basis. The site in charge is responsible for maintaining the Generation & Maintenance log books, along with the history card for each and every WTG.

Monitoring

As emission reductions from the project are determined by the number of units connected to the grid, it is mandatory to have a monitoring system in place and ensure that the project activity produces and exports the rated power at the stipulated norms. The sole objective of having monitoring system is to have a constant watch on the emission reductions.

The project activity is designed and capable of synchronising within a frequency range of 47.5 to 51.5 Hz and a power factor between 0.85 lagging and 0.95 leading at the generator terminals. The delivered electricity would be metered by TNEB at the high voltage side of the step up transformers. Metering is done either for two /three / more wind mills depending on the location of wind mills and service connection number. Metering equipment is electronic trivector meters of accuracy 0.5%. The metering equipment is maintained in accordance with electricity standards and have the capability of recording hourly and monthly readings. The monthly meter readings are taken at the interconnection point by TNEB between fifteenth to twentieth day of the each month. Records of joint meter reading are maintained at site and a copy is maintained at the head office.

The meter (export and import) installed at the project activity is of 0.5% accuracy class. The meter is jointly inspected and sealed on behalf of Jayavilas and TNEB, in the presence of its authorised representatives. The calibration of the meter takes place once in two years.

The generation data is recorded daily from the panel board of the WTG too. This reading is compared with the Export meter. If discrepancy is observed, the meter would be calibrated. This ensures the accuracy of the measurements.

For the purpose of emission reduction estimates, the electricity exported to the grid is reduced by 5 % to account for wheeling charges. Therefore, only 95 % of the electricity exported is considered for calculation of emission reductions. In the Monthly meter reading report of TNEB, the net generation is given after deducting the electricity imported by the project activity and 5 % wheeling charges. Therefore, the Net electricity exported to the grid is the “Net Generation” mentioned in the Monthly meter reading. This figure is multiplied by the baseline emission factor obtained from the latest publicly available data from Central Electricity Authority, to give the emission reductions of the project activity.