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Wind energy and Global Policy in India

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ABSTRACT

Energy policy plays a vital role to mitigate the impacts of global warming and crisis of energy availability. This paper explores the wind energy industry from the point of view of the wind energy policy. It is noticed that energy policy could help increasing wind power generation as well as stimulating the energy industry. It may be stated that without specific energy policy, a country would not be able to solve the acute problems like reducing greenhouse gases (GHGs) emission, scarcity of energy, etc. Due to growing population, economic growth, and socioeconomic development, energy is the most essential need. Worldwide, about 86.4% of energy is produced by fossil fuels. Globally, India ranks fourth among the countries that produce wind energy. The last five years' growth in wind energy in India is about 16%. This growing Indian wind energy market is compared with the world scenario along with the state of Maharashtra in India, which is at the second position in the country, backed up by a detailed database. As India plans to reach 175 Gigawatt (GW) of renewable energy by 2022, wind energy will be a major contributor, contributing 60 GW to this expansion plan. Estimates show that India's wind potential is 302 GW and India Energy Security Scenarios 2047 show a possibility of achieving a high of 410 GW of wind.In 2016-17, India added a record 5.4 GW of wind power capacity, surpassing the target of 4 GW. India's wind power installations accounted for a 6.6% share of the global market in 2016. Wind power capacity accounted for over 9.1% of total domestic installed capacity. India's well-developed wind power industry has the capability and experience to help meet the country's climate and energy security goals.Wind Energy It is one of the most environment friendly, clean and safe energy resources. The ten machines near Okha in the province of Gujarat were some of the first wind turbines installed in India. India has the 5th largest wind power installed capacity of 3595 MW in the world. The estimated potential of wind energy in India is about 45,000 MW.

1. Introduction

The world population is rising at an exponential rate due to which the demand for energy is increasing. Generation of energy is considered an indispensable part of life and of national advance. There exists a direct relationship between development and energy consumption. Hence we need to produce more energy to be progressive[1]. To produce more energy, we depend on fossil fuels. The use of fossil fuels increases the emission of pollutants such as SO_x, NO_x, and carbon monoxide that have a detrimental effect on the environment[2]. Hence, the use of alternate energy sources such as wind, solar, and hydrogen is gaining importance[3]. Wind has proven to be a very effective source of energy due to technological richness, infrastructure, and relative cost attractiveness[4].Wind can offer several advantages such as being inexhaustible, pollution free, and requiring minimal or no fuel[5]. Renewable energy and especially wind energy does not emit any CO_2 in the atmosphere—thus it protects us from global warming as well. This is the reason why many countries are using wind energy as a source of energy[6]. In developing countries, one-third of the world's population still lives without electricity. Wind energy systems have made it possible to harvest cost-effective power generation[7]. Wind turbines have traditionally been used for almost 200 years to generate electricity[8]. The use of wind turbines for renewable energy has become one of the most viable substitute sources of power generation due to some compensations such as being lucrative and eco-friendly[9].

Wind energy is the most gifted and potential source of energy, even though its obtainability varies from place to place. However, the main drawback is to obtain a continual power supply. Wind turbine technology has seen a dramatic change in the last three decades. Continuous development in the technology of wind turbines such as power electronics, aerodynamics, and mechanical drive train design has made it an efficient source of energy. The disadvantage is of noise pollution, which is much less than other power plants[10].

2. World Wind Energy Development

The onshore wind energy potential is very large as paralleled to the total world power consumption. It is nearly $20{,}000 \times 10^9$ to $50{,}000 \times 10^9$ KWh per year against the total consumption of power of about $15{,}000 \times 10^9$ KWh. The impending of wind energy depends on aspects such as average wind speed, wind speed distribution, turbulence intensities, and cost of wind turbine systems. The global wind energy council is operating in the wind energy sectors of several countries. These participants operate in more than 100 countries with over 2,500 organizations involved in hardware manufacture, project development, power generation, and finance consultancy on a build, operate, and transfer (BOT)

basis. These participants are also involved in research and academics[10].Most of the developed countries are facing challenges to meet the power demand due to the increase in population and industrialization. The U.S. Department of Energy (DOE) has given the directions toward the development of energy by wind: Wind energy technology must be cost-effective with increasing viability. The supporting research is also conducted in the area of wind development technology such as power system integration, resource information, industry support, and market acceptance[11]. The power produced by wind technology of the future needs to be cost-effective and capable of competing with other energy such as from coal and natural gas[12]. Present R&D is successful toward wind power development; many countries have adopted it as a main source of energy, and a number of growth studies have been presented[13]. The global wind power installation capacity has been increased in 2012 to 44,799 MW, and it became a total of 282,587 MW with an 18.7% increase on the 238,050 MW installed in 2011. More than half of the wind power generation is added in the year 2010.

The largest wind farm of India in Muppandal, Tamil Nadu

3. Wind Energy Development in India

India is now fourth among the several countries that produce more electricity from wind power. In India, the Ministry of New and Renewable Energy (MNRE) and the Indian Renewable Energy Development Agency (IREDA) work in coordination with the state government's wind energy department. Each state has its own wind energy department as in Maharashtra (MEDA). IREDA deals with identification of wind potential sites, wind resource assessment, setting up government policy, financing/profitability, availability of equipment, service, perception of investors, constraints/barriers and suggestions, and so on. IREDA has set up Anemometry Masts (AM) all over India to measure wind power density (WPD). AMs have recorded the qualifying criteria of WPD in the country, being above 200 W/m^2 at a height of 50 meters and at an 80-meter height above ground level, and the number of stations along with the potential power capacity and achievement up to 2014.In India, in 1985, demonstration type wind energy projects were started. In this, about 69.6 MW power projects were started at various locations in India. In 1986 five wind farms were started with a capacity of 3.3 MW power generation. The first commercial wind power generation started in 1990 at Kattadilalai, Muppandal, in Tamil Nadu. Until 1992, many wind turbines were installed in coastal areas of Tamil Nadu, Gujarat, Maharashtra, and Orissa. After 1996, India has seen steep growth in wind power production. In 2004, Asia's biggest and tallest wind turbine was built in India. IREDA under the guidance of MNRE has drawn long-term policy for the international market to invest in India for the development of wind power energy. It has also designed policy for local investors in the renewable energy development sector. In the last two decades, the growth of wind energy in India is from 41.3 MW in 1992 to 22,465 MW at the end of 2014[14]. Among the Indian states, Tamil Nadu has the highest growth in wind power energy development and is producing 5867.165 MW, which is 41.61% of total wind energy development in India by 2011 and 7,254 MW at the end of 2014[15]. Among other states, Maharashtra 4024.65 MW, Gujarat 3405.605 MW, Karnataka 2331.295 MW also achieved significant growth of 16.30%, 15.44%, and 12.51%, respectively, at the end of 2014. The center for wind energy technology (C-WET) has published a wind power density atlas of India; it shows the various areas of wind potential of more than 200 $Watt/m^2$ The Indian wind atlas shows that India has the potential of producing wind energy of 49,130 MW at 50 m height and 102,788 MW at 80 m height above the ground level. India currently has an installed wind power generation capacity of 22,465 MW. Also, barely 12% of the total power generation is from renewable sources. The remaining 88% of power depends on other energy resources. Offshore wind power policies should be developed; it helps to increase the wind power energy. European countries, most notably the UK and Germany, have adopted effective offshore policies. Resolving the Indian power sector the renewable energy policies have to be improved. These policies are classified into five categories, namely:

1. Government support
2. Fiscal and quota-based incentives
3. Local expertise
4. Capital for investments
5. Building and enabling ecosystem.

Presently, India is emitting CO_2 of about one ton/year-capita. To reduce this, India is keen on investing in renewable energy technologies. In the year 2011 investment in renewable energy technologies was $12.3 billion compared to the investment made in the previous year (2010: ˜$7.5 billion), a hike of nearly 36% in the turnover. This quantity is to be reduced by increasing the renewable energy and decreasing the consumption of fossil fuel. This indicates the large scope there is in India for the development of renewable energy. The present extenuation of CO_2 in the Indian energy sector is about 203 million tons with fixed a capacity of 24 GW in 2012. Nevertheless, a large amount of scope is seen in the Indian market for the growth of wind energy[16].

4. Wind Energy Policies in India

India needs to sustain an economic growth of at least 9% over the next 25 years if it is to eradicate poverty and meet its larger human development goals. The primary energy supply (including the gathered noncommercial one such as wood and dung) must increase at a rate of 5.8% annually for fueling the growth. Meeting this requirement is a challenge that needs to be addressed through an integrated energy policy. The broad vision behind the integrated energy policy is to reliably meet the demand for energy services of all sectors, including the lifeline energy needs of vulnerable households in all parts of the country with safe, clean, and convenient energy at the least cost [17].

(a)State Wise Tariff for Wind Power

Talking about wind energy in India, all started well with wind since around 2002 until the end of 2011 as it enjoyed the benefits of accelerated depreciation (AD) till April 2012. The generation-based incentive (GBI), announced in 2011, was later discontinued. Now the government has launched its first wind energy mission to give a boost to the wind energy sector and putting it in the same league as the high-profile solar mission. The National Wind Energy Mission (NWEM) has been launched. This might provide a great boost to the wind energy sector, which is experiencing slowdown since 2011 continually. In 2011 approximately 29,536 MW of renewable power capacity was installed in India, which included about 19,933 MW from wind, 2,079 MW from solar, 3,746 MW from small hydro, and 3,776 MW from bio energy[18].India is the fourth largest wind power producer in the world with an installed total capacity of close to 23 GW in 2014.

(b)Renewable Energy Certificate Scheme (REC)

Renewable energy is promoted by the Ministry of New and Renewable Energy (MNRE), the central authority for all policies, regulations, and approvals relating to renewable energy.It is supported by the Ministry of Power and the Central and State Electricity Regulatory Commissions (CERC and SERCs). CERC deals with the national grid and interstate transfer/trading of power, while SERCs manage regional distribution and transmissions. These play a key role in the promotion of renewable energy as they have the sole authority to ascertain the feed-in tariffs and other policy matters, such as the Renewable Portfolio Standard (RPS). Energy Development Agencies (EDAs) represent the MNRE at the state level. Their main purpose is to assess and promote renewable energy frameworks for individual states and to advise the MNRE, state governments, and SERCs. IREDA promotes financial assistance for renewable energy and energy efficiency projects in India. The price of REC would be determined in power exchange. REC would be traded in power exchange within the forbearance price and floor price determined by CERC from time to time. CERC has determined the floor price and forbearance price on August 23, 2011 applicable from April, 2012 until FY 2016–17. The forbearance and floor price of solar and non-solar energy sources in 2012[18].

(c) National Clean Energy Fund (NCEF)

NCEF was proposed in the Union Budget 2010–11 for funding research and innovative projects in clean energy technology. In many areas of the country, the pollution level has reached alarming proportions. While it must be ensured that the principle of “polluter pays” remains the basic guiding criterion for pollution management, there should also be a positive thrust for development of clean energy. And to build on the purpose of the NCEF, the government of India proposed to levy a clean energy process on coal produced in India at a nominal rate of Rs.50 per ton, which will also be applicable to imported coal. By the end of March 2012, NCEF was worth rupees 3,864 crore. The latest economic survey reveals that the government expects to collect rupees 10,000 crore under the Clean Energy Fund by the end of 2015. An allocation of rupees 200 crore from the fund was proposed for an environmental remediation program and another rupees 200 crore for the Green India Mission in 2013–14[19].

(d) Land Allocation Policy

The government of India amended the Wind Power Policy 2012, with an aim of attracting more investors and giving boost to renewable energy. The government wants to ensure an easy process for allocation of land and other formalities for setting up wind power projects[18].The above detailed study and analysis of data at various sites in the world, in India, and in the state of Maharashtra indicates that India is facing the challenge of sustaining its rapid economic growth. The threat of climate arises from the emissions of greenhouse gases emitted from continuous generation of energy from nonrenewable sources, intensive industrial growth, and high ingestion lifestyles. While engaged with the international community to jointly and supportively deal with this hazard, India needs a national approach to, first, acclimate to climate change and, second, to further augment the ecological sustainability of India’s enlargement path.Climate change may adversely affect India’s natural resources and also the livelihood of its people. This climate change will affect agriculture, water, and forestry. In charting out the development in India, the above data analysis clearly indicates that India has a wider spectrum of choices in the sustainable development of energy because it is at an early stage of development and that wind energy would be one of the viable options.

Identifying the global climate change, India is actively participating in the UN Framework convention on climate change. The main objective is to establish an accurate, compatible, and equitable sustainable development of energy based on the principles designed by the United Nations Framework convention on climate change (UNFCCC). India is not lagging behind in the development of renewable energy and protecting the climate. In parallel to this, India has developed the organization known as Indian National Action Plan for Climate Change (NAPCC). NAPCC has made the target of producing approximately 15% of the energy mix of India by 2020. To achieve this target, the Indian Ministry of Power launched the Renewable Energy Certificate (REC) mechanism in November 2010. This REC will assess the performance of the adjusting wind turbine projects for low-cost renewable energy generation. REC has decentralized distribution in and generation of renewable energy to different states. The participation in REC as per state data is Tamil Nadu 27%, Maharashtra 23%, and Uttar Pradesh 22%. REC helps to make the best policies for the state to implement on existing energy generation projects[20]. The Indian electric supply system consists of a centralized generation system. Nowadays a centralized system is not capable of handling all the problems related to conventional energy. It is difficult for the authorities to visit each and every site and make the decision. For this reason the work will slow down and get delayed. This centralized electricity supply system is to be decentralized with the authority of the decision on the development of conventional energy. This electric utility has been restructured into a number of subcontrolling authorities capable of making decisions on the development of small-scale projects. Nowadays the resources are being utilized through small and modular energy systems known as distributed generation

system (DGS) based on renewable energy resources. This helps to start small-scale projects[21].

5. Conclusion

It is essential that clean energy be produced in large amounts at reasonably less cost. One way of doing this is to use nonconventional energy sources such as wind energy. This review has discussed in detail the current position of wind energy in India with a focus on the situation in the state of Maharashtra. Here stock is taken of the capacity of the state of Maharashtra for possible wind energy production. The data of present installations, their capacity, and windy sites along with wind-power density has been given in detail. A detailed literature survey has been done, and sufficient relevant information has been provided.

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