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Wind Power at Offshore

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Abstract—*Renewable energy represents an area of tremendous opportunity in India. Energy is considered a prime agent in the generation of wealth and a significant factor in economic development and also essential for improving the quality of life. Development of conventional forms of energy for meeting the growing energy needs of society at a reasonable cost is the responsibility of the Government.*

Limited fossil resources, coal, natural gas, oil and associated environmental problems have emphasized the need for new sustainable energy supply options. Now a days India depends heavily on coal and oil for meeting its energy demand which contributes to smog, acid rain and greenhouse gases' emission. Last 25 years has been a period of intense activities related to research, development, production and distribution of energy in India. Though major energy sources for electrical power are coal and natural gas, development and promotion of non-conventional sources of energy such as solar, wind and bio-energy, are also getting sustained attention. The use of electricity has grown since it can be used in variety of applications as well as it can be easily transmitted, the uses of renewable energy like wind and solar is rising. Wind energy is a clean, eco-friendly, renewable resource and is non-polluting.

This paper discusses the ways in which India has already supported the growth of renewable energy technologies i.e. wind energy and its potential to expand their contribution to world growth in a way i.e. consistent with world's developmental and environmental goals and current status, major achievements and future aspects of wind energy in India.

1. INTRODUCTION.

Wind power is the conversion of wind energy into a useful form of energy, such as using wind turbines to make electrical power, windmills for mechanical power, wind pumps for water pumping or drainage, or sails to propel ships. Large wind farms consist of hundreds of individual wind turbines which are connected to the electric power transmission network. For new constructions, onshore wind is an inexpensive source of electricity, competitive with or in many places cheaper than fossil fuel plants.Small onshore wind farms provide electricity to isolated locations. Utility companies increasingly buy surplus electricity produced by small domestic wind turbines. Offshore wind is steadier and stronger than on land, and offshore farms have less visual impact, but construction and maintenance costs are considerably higher. Wind power, as an alternative to fossil fuels, is plentiful, renewable, widely distributed, clean, produces no greenhouse gas emissions during operation and uses little land. The effects on the environment are generally less problematic than those from other power sources. As of 2011, few country is generating more than a quarter of its electricity from wind and 83 countries around the world are using wind power to supply the electricity grid.

2. CURRENT SITUATION IN INDIA

The development of wind power in India began in 1986 with first wind farm being set up in costal area of Maharastra (Ratnagiri), Gujrat (Okha), and Tamilnadu (Tuticorin) with 55kW vestas wind turbines.

The National Institute of Energy (NIWE ; previously CWET) has announced a revised estimation of potential wind resource in India from 49130 MW to 302000 MW assessed at 100 Hud height. In the year 2015, the MNRE set the target for wind power generation capacity by the year 2022 at 60, 000 MW.

As of 30 June, 2016 the installed capacity of wind power in India was 27, 151 MW, mainly spread across south, west and north regions. East and North east region have no grid connected wind power plant as of March, 2015 end. No offshore wind utilizing traditional fixed bottom wind turbine technologies is shallow sea areas or floating wind turbine technologies in deep sea areas are under implementation. However, an offshore wind policy was announced in 2015 and presently weather stations and LIDARs are using set up in NIWE at locations.

In India offshore wind power farm is rare but followings are important, helps India to grow up

Wind farm	Current capacity(MW)	State
Jaisalmer wind park	1064	Rajasthan
Muppandal wind farm	1500	Tamilnadu

There are so many place in different states in India where wind power is sufficient and Where we can established windmill. If we establish this new renewable power generation technology then we will able to develop our country in economically and job market .Because the Power Skill Development Council has identified 100 job roles where 46,

29, 600 people will be trained in next 10 years. This is going to help industry get trained people to perform various jobs efficiently

- ***Bihar:-***
  Araria, Aurangabad, Banka, Begusarai, Bhabhua, Bhagalpur, Jamui.
- ***Uttar Pradesh:-****Agra, Aligarh, Allahabad, Ambedkarnagar, Azamgarh, Lalitpur.*
- ***Haryana:-****Ambala, Kurukshetra, Rohtak, Hisar, Jind, Gurgaon.*
- ***Punjab:-***
  Hoshiarpur, Fafidkot, Nawanshahir, Rupnagar, Amritsar.
- ***Assam:-***
  Tajpur, Golaghat, Nagaon, Diphu, Haflong.
- ***Manipur:-****Tamenglong, Chandel, Senapati, Ukhrul, Bishnupur.*
- ***Nagaland:-***
  Dimapur, Kohima, Mokokchung, Mon.
- ***Jammu&kasmir:-***
  Mirpur, Chilas, Gilgitwazara,
- ***Arunachal Pradesh:-***
  Seppa, Khonsa, Tawang.
- ***Himachal Pradesh:-***
  Mandi, Solan, Sirmaur, Chamba.

Economical Efficiency:- It is a wind turbine for producing electricity sufficient for a household (1 kVA). The windmill can be installed near the house or on the roof with an RCC construction. The windmill has been found producing up to 0.8-1.2 kVA (80 volt @ 10-15Amp) electric power at a wind speed of 3-3.5 m/s.

3. FUTURE DEVELOPMENT:-

1. The consortium published initial pre-feasibility assessment reports for offshore wind farm development in Gujarat and Tamil Nadu on 16 June 2015. In September 2015, the India's cabinet has approved the National Offshore Wind Energy Policy.
2. The official assessment shows this country has potential to generate over 100, 000 MW of wind energy. Till May 2015, generation capacity of 21, 268.3 MW has been created and Indian government decided that it upgrade up to 30000 till 2017
3. Generation of wind energy by offshore wind turbines are not much used in India because of the Indian economy. Indian economy is not very strong to setup an offshore wind turbines industry but, due to scope of this type of generation of energy some companies came forward to set up the offshore wind turbines in 2015-18 In India, Gujarat is the first place which is planning to set up the offshore wind power project which is initiated by Suzlon Energy limited.
4. The Government has up-scaled the target of renewable energy capacity to 160GW by the year 2022 which includes 100 GW from solar, 60 GW from wind.
5. Medium Scale Grid Connected wind Power Projects. With this ambitious target, India will become one of the largest Green Energy producers in the world, surpassing several developed countries.
6. The total investment in setting up 60 GW will be around Rs.6, 00, 00crore . The target, which looked overambitious, now seems within the realms of reality with several States already witnessing silent revolution on power generation.
7. Confident of the growth rate in clean energy sector, the Government of India in its submission to the United Nations Framework Convention on Climate Change on Intended Nationally Determined Contribution (INDC) has stated that India will achieve 40% cumulative Electric power capacity from non-fossil fuel based energy resources by 2030 with the help of transfer of technology and low cost International.
8. India is planning to enter in to offshore wind power, with a 100 MW demonstration plant located off the Gujarat coast. In 2015-16 a consortium, led by Global Wind Energy Council (GWEC) started project FOWIND (Facilitating Offshore Wind in India) to identify potential zones for development of off-shore wind power in India and to stimulate R & D activities in this area. The consortium was awarded the grant of €4.0 million by the delegation of the European Union to India in 2013 besides co-funding support from GPCL. The project action will be implemented from December 2013 to March 2018.

9. The project focuses on the States of Gujarat and Tamil Nadu for identification of potential zones for development through techno-commercial analysis and preliminary resource assessment

It will also establish a platform for structural collaboration and knowledge sharing between stakeholders from European Union and India, on offshore regulation, industry and human resource development. FOWIND activities will also help facilitate a platform to stimulate offshore wind related R&D activities in the country.

4. BENIFIT:-

Financial Competitiveness of Wind Energy: Recent reports suggest that wind energy has already become cost competitive with traditional energy in India and solar energy will become cost competitive by 2016-18 (Parkinson, 2014). As it is cost competitive with traditional energy the economy of scale would make it even cheaper when we scale up the wind power generation in massive way.

5. CONSTRUCTION:-

A windmill's noise is directly proportional to the speed of its rotor tips. Two-bladed turbines have to spin faster than their three-bladed competitors to generate the same amount of energy. The major improvements have come in the types of materials used in construction. This trend will likely continue in future windmill products. However, the future of harnessing wind power is not in traditional windmills at all. The ***tower*** structure is not only carrying the weight of the nacelle, rotor, but must also absorb the huge static loads caused by the varying power of the wind. Generally, a tubular construction of concrete or steel or the lattice tower form is used.

The energy a windmill generates is proportional to the area of the rotors' circular sweep, so energy increases proportionally to the square of the blade length.

- hub height 40-65 m: approx. 600rated power and approx. 40 to 65 m rotor diameter
- hub height 65 to 114approx. 1.5 to 2rated power and approx. 70 m rotor diameter
- hub height: 120 to 130approx. 4.5 to 6rated power and approx. 112 to 126 m rotor diameter
- **Rotor and rotor blades**
- The **rotor** is the component which, with the help of the rotor blades, converts the energy in the wind into rotary mechanical movement.
- Currently, the three-blade, horizontal axis rotor dominates. The **rotor blades** are mainly made of glass-fibre or carbon-fibre reinforced plastics (GRP, CFRP).
- **Nacelle with drive train**
- The nacelle holds all the turbine machinery. Because it must be able to rotate to follow the wind direction, it is connected to the tower via bearings. The build-up of the nacelle shows how the manufacturer has decided to position the drive train components above this machine bearing.

6. GEARBOX:-

If a specially developed multi-pole ring generator is used then gearbox is no longer required.

The *gearbox* converts the rotor motion of 18-50 rpm into the approx. 1, 500 rpm which the generator requires.

The *gearbox* thus takes on the task of matching the rotation speeds of the slow-moving rotor and the fast-moving generator, and generally has several steps to cover for various wind conditions.

7. ADVANTAGE:-

- It's a clean fuel source.
- Wind is a domestic source of energy.
- It's sustainable. Wind is actually a form of solar energy. Winds are caused by the heating of the atmosphere by the sun, the rotation of the Earth, and the Earth's surface irregularities. For as long as the sun shines and the wind blows, the energy produced can be harnessed to send power across the grid.
- Wind power is cost-effective. It is one of the lowest-priced renewable energy technologies available today.
- In the future, wind power promises to be an environmentally friendly substitute for fossil fuels.
- Wind turbines can be built on existing farms or ranches. This greatly benefits the economy in rural areas, where most of the best wind sites are found. Farmers and ranchers can continue to work the land because the wind turbines use only a fraction of the land. Wind power plant owners make rent payments to the farmer or rancher for the use of the land, providing landowners with additional income.
- Wind creates jobs. If the wind sector invest money of private capital in the INDIAN economy to build projects and employed more workers.

8. DISADVANTAGE:-

The total cost can be same like solar system but more expensive than hydro.

- Electricity production depends on- wind speed, location, season and air temperature. Hence various monitoring systems are needed and may cost expensive.
- High percentage of the hardware cost (for large WT) is mostly spent on the tower designed to support the turbine

9. CONCLUSION:

It has been concluded that installation is very high and now India ranks fifth in the world with an installed capacity of about 18421 MW. In this paper the development of wind energy in India and five potential Indian states such as Tamil Nadu, Rajasthan, Maharashtra, Madhya Pradesh and Karnataka have been discussed. Wind power is one of the most important alternatives to fossil fuels and is available in plenty. It is renewable, widely distributed and clean .In addition to this; it does not produce any green house gasses.

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