

Wind Power Development in India

India faces a formidable challenge in meeting its energy needs and providing adequate and affordable energy to all sections of society in a sustainable manner. The country today faces an energy demand supply gap of about 8% with peak shortages to the order of 11-12%. Also, grid access is yet to be provided to over 56% of rural households. The solution to this challenge lies, inter-alia, in maximizing the utilization of renewable energy sources for meeting our energy demands. Moreover, the ever increasing prices of fossil fuels and the growing concern over global warming, due to fossil-fuel based power plants, has led to a constant interest, in all sectors, to harness renewable sources for power generation, in particular, wind energy.

GLOBAL SCENARIO

Wind energy has emerged, world-wide, as a mature and booming global business. Generation costs have fallen over the last few years, making it competitive with conventional energy sources. The technology has improved dramatically, in view of higher capacity machines, higher hub-heights, and efficient and reliable technology. Over the last decade, global wind installations have continued to grow at an average growth rate of around 30%. The world witnessed 2008 as another record year of wind power development, with more than 27,000 MW of new installations, taking the cumulative installed capacity to 1,20,798 MW. The 2008 global market for wind turbine installations is estimated to be of the order of Rs. 2000 Billion. It is estimated that the present installed capacity can produce around 260 TWh of energy and save about 158 million tons of CO₂ every year.

In 2008, the United States surpassed Germany in becoming number one in the global market, and China, very dramatically, added over 6,300 MW to its capacity. China has been doubling its installed capacity during the last four years, in a row. The United States (25.2 GW) is followed by Germany (23.9 GW), Spain (16.8 GW), China (12.2 GW) and India (9.6 GW up to Dec. 2008).

WIND RESOURCE ASSESSMENT

Wind Energy is intermittent and highly site-specific and, therefore, an extensive Wind Resource Assessment Programme was created as it was essential for deciding the potential sites. Therefore, the Ministry has emphasized wind resource assessment from the beginning and, today, India has abundant data, collected from about 1100 wind monitoring stations in 25 states and union territories.

The Wind Resource Assessment Programme is being implemented in the country through the Centre for Wind Energy Technology (C-WET), an autonomous institution of the Ministry and associated State Nodal Agencies. C-WET also assists in determining areas most suitable for deployment of wind power systems through wind mapping of the country. The wind power potential has been estimated to be 48,000 MW, assuming that 1% of land is available for wind power generation in the potential areas.

The locations having annual mean wind power density greater than 200 watts / m², at 50 m height, are considered to be suitable for commercial wind power development. A total of 216 wind monitoring stations, covering sites in 13 States/UTs, have been found to be potential sites. Seven volumes of the handbook on Wind Energy Resource Survey in India, covering wind data for 234 sites in 13 states/UTs, have so far been published. The details of potential sites can be obtained from the website of C-WET. FISCAL

INCENTIVES AND PROMOTIONAL POLICIES

The government promotes the wind energy sector in the country through fiscal incentives such as 80 % accelerated depreciation in the first year, concessional custom duty on certain components of wind electric generators, excise duty exemption, ten years' tax holiday on income generated from wind power projects, and loans from the Indian Renewable Energy Development Agency (IREDA), and other financial institutions. MNRE has been issuing guidelines to all state governments to create an attractive environment for the purchase, wheeling, and banking of electricity generated from wind power projects. A preferential tariff is being provided to increase wind energy generation in the potential states. The states of Tamilnadu, Andhra Pradesh, Haryana, Karnataka, Madhya Pradesh, Rajasthan, Maharashtra, Gujarat, Punjab, Kerala, and West Bengal have announced the preferential tariffs ranging from Rs.3.39 to 4.50 per kWh. A total of 15 state regulatory commissions have announced their Renewable Power Obligations (RPOs), which mandate the distributing licensees to necessarily take up to 10% of electricity from renewables, which have accelerated their growth. A National Action Plan for Climate Change has been prepared which envisages a national minimum percentage of energy from renewables and also the concept of renewable energy certificates, which are tradable.

The main driving force and the real incentive for commercial development of the wind sector has been the provision for accelerated depreciation of 80%. This provision has enabled large profit making companies, small investors, and captive users to participate in the sector. However, in the last few years, the power scenario in India has witnessed a qualitative change with the entry of independent power producers and foreign direct investors, who are also being encouraged to enter the field of renewables. Since they cannot avail of the accelerated depreciation provision, the government has approved a Generation Based Incentive Scheme. Under this scheme, a GBI will be provided to wind electricity producers @ Rs. 0.50 per unit of electricity fed into the grid, for a period not less than 4 years and a maximum of 10 years in parallel with accelerated depreciation on a mutually exclusive manner, with a cap of Rs. 62 lakhs per MW. The provision of GBI will continue till the end of the 11th Plan period. However, provision of accelerated depreciation in parallel with GBI will continue till the 11th Plan period or till the introduction of the Direct Tax Code, whichever is earlier.

GUIDELINES FOR SETTING UP PROJECTS

The Ministry has been issuing comprehensive guidelines for wind power projects to all concerned since July 1995, to bring about healthy and orderly growth of the wind energy sector and to achieve optimum generation of power in the most efficient and cost-effective manner. These guidelines relate to preparation of Detailed Project Reports (DPR), micro-siting, selection of wind turbine equipment, operation and maintenance, performance evaluation, etc. These guidelines have created awareness in the state electricity boards, state nodal agencies, manufacturers, developers, and investors about planned development and implementation of wind power projects. They have helped in installation of quality wind turbines and an orderly growth in the country. Besides, demonstration wind power projects were taken up by the Ministry in the mid eighties. The basic objective of demonstration wind power projects was to create necessary infrastructure to open up the sites for further commercial development by demonstrating their success, so that the private sector gets confidence to invest. With an aggregate demonstration project capacity of 71 MW, established at 33 locations in 9 States, most of the potential sites have been demonstrated and it has led to commercial development. These projects have helped private investors in analyzing the performance and economics of wind power projects and identifying areas of concern in the operation of wind based power projects.

COMMERCIAL WIND POWER DEVELOPMENT

Commercial wind power projects have been promoted by the Ministry of New and Renewable Energy since the year 1993-94. Wind power has been making a significant contribution to the installed capacity of renewable power generation and has emerged as a competitive option to fossil fuel based power generation. This is due to the multidimensional initiatives taken by the Ministry under the Wind Power Programme, which aims at a large-scale commercialization of cost-effective generation of grid-quality wind power. The wind power programme includes a comprehensive wind resource assessment programme; research and development; implementation of demonstration projects to create awareness; development of infrastructural capability; capacity of manufacture, installation, operation and maintenance of wind turbines and policy formulation. An important role played by the Ministry has been towards introduction of suitable fiscal and promotional incentives at the central and state levels to encourage private investors and developers to take up commercial projects.

The successful operation of the demonstration projects attracted large investors towards wind. The annual growth picked up from the start of 2002. The last five years, i.e. 2004-05, 2005-06, 2006-07, 2007-08 and 2008-09 have witnessed a record addition of 1111 MW, 1716 MW, 1742 MW, 1663 MW and 1485 MW respectively. The bulk of the addition is in Tamil Nadu. A total wind power capacity of 10,900 MW of commercial projects has been established upto November, 2009, mainly in Tamil Nadu, Gujarat, Maharashtra, Andhra Pradesh, Karnataka and Rajasthan. The total wind power capacity of 11000 MW by November, 2009 (including the demonstration projects) contributes to about 8% of the total grid-connected, installed power capacity in the country. Large scale commercial developments are currently taking place in the states of Tamilnadu, Maharashtra, Karnataka and Gujarat.

The largest commercial installation of wind turbines in the country so far has been in the Muppandal-Perungudi area, near Kanyakumari in Tamil Nadu. With an aggregate capacity of about 1400 MW, this represents one of the largest concentrations of wind farm capacity, at a single location, in the world. The highest capacity utilization factor of 39% has been achieved in a commercial project at Jogimatti in Karnataka. Another commercial project installed in Rajasthan, has indicated a capacity utilisation factor of 27%, despite being on a moderately windy zone.

TECHNOLOGY DEVELOPMENT AND MANUFACTURING BASE

Wind electricity generation technology has evolved very rapidly in the country. State-of-the-art technologies are now available in the country for the manufacture of wind turbines. All the major global players in this field have their presence in the country. The unit size of machines has gone up from 55-100 kW in the 1980s, to 2.00 MW. Wind turbines are being manufactured by 14 manufacturers in the country, through (i) joint ventures under licensed production (ii) subsidiaries of foreign companies, under licensed production, and (iii) Indian companies with their own technology. An indigenization level of up to 80% has been achieved in machines. The current annual production capacity of domestic wind turbines is about 3000 MW, which can be easily expanded to 5,000 MW, if the market demands it. Wind turbines of unit sizes of 225 kW, 350 kW, 700 kW, 800 kW, 1 MW, 1.25 MW, 1.5 MW, 1.65 MW, and 2.00 MW are being installed across the country. The technology is moving towards better aerodynamic design; use of lighter and larger blades; higher towers; direct drive; and variable speeds of gearless operation using advanced power electronics. A recent development is the 'Permanent Magnet' technology. The technology is continuously upgrading, keeping in view global developments in this area. Wind turbines and wind turbine components are exported to the US, Australia, Europe, Brazil, and other Asian countries.

The C-WET periodically publishes a list of models of type tested wind turbines and the details of manufacturers thereof. Only the wind turbine models appearing in this list are permitted to be grid-connected.

CENTRE FOR WIND ENERGY TECHNOLOGY

A centre for Wind Energy Technology (C-WET), Chennai has been established in Tamil Nadu as an autonomous institution under the administrative control of the Ministry. The centre serves as the technical focal point for wind power development and supports the growing wind power sector in the country. Besides offering various consultancy services to customers, C-WET's main activities include research and development, to achieve and maintain reliable and cost-effective technology; wind resource assessment; preparation of standards; testing and certification of wind power systems; information dissemination.

NEW INITIATIVES

Wind Atlas

A numerical 'Wind Atlas' is in the final stages of completion, which will help the stake-holders in getting better micro-siting, leading to higher generation from wind power projects. The wind atlas is being prepared in association with the Riso National Laboratory, Denmark. Riso is the pioneer institution for development of wind atlases for many countries. The modeling techniques used for preparation of a wind atlas for India includes WasP and KAMM. The vast field wind data obtained under wind monitoring programme is being used for validation of the atlas. Preferential Tariff Rates As per the Electricity Act, 2003, the state utilities are to encourage wind energy development by providing preferential tariff rates for generation of electricity from all renewable energy sources including wind energy. The Ministry has been constantly interacting with various SERCs and the CERC to finalize the preferential tariff policy for wind power projects. The SERCs in the states of Gujarat, Andhra Pradesh, and Tamil Nadu have revised their tariffs, which are encouraging investments in the wind energy sector. The CERC has recently issued new guidelines for tariff determination, which is expected to be very attractive compared to the existing tariff rates.

National Grid Code

The Indian grid is very unstable. Wind power development has been adversely affected by lack of adequate evacuation, transmission facilities, and its stability. It has been seen that even the machine and winds are available but, at times, the grid is not available for evacuation and transmission of power. This results in lower Capacity Utilisation Factors (CUFs). In order to minimize such situations, a National Grid Code is under preparation, which will be suitable for wind power projects. This will help in maintaining better grid stability by large wind power projects.

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