Issues and Strategies for Wind Power Development in India

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Abstract

The demand for power in the country has continuously outstripped its production and a peak energy shortage of around 12 % prevails. To meet this shortfall the cleanest options available to India are renewable energy technologies including wind power which pay a crucial role in the country’s emerging energy mix. Not only are they environmentally sound but also their project gestation periods are significantly shorter than those for thermal or nuclear power plants. There is an increasing public awareness and international consensus towards a global compact for addressing the problems of climate change and energy security. India is one of the key emerging economies yet a highly vulnerable country to both climate change and energy market fluctuations. Wind power through its scalability and speed of deployment, can not only help reduce India’s carbon footprint but also help towards achieving energy security by reducing its dependence on fossil fuel imports in the long term. The issues concerning the wind power generation at global and national level, the wind power potential in the country, strategies for development, incentives available etc., are discussed in detail in this paper.

Key words: fluctuations- deployment- production- national- generation potential- scalability- concerning.

1. Introduction

Globally wind energy utilization is on the upbeat. A growing economy, like India, needs every possible source of energy to fuel its progress. Wind energy has posted, amongst all renewable energy sources, the highest growth rates. The exploratory installations of a few small grid connected wind turbines in the mid-1980s paved the way for rapid growth over the next two decades. Capacity addition is in the range of 1500-2000 MW per year over the past three years. Windmills were experimented with after the first oil shock, essentially to reduce dependence on grid for agricultural and other water pumping requirements. Though the incursions were small, need for a new approach to wind resource assessment in the country, realized as early as the 1960s, fructified with the establishment of independent wind monitoring stations in four states by Department of Non-conventional Energy Sources (DNES) in association with state Nodal Agencies. Parallelly, setting up of three wind farms in Gujarat and Tamil Nadu lead to the advent of private sector wind farming. The Government of India formulated guidelines for grid connected wind power projects for adoption by states helped to...
streamline procedures. This along with a host of fiscal incentives introduced for private sector participation resulted in the installation of Wind Power Projects by a greater way. Establishment of center for Wind Energy Technology in 1999 provided the much needed technical support in terms of wind resource assessment, testing, certification and research.

2. Present Situation

The Indian wind energy sector has an installed capacity of 14,158 MW as on 31st March 2011. In terms of wind power installed capacity India ranks fifth amongst the wind-energy-producing countries of the world after USA, China, Germany and Spain. The potential is far from exhausted. Indian Wind energy Association has estimated that with the current level of technology, the ‘on-shore’ potential for utilization of wind energy for electricity generation is of the order of 65,000 MW. The unexploited resource availability has the potential to sustain the growth of wind energy sector in India in the years to come. Exhaustive wind resource assessment has been carried out in 687 stations spread over various parts of the country indicated that 234 wind monitoring stations have indicated wind power density of 200W/sq. mt or more at 50 m above ground level. Micro Survey of Wind Resource for 97 wind monitoring stations have been completed to know the zone of influence and wind power potential around the stations to meet the requirement of wind energy developers in the country. Wind farms have been installed in Andhra Pradesh, Gujarat, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Rajasthan, and Tamil Nadu & West Bengal. Majority of the installed capacity belongs to private sector in seven states. A good number of wind turbine manufacturers are active in India and producing Wind Electric Generators (WEGs) of rating 225 KW to 2500 KW. A large number of agencies have come up to supply components / spares / accessories and to provide services like Erection, O & M, and Civil & Electrical construction. A large number of water pumping windmills and small aero-generators have been installed in the country. Wind-Solar and Wind-Diesel hybrid systems have also been installed at a few places. The Central ministry and several State nodal agencies encourage growth of Wind Energy Sector through financial incentives and policy support. The Central Electricity Regulatory Commission & State Electricity Regulatory Commissions have declared suitable tariff for wind power, renewable purchase specifications, renewable energy specifications etc., The Ministry of New & Renewable Energy (MNRE), Govt of India has established a Centre for Wind Energy Technology at Chennai with field test station at Kayathar to act as technical focal point for wind power development in the country. Financial assistance for renewable sources of energy is available through Indian Renewable Energy Development Agency (IREDA), a supporting arm of MNRE, Govt of India. Over the last decade significant progress has been made in harnessing wind for power generation in Europe, USA, and in India. The technical feasibility of using wind as a source of power generation has emerged in the near-term as the most promising renewable energy technology for generating electricity. The growth in energy demand, limitations of supply and increasing cost of fossil fuel generation, and environmental concerns make wind power a competitive option in countries, which have a good wind resource base.

3. Government’s initiatives

The wind power programme in India was initiated towards the end of the Sixth Five Year Plan, in 1983-84. Then, there were two distinct issues related to wind power development in India. Firstly, a revisit to the assessment of wind as an energy resource was essential. The second issue was about strategic development and deployment of wind power hardware. A market-oriented strategy was adopted from inception. This has led to the commercial deployment of the technology rather than being subsidy driven. To aid this approach, demonstration projects were set-up and fiscal incentives provided for
development of infrastructure capability. Ministry also played a pivotal role in making available finances for setting up commercial wind farms through World Bank and other sources at attractive interest rates. To help develop and accelerate the pace of utilization of wind energy in the country, the Government of India set up the Centre for Wind Energy Technology (C-WET) in Chennai as an autonomous institution of the Government of India. A Wind Turbine Test Station with technical and partial financial support from Government of Denmark was established at Kayathar, in Thoothukudi District, Tamil Nadu, as an integral part of the Centre. C-WET is envisioned to serve as a technical focal point of excellence to foster the development of wind energy in the country.

4. Assessment of Wind Power Resource

With the interest in wind as an energy resource reviving during late 1970s, the need to revisit the wind resource assessment from a fresh angle was realized by 1982. The project proposal was formulated by the Field Research Unit of Indian Institute of Tropical Meteorology (IITM, FRU) in consultation with National Aerospace Laboratory (NAL), Bangalore. The then Department of Non-conventional Energy Resources (DNES) sponsored a project to IITM, FRU to install 36 monitoring stations in the states of Gujarat, Maharashtra, Tamil Nadu and Orissa. Each of these states had known windly areas through several indicators. It was recognized that involvement of State nodal agencies was important in this program. Accordingly, the proposals outlined the responsibilities of each of these agencies involved. DNES funded and coordinated the project. State Nodal Agencies in charge of renewable energy programmes participated actively during formulation and execution of the program. In cases where State Nodal Agencies (SNAs) were not fully functional, Electricity Boards took responsibilities of program implementation. It took two to three years to begin the measurements from the conceptual stage. After the work was initiated in the four states, other states joined and today almost all the states including newly formed states of Jharkhand and Chhattisgarh have wind monitoring programs.

5. Wind monitoring stations in India

The Ministry of New & Renewable Energy (MNRE) under the Government of India in association with other agencies encourages the development of the wind energy-producing sector in India. The government has facilitated the growth of the wind energy sector through financial aids and several policies. As many as 687 wind monitoring stations in India have been formed out of which 104 stations are operating at present. Among all the states in India, Maharashtra has the maximum number of wind monitoring stations. There are 30 wind-monitoring stations in Maharashtra, which are at present operating. Karnataka ranks second with 13 stations. The wind monitoring stations in all the states of India is given in the table presented below along with their Wind Power Density (WPD):

<table>
<thead>
<tr>
<th>State/Union Territories</th>
<th>Number of Monitoring Stations operating</th>
<th>Total Wind Monitoring Stations Formed</th>
<th>Stations with the Annual Average WPD &gt; 200 W/m² at a height of 50 m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Andaman &amp; Nicobar</td>
<td>1</td>
<td>14</td>
<td>2</td>
</tr>
<tr>
<td>Arunachal Pradesh</td>
<td>-</td>
<td>9</td>
<td>-</td>
</tr>
<tr>
<td>Andhra Pradesh</td>
<td>4</td>
<td>67</td>
<td>35</td>
</tr>
<tr>
<td>Assam</td>
<td>1</td>
<td>9</td>
<td>-</td>
</tr>
</tbody>
</table>

Table: Wind Power monitoring stations

Issues and Strategies for Wind Power Development in India
6. Issues concerning Technology Development:

In India, wind energy field technology deployment preceded indigenous development. Being a very new technology, the time lag between the European development and indigenous development is very small. In India, wind turbines are manufactured to the same quality standard as they are manufactured elsewhere. Two types of wind turbines namely stall regulated and pitch regulated are being deployed in the country and abroad for grid-interactive power. The stall regulated wind turbines have blade angle fixed at a particular angle. In pitch regulated wind turbines the blade angle can be changed to control the output depending upon wind speed. Both technologies have their own advantages and disadvantages. Wind turbines are also available with lattice, steel tabular and concrete tubular towers. The
trend in recent installation is moving towards better aerodynamic design; use of lighter and larger blades; higher towers; direct drive; and, variable speed gearless operation using advanced power electronics in typically weak local grid networks. Wind turbines are being indigenously manufactured by 12 manufacturers, mainly through joint ventures or under licensed production agreements. A few foreign companies have also set up their subsidiaries in India, while some companies are now manufacturing wind turbines without any foreign collaboration. The current annual production capacity of domestic wind turbine industry is about 2500 MW. The technology is continuously upgraded, keeping in view global developments in this area. The progress of phased indigenization by leading manufacturers of wind turbines up to 500 kW has led to 80% indigenization level. Import content is high in higher capacity machines, since vendor development of higher capacity machines will take some time. The industry has taken up indigenized production of blades, gear boxes etc., Wind turbines and Wind Turbine components are exported to the US, Australia and Asian countries.

7. Promotional policies for Wind Power

The current level of capacities has been achieved due to the market development initiatives taken up by the Ministry of New & Renewable Energy (MNRE). The experience over the last twenty years has significantly enhanced knowledge and understanding of not only wind regimes in India but also of the technology, operation and maintenance, project development and policy environment. The significant outcomes have been:

1. Wind energy has emerged as economically viable means of electricity generation and competes well with conventional power generation.
2. Indigenous development of world-class wind turbines in the range of 225 kW to 2.00 MW by Indian wind turbine manufacturers.
3. Identification of high wind areas in the country such as Muppadal (TN), Chitrardura(Karnataka) etc.

Fiscal incentives such as tax holidays, concessional customs tariffs and 80% accelerated depreciation offered by the Central Government have generated significant interest in the private sector. Ten states namely Andhra Pradesh, Haryana, Karnataka, West Bengal, Madhya Pradesh, Maharashtra, Rajasthan, TamilNadu, Gujarat and Kerala have announced policy for wind power projects. The Ministry also has a specialized technical centre named Centre for Wind Energy Technology at Chennai.

Conclusions

Wind energy is the fastest growing renewable energy sector in the country. With a cumulative deployment of over 14,000 MW capacities, it accounts for nearly 70% of the installed capacity in the renewable energy sector in the country. The sector is growing rapidly and we are likely to achieve the capacity addition of nearly 2000 MW per year. The Government of India has always been at the forefront of providing all out support for the accelerated development of wind energy through proactive policy and regulatory interventions. The policies provide for a host of fiscal incentives, feed-in-tariffs as a recently activated renewable energy certificate regime. The recently introduced generation based incentive scheme is expected to help more independent power producers to enter the arena and the government’s facilitative measures is expected to help the country rapidly achieve its wind power potential.

References


AUTHOR’S PROFILE

Dr. Prasada Rao Y.V.S.S.S.V. is a Doctorate (Ph.D) in the faculty of Mechanical Engineering. He is also a post-graduate in Business Administration (M.B.A) and a Fellow of Institution of Cost & Works Accountants of India (FICWA). He is a University Rank holder both in engineering and management with several academic and professional credentials including the best teacher award. He has 30 years of experience in Industry, Research, and Teaching & Academic administration. Presently he is with the prestigious K L University, Vijayawada, and Andhra Pradesh, India.