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WIND POWER DEVELOPMENT IN TAMIL NADU

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Abstract

Wind power is one of the oldest-exploited energy sources by humans and today is the most seasoned and efficient energy of all renewable energies. Wind energy does not contaminate, it is inexhaustible and reduces the use of fossil fuels, which are the origin of greenhouse gasses that cause global warming. In addition, wind energy is a native energy, because it is available practically everywhere on the plant, which contributes to reducing energy imports and to creating wealth and local employment. Tamil Nadu is the leading State in India in promoting and harnessing renewable sources of energy particularly wind. Tamil Nadu is endowed with rich wind energy potential in the country. In the Tirunelveli region in Tamil Nadu alone, there are two wind seasons – May to October and November to March, with the wind speeds higher during the first period. In Muppandal in Tamil Nadu, the wind speed exceed 43.2-46.8 km an hour during the peak period. Of the total installed capacity in the country of 26915 MW, the share of Tamil Nadu is 7654.17 MW as on 31st March, 2016. This paper is devoted to the areas like factors favouring wind mills in Tamil Nadu, wind power potential and installation in Tamil Nadu and supportive policies for the growth and development of wind power in Tamil Nadu.

Keywords:Wind Power; Energy; Wind Speed; Wind Potential; Installed Capacity.

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1. INTRODUCTION

Wind power is one of the oldest-exploited energy sources by humans and today is the most seasoned and efficient energy of all renewable energies. Wind energy does not contaminate, it is inexhaustible and reduces the use of fossil fuels, which are the origin of greenhouse gasses that cause global warming. In addition, wind energy is a native energy, because it is available practically everywhere on the plant, which contributes to reducing energy imports and to creating wealth and local employment. For these reasons, producing electricity through wind energy and its efficient use contributes to sustainable development.

2. WIND POWER

Wind power is a form of solar energy. Winds are caused by the uneven heating of the atmosphere by the sun, the irregularities of the earth's surface, and rotation of the earth. About 2 per cent of the sun's radiation that falls on the earth is converted to wind energy through the heating and cooling of the earth's surface. When the wind blows, its energy can be used to turn the blades of a wind turbine. The spinning of the blades sends energy to the wind turbines generator. Wind turbines convert the kinetic energy in the wind into mechanical power. This mechanical power can be used for specific tasks such as grinding grain or pumping water or a generator can convert this mechanical power into electricity to power homes, businesses, schools, and the like. The features of wind energy are as follows:

- Wind Power does not require raw material. Wind is natural and never ending. Wind power is renewable and does not get depleted with use like fossil fuels.
- Wind power can be developed in modular form with low gestation period. The complete wind turbine generators and associated electrical equipments are standard products and can be procured in a short time. A wind farm having a capacity of 10 to 20 MW takes only six months from concept to commissioning.
- The cost of installation of wind power plant is competitive when compared to a conventional power plant. Although its capital cost is high, the operating cost is very less as there is no fuel cost and the maintenance cost is also low.
- Wind energy is does not pollute the atmosphere, unlike thermal power plants. When about 250 tonnes of coal is consumed to generate electricity in a thermal power plant, it emits 800 tonnes of carbon dioxide and other poisonous gases into the atmosphere.

- Reduces climate change and other environmental pollution.
- Wind energy can be utilised as a shield against ever increasing power prices. The cost per kWh reduces over a period of time as against rising cost for conventional power projects.
- Diversifies energy supply, eliminates imported fuels, and provides a hedge against the price volatility of fossil fuels. Thereby provides energy security and prevention of conflict over natural resources.
- One of the cheapest sources of electrical energy.
- Least equity participation required, as well as low cost debt is easily available to wind energy projects.
- A project with the fastest payback period.
- Operation and Maintenance (O&M) costs are low.
- No marketing risks, as the product is electrical energy.
- Creates employment, regional growth and innovation.
- Reduces poverty through improved energy access.
- Fuel source is free, abundant and inexhaustible.
- Provides viability of small business.

Table 1. Wind Measurement At 50 M Height

Wind Power Class	**Wind Speed(m/s)**	**Wind Power Density at 50 m Height(W/m^2)**	**Description**
1	0 – 5.6	0 – 200	Poor
2	5.6 – 6.4	200 – 300	Marginal
3	6.4 – 7.0	300 – 400	Fair
4	7.0 – 7.5	400 – 500	Good
5	7.5 – 8.0	500 – 600	Excellent
6	8.0 – 8.8	600 - 800	Outstanding

Source: Indian Wind Power

WIND POWER IN TAMIL NADU

Power development is an important input for the States Industrial, Commercial and Socio economic growth. For this, the availability of affordable, reliable and quality power is necessary.

Therefore, adequate provision has to be made for augmenting power supply to bridge the gap between demand and supply as well as to meet the increasing future demand.

The 2016-17 year was a transformational one for India. Compared to the previous four years, thermal power installations dropped by 60 per cent to just eight GW of the net new capacity, while renewable energy installations more than doubled to a record 15.7 GW. Keeping this in view, Government is giving utmost importance to power sector in Tamil Nadu. The Government of Tamil Nadu is committed to mitigate the climate change effects by bringing out policies conducive to promote renewable energy generation in the State. The state is blessed with various forms of renewable energy sources viz., Wind, Solar, Biomass, Biogas, Small Hydro, etc. Municipal and Industrial wastes could also be useful sources of energy while ensuring safe disposal.

Table 2. Renewable Energy Generation (Up To 08-02-2016)

Renewable Energy Programme/ Systems	**Cumulative Achievement (in MW)**
Wind Power	7597.65
Bagasse Cogeneration	659.40
Biomass Power	230.00
Solar Power (SPV)	1061.82
Total	**9548.87**

Source: teda.in

Table 2 explains that among the renewable energy sources, wind power leads with 7597.65 MW in installation in Tamil Nadu.

3. Factors influencing Wind Power in Tamil Nadu

➢ Geographical Location

Tamil Nadu is one of the best windy sites in our country. It is situated at Southernmost tip of India. It is surrounded by seas in two sides-Bay of Bengal in east and Indian Ocean in south and also Western ghats in the western border. The western ghats consists of small hills of low

altitude but continuous. Thus, there is constant and high wind flow at Aralvaimozhi, Pazhavoor, Palghat and Sengottah passes.

- **South West Monsoon**

In the months of May, June and July, the sun travels to the line of Cancer. During summer when the sun is shining brightly over the northern hemisphere, the big land mass of Asia is intensely heated. The intense heating creates a low pressure area. The low pressure area ultimately becomes so intense that even the south-east trade wind of southern hemisphere is drawn across the equator by it. The rotation of earth about its own axis turned the wind as south-west monsoon. The monsoon wind from the Indian Ocean and Arabian Sea causes high wind flow to Tamil Nadu.

- **North East Monsoon**

In August, September, October and November, the sun is in the line of Capricorn. Therefore, north-east trade wind crosses the equator and become north-east monsoon. During this monsoon also Tamil Nadu especially the three windy regions – Muppandal, Kayathar and Poolavadi- experiences bountiful wind flow since it is situated near the equator.

- **Nearness to Sea**

Among the three passes, Aralvaimozhi pass is just adjacent to the sea shore. During the day time the water gets heated quickly and becomes a low pressure area. The land mass does not get immediately heated. Therefore, the pressure is high. Wind flows from high pressure to low pressure area. Thus during day time, Muppandal region in this pass has a good wind flow. In the night, the water becomes cool quickly than the land mass. Thus, in the evening hours and night, wind flows from sea to this region.

- **Wind Passes in Tamil Nadu**

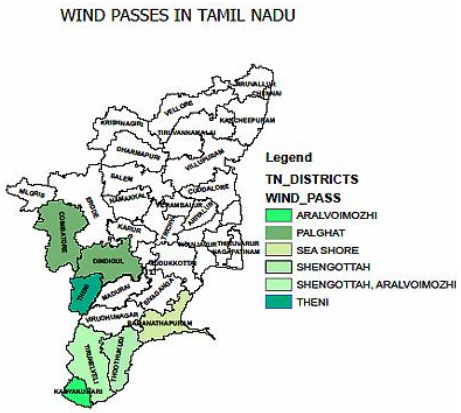
Nature has bestowed with three passes in Tamil Nadu namely, Aralvaimozhi pass, Sengottah pass and Palghat pass. These three regions serve as an entry points to good amount of wind and having a funnel effect of blowing the wind across the entire terrain. Kambam Pass in Dindigul District has been identified as wind potential area in the recent past.

Table 3 Area of Wind Passes in Tamil Nadu

Name of Passes/ Districts	Area
Palghat	Coimbatore and Dindigul
Shengottah	Tirunelveli and Tuticorin
Aralvoimozhi	Kanyakumari, Radhapuram and Muppandal
Cumbum	Theni, Cumbum and Andipatti
Sea Shore	Rameswaram, Poompugar and Mullaikadu.

Source: http://www.tangedco.gov.in/new-wind.php

Figure 1. Wind Passes in Tamil Nadu



Source: http://www.tangedco.gov.in/new-wind.php

➢ **Other Factors**

Tamil Nadu tops India's list in harnessing wind power due to following credentials:

➢ The wind power density is high in Tamil Nadu, when compared to other states.

➢ The terrain of Tamil Nadu is almost plain and the accessibility to any site is easy when compared to mountainous terrain in other states like Kerala and Karnataka. This helped in quicker erection of wind farms, transmission and distribution lines to nearby grid.

➢ Developers could purchase lands for wind farms directly from the owners at mutually agreed rates.

➢ Better availability of infrastructure facilities.

➢ Strong grid.

➢ The industrial tariff being high in Tamil Nadu, wheeling power from the wind farm resulted in huge saving in power bill.

- Helping attitude of TNEB and the state nodal agency.
- Entrepreneurship of industrialists and windmill manufacturers.

4. Annual Average Wind Speed

The annual average wind speed in these areas is in the range of 18 to 22/19 to 25 kmph. In Muppandal area (Aralvaimozhi pass) in Kanyakumari District the monthly average wind speed even touches around 39 kmph during May/June. These locations were identified as potential sites with wind speed of more than 18 mph and wind power density of more than 150 watts/m^2 at 30m level or 200 watts/m^2 at 50m level suitable for commercial exploitation by harnessing wind energy for power generation.

Tamil Nadu is endowed with three prominent passes having high wind potential, due to the tunneling effect during South West Monsoon.

Table 4. Annual Average Wind Speed

Name of Passes/ Districts	**Annual average Wind Speed (Km/hour)**
Palghat	18-22
Shengottah	18-22
Aralvoimozhi	19-25
Cumbum	19-25

Source: http://teda.in/programes/wind-energy

The peak wind season in Tamil Nadu was from June to September. During this period, wind energy contributed about 30-35 per cent of the energy consumption in the State.

5. Wind Power Potential in Tamil Nadu

The wind power gross and exploitable potential in Tamil Nadu is shown in Table 5.

Table 5. Wind Power Potential in Tamil Nadu

Location	District	Gross Potential (MW)	Technical Potential (in MW)
Aralvaimozhi Pass-Muppandal Region	Kanya Kumari and Tirunelveli	2100	1600
Sengottah Pass- Kayathar Region	Tirunelveli and Thoothukudi	1300	700
Palghat Pass- Poolavadi Region	Coimbatore and Erode	1450	1300
Other areas		650	400
Total		**5500**	**4000**

(Source:TEDA)

From Table 5, it was identified that Tamil Nadu has an exploitable potential of 4000 MW which is about 30 per cent of India's technical potential.

6. Wind Power Installed Capacity in Tamil Nadu

Tamil Nadu is endowed with rich wind energy potential in the country. Tamil Nadu had the highest installed wind energy capacity in the country. Of the total installed capacity in the country of 26915 MW, the share of Tamil Nadu is 7654.17 MW as on 31st March, 2016.

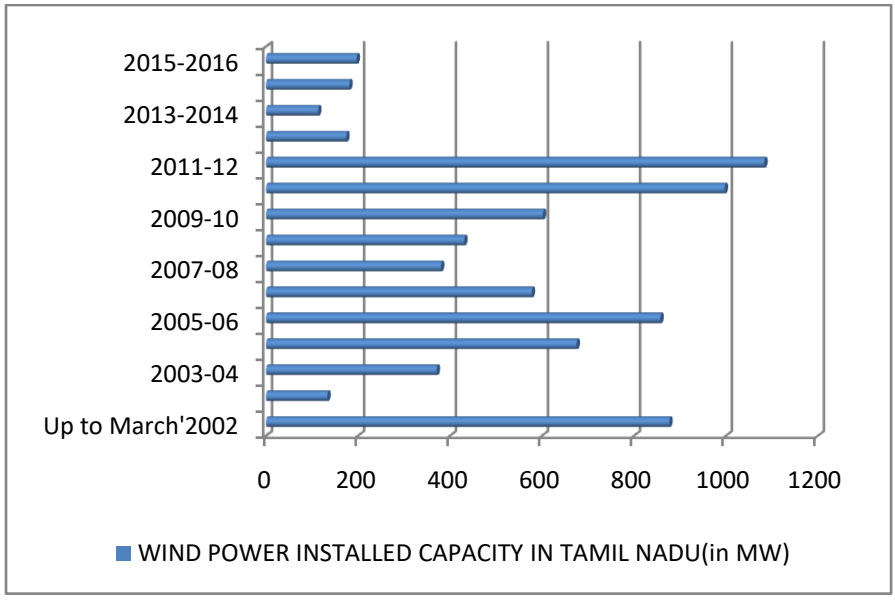
Table 6. Year-Wise Wind Power Installed Capacity in Tamilnadu (Up To 31.03.2016)

Year	Wind Power Installed Capacity in Tamil Nadu (in MW)
Up to March'2002	877.00
2002-03	133.60
2003-04	371.20
2004-05	675.50
2005-06	857.55
2006-07	577.90
2007-08	380.67
2008-09	431.10

2009-10	602.20
2010-11	997.40
2011-12	1083.50
2012-2013	174.60
2013-2014	113.50
2014-2015	181.30
2015-2016	197.15
Total	**7654.17**

Source: http://niwe.res.in/information_isw.php

Figure 1.Year-Wise Wind Power Installed Capacity In Tamilnadu (Up To 31.03.2016)



7. Wind Power Generation in Tamil Nadu

Tamil Nadu is now meeting its entire demand of electricity from new power generation projects and wind energy initiatives. According to sources, Tamil Nadu now meets its entire average demand per day of about 13,000 MW (approximately 300 Million Units) without any load shedding and compulsory cuts for industries and commercial users. Out of the total requirement of 13,000 MW for Tamil Nadu, about 3000-3500 MW comes from wind, 3800 MW from Thermal, 3000 MW from Central Generating Stations, 500 MW Hydro, 350 MW from gas and rest from other sources including long term power purchase agreements for supply of power.

Table 7. Wind Power Generation in Tamilnadu

Location	Exploited (MW)
Aralvoimozhi Pass	1400.625
Shenkottah Pass	727.135
Palghat Pass	1395.225
Rameshwaram Seashore	6.850
Mullaikadu Seashore	1.355
Total	**3531.19**

The peak wind season in Tamil Nadu was from June to September. During this period, wind energy contributed about 30-35 per cent of the energy consumption in the State.

8. Incentives and Guidelines for Wind Power Generation in Tamil Nadu

TABLE 8. Incentives and Guidelines for Wind Power Generation in Tamil Nadu

Banking	5 %b(12 months financial year April to March
Buy-back	Rs.3.39/ per kWh (No Escalation)
Capital Subsidy	-
Incentive	25 paise per kVARh(10% of net active energy generate) 50 paise per kVARh (more than 10%)
Third Party Sales	Allowed under Electricity Act 2003 subject to regulation framed by respective SERs
Wheeling Charges	5% of Energy (HT Services)

Source:http://wind-power.industry-focus.net/incentivesguidelines-in-tamil-nadu.html

9. Organizations and Associations

To sustain wind energy development, to help Tamil Nadu achieve self-reliance in the power sector and to tackle the challenges in sustaining the development and accelerating the pace of utilization of wind energy in the state, the following organizations and individuals play a sterling role:

- **National Institute of Wind Energy (NIWE)**

The National Institute of Wind Energy (NIWE), Chennai was established in Tamil Nadu in 1998 as an autonomous institution under the administrative control of the Ministry of New and

Renewable Energy. NIWE main activities include resource assessment and testing & certification.

- **Tamil Nadu Energy Development Agency**

The Government of Tamil Nadu realized the importance and need for renewable energy, and set up a separate Agency, as registered society, called the Tamil Nadu Energy Development Agency (TEDA) with the following specific objectives:-

- To promote the use of new and renewable sources of energy (NRSE) and to implement projects therefore.
- To promote energy conservation activities.
- To encourage research and development on renewable sources of energy.

- **Tamil Nadu Power Finance and Infrastructure Development Corporation Limited**

The Tamil Nadu Power Finance and Infrastructure Development Corporation Limited (Power Finance) was incorporated on 27.06.1991. The Corporation is registered with Reserve Bank of India as a Non Banking Finance Company. The objective of the Corporation is to mobilize funds for the Power Sector in Tamil Nadu, particularly for the schemes relating to generation, transmission and distribution network of the Tamil Nadu Electricity Board.

- **Fiscal and Promotional Incentives from State Governments**

- Energy buyback, power wheeling and banking facilities
- Sales tax concession benefits
- Electricity tax exemption
- Demand cut concession offered to industrial consumers who establish power generating units from renewable energy sources
- Capital Subsidy

10. Conclusion

Future generations should have the same or greater quality of life benefits as the current generation does. Balancing the fulfillment of human needs with the protection of the natural environment not only in the present, but in the indefinite future is termed as sustainable

development. As the energy from fossil fuel is expected to be depleted from the world soon, the renewable energies are rapidly tapped and augmented to the conventional type. During the past 30 years, significant efforts have gone into the production and use of renewable energy products. Tamil Nadu in India has to-day among the world's largest programmes for renewable energy. Several renewable energy systems and products are now not only commercially available but also economically viable in comparison to fossil fuel. The development of energy from nuclear source is slowly picking up. Wind power costs are much more competitive with other generating technologies because there is no fuel to purchase and minimal operating expenses. The installation of wind mills has also provided an employment opportunity. There are many opportunities for different kinds of skilled and unskilled people in the wind industry from the very first day of land selection for the installation of wind mills till commissioning and for the further smooth functioning of the unit. In rural areas, wind energy can bring investment and jobs to isolated communities. Wind power is attractive as a means of providing a cheap and flexible electricity supply to dispersed communities. The development of wind farms has also paved way to good road, school, and water tanks in the remote areas. Hosting wind farms provides farmers with a steady income whilst they continue to graze or crop their land. Thus, at this moment, wind power is the only renewable energy technology that has the advantage of maturity, cost competitiveness and modularity. For the development of wind power in Tamil Nadu, hostile initiatives are necessary for building more efficient WEGs to suit our climate and grid conditions, duty free import of equipments is to be allowed, the government should declare wind potential areas as national resources and a stable and long term national policy framework is necessary to attract investment towards this sector.

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