The Uses of Wind Energy in India.

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Abstract:

Renewable energy is one of the fastest growing industries on the planet, with crores of rupees invested each year to meet national energy sustainability goals. This paper will provide a solid foundation for understanding the wind energy. Wind energy is a form of solar energy.It describes the process by which wind is used to generate electricity. Wind turbines convert the kinetic energy in the wind into mechanical power. A generator can convert mechanical power into electricity. In a country like India or any region where energy production is based on imported coal or oil will become more self-sufficient by using alternatives such as wind power. Electricity produced from the wind produces no CO_2 emissions and therefore does not contribute to the greenhouse effect. Wind energy is relatively labour intensive and thus creates many jobs. In remote areas or areas with a weak grid, wind energy can be used for charging batteries or can be combined with a diesel engine to save fuel whenever wind is available.This paper describes the different types and uses of wind energy in our country.

Key Words: Wind Energy, Electricity, Turbines, Self Sufficient, Environment.

Introduction:

Wind has been used by people for over 3000 years for grinding grain, sailboats, and pumping water Windmills were an important part of life for many communities beginning around 1200 BC.The first modern wind turbine, specifically designed for electricity generation, was constructed in Denmark in 1890.The wind energy is mainly used to generate electricity. Wind is called a renewable energy source because the wind will blow as long as the sun shines.Energy is considered as one of the most important factor to run the world. Most of the energy or large part of it are generated by the fossil fuel, which are being used from a long time which are causing a major problem in environmental and the damage done is not reversible. As the fossil fuel are damaging and are also limited in quantity available, so the need of alternate energy was needed. Wind energy is considered as low effects on the environment and growing faster day by day which is considered as quarter in last few decades.

The process of capturing is considered as easy as and less damaging than the other energy sources. Wind power is taken.Wind is a natural, replenishable source of energy. With the invention of wind turbines, it has made it possible to convert wind into the energy people can use in homes and

businesses. Earth's climate is rising continually, and if humans don't begin to change the use of nonrenewable sources to renewable, the planet will have devastating consequences.

Nowadays, the increasing environmental issues especially concerning the global warming have motivated a run for the use of renewable energy sources. Wind energy represents a major player in this context and today it is the most widespread renewable fuel, but still requires many technological improvements. The wind turbines (WTs) plays a key role in wind energy applications.

Today's consequences range from climate change, polar caps melting, and oceans rising. Recent achievements in wind energy are making it a popular renewable source worldwide. The problem with fossil fuels is that every day these fuels are ruining the Earth's atmosphere which is the air plants, wildlife, and humans share in order to live. Damaging the air that species need is hurting all aspects of life. Wind energy is increasingly available throughout the world in order to slowly dwindle reliance on nonrenewable resources. Countries like Saudi Arabia rely greatly on fossil fuels, but recently have made a step closer to the first wind power project (Shukla).Nonrenewable energy emits harmful greenhouse gases that come from fossil fuels. Over time these gases ruin the Earth's atmosphere by altering the climate change. Wind energy has become one of the most important and remarkable alternatives for the generation of electricity from renewable energy sources.

Review of Literature:

C. M. Wang, T. UtsunomiyaS. C. Wee (20 Oct 2010) they study on floating wind turbines: a literature survey. This article presents a literature survey of research and development on floating wind turbines. The various, proposed conceptual designs for floating platforms used for floating wind turbines are described and the working principles of these various floater concepts are outlined. This is followed by an overview of the research work that has been undertaken pertaining to floating wind turbine technology by several research institutes and the academic community. The research work undertaken to date is reviewed categorically according to the proposed floater concept (spar-buoy type, TLP type, semi-submersible type, pontoon type and others) as per sections 3–7. Based on the research work undertaken thus far, recommendations for future work are suggested.

R. Saidurand A.Rahim(June 2011) Renewable and Sustainable Energy Reviews, Elsevier Journal, presented a paper on Environmental impact of wind energy. This paper compiled latest literatures in terms of thesis (MS and PhD), journal articles, conference proceedings, reports, books, and web materials about the environmental impacts of wind energy. This paper also includes the comparative study of wind energy, problems, solutions and suggestion as a result of the implementation of wind turbine. Positive and negative impacts of wind energy have been broadly explained as well. It has been found that this source of energy will reduce environmental pollution and water consumption. However, it has noise pollution, visual interference and negative impacts on wildlife.

C. Gopal, M. Mohanraj P. Chandramohan(September 2013). Renewable and Sustainable Energy Reviews, Volume 25. They concentrate onRenewable energy source water pumping systems—A literature review. The research developments with renewable energy source water pumping systems (RESWPSs) are reviewed in this paper. The reported investigations are categorized into five major groups as follows: (i) solar photovoltaic water pumping systems (SPWPSs), (ii) solar thermal water pumping systems (STWPSs), (iii) wind energy water pumping systems (WEWPSs), (iv) biomass water pumping systems (BWPSs) and (v) hybrid renewable energy water pumping systems (HREWPSs). More than a hundred published articles related to RESWPSs are briefly reviewed. Additionally, the limitations with RESWPSs and further research needs are described. This paper concludes that renewable energy sources (RESs) play a vital role in reducing the consumption of conventional energy sources and its environmental impacts for water pumping applications.

Eduardo José Novaes Menezesand Alex J.(10 February 2018), they Presented a paper on A review on wind turbine control and its associated methods. In this paper they describe the Wind energy and its role. The control of wind turbines (WTs) plays a key role in wind energy applications, ensuring their high efficiency and cost-effectiveness. This has been an intensively researched subject and its developments are crucial to design even better and more efficient wind turbines. However, currently very little papers are addressed to summarize and list wind turbine control concepts. In the present paper, a literature review of wind turbine control is presented dealing with the main wind energy control methods. The main objective of the paper is to form a detailed background to serve as a starting point for new researches on WT control that can be decisive to energetic sustainability. Further, the paper discusses the most recent control developments and their contributions to mitigate environmental issues.

Objectives:

1.To understand the concept andpotential of Wind Energy in India.

2. To know the major types of wind energy.

Methodology:

The present study has undertaken to examine the role of wind energy in Indian economy, and the concept andpotential of Wind Energy in India. The study used secondary data from various published reports from Renewable and Sustainable Energy Reviews -2010 & 2018, Experts opinion published in leading newspapers, published articles in journals, etc.

The concept andpotential of Wind Energy in India.

The terms "wind energy" describe the process by which the wind is used to generate mechanical power or electricity. 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.Development of wind power in India began in December 1952, when Maneklal Sankalchand Thacker, a distinguished power engineer, initiated a project with the Indian Council of Scientific and Industrial Research (CSIR) to explore the possibilities of harnessing wind power in the country.

The potential for wind farms in the country was first assessed in 2011 to be more than 2,000 GW by Prof. Jami Hossain of TERI University, New Delhi.This was subsequently re-validated by Lawrence Berkley National Laboratory, US (LBNL) in an independent study in 2012. As a result, the MNRE set up a committee to reassess the potential and through the National Institute of Wind Energy (NIWE, previously C-WET) has announced a revised estimation of the potential wind resource in India from 49,130 MW to 302,000 MW assessed at 100 m hub height.Wind turbines are now being set up at even 120 m hub height and the wind resource at higher hub heights of around 120 m or more that are prevailing is possibly even more.In 2015, the MNRE set the target for Wind Power generation capacity by 2022 at 60,000 MW. No offshore wind farm is under implementation as of December 2017. However, an Offshore Wind Policy was announced in 2015 and presently weather stations and LIDARs are being set up by NIWE at some locations.The first offshore wind farm is planned near Dhanushkodi in Tamil Nadu.

Wind power accounts for nearly 10% of India's total installed power generation capacity and generated 62.03 TWh in the fiscal year 2018–19, which is nearly 4% of total electricity generation.[26] The capacity utilisation factor is nearly 19.33% in the fiscal year 2018-19 (16% in 2017–18, 19.62% in 2016-17 and 14% in 2015–16). 70% of annual wind generation is during the five months duration from May to September coinciding with Southwest monsoon duration. In India, solar power is complementary to wind power as it is generated mostly during the non-monsoon period in daytime. Nearly 40% of the wind power is generated during the night time which is equal to the stored solar power in terms of price.

Wind is an intermittent and site-specific resource of energy and therefore, an extensive Wind Resource Assessment is essential for the selection of potential sites. The Government, through National Institute of Wind Energy (NIWE), has installed over 800 wind-monitoring stations all over country and issued wind potential maps at 50m, 80m, 100m and 120m above ground level. The recent assessment indicates a gross wind power potential of 302 GW in the country at 100 meter and 695.50 GW at 120 meter above ground level. Most of this potential exists in seven windy States as given below: -

S. No.	State	Wind Potential at 100 m (GW)	Wind Potential at 120 m (GW)
1	Gujarat	84.43	142.56
2	Rajasthan	18.77	127.75
3	Maharashtra	45.39	98.21
4	Tamil Nadu	33.79	68.75
5	Madhya Pradesh	10.48	15.40
6	Karnataka	55.85	124.15
7	Andhra Pradesh	44.22	74.90
	Total 7 windy states	292.97	651.72
8	Others	9.28	43.78
	Total	302.25	695.50

Source: National Institute of Wind Energy (NIWE)

Small wind systems also have potential as distributed energy resources. Distributed energy resources refer to a variety of small, modular power-generating technologies that can be combined to improve the operation of the electricity delivery system.

Types of wind energy.

1.Utility-Scale Wind power operators.

This defines wind turbines that range in size from 100 kilowatts to several megawatts, where electricity is supplied to the power grid and distributed to the end user by electric utilities or power operators.

2. Offshore Wind

Wind turbines that are erected in large bodies of water. These are generally larger than onshore turbines, and because the larger the turbine the greater the efficiency, they are able to generate more power.

3. Distributed or “Small” Wind”

This applies to wind turbines below 100 kilowatts that are used to directly power a home, farm, or small business that is not connected to the grid.

The two types of wind energy turbines:

1. Horizontal-Axis Turbines

These types of turbines typically have three blades, similar to airplane propellers. All of the components (including the blades, shaft, and generator) are on top of a tall tower with the blades facing into the wind and the shaft horizontal to the ground. Nearly all of the wind turbines in use are horizontal axis turbines.

2. Vertical-Axis Turbines
The egg-beater, Darrieus style model, have blades that are attached to the top and the bottom of a vertical rotor. Although they have been around for centuries, very few of these exist today because they do not perform as well as horizontal-axis turbines.

Wind turbines stand together on wind farms which function as a single power plant that put electricity onto the grid. Once wind energy is on the main power grid, electric utilities will deliver the electricity where it is needed. Wind is an important source of renewable energy, contributing to 6.3% of the nation's electricity supply. There are more than 58,185 land-based wind turbines operating across 43 states, Guam, and Puerto Rico representing more than 90 gigawatts of energy capacity. The US offshore wind industry is seeing momentum as well and currently contains more than 25,000 megawatts of potential capacity across 13 states.

Conclusion.

In this way, wind is caused by the unequal heating of the air it can be said to be an indirect form of solar energy. Wind energy is a renewable source of non-polluting energy. It has tremendous potential which, if harnessed, can easily satisfy the energy demands of a country.However, it is useful in those areas with more or less steady winds and remote areas which are far removed from central power grids where electric power is not available due to high cost of generation and distribution to small dispersed users. In rural areas, windmills have been used since ages for grinding grain and pumping water for drinking, washing and irrigation.The present day wind energy systems are not very reliable in practice besides being a source of immense noise pollution. More developmental work is needed in order to fully harness the tremendous potential of this important natural non-polluting renewable energy resource.

Wind power generation capacity in India has significantly increased in recent years. As of 30 September 2022, the total installed wind power capacity was 41.666 GW, the fourth largest installed wind power capacity in the world. Wind power capacity is mainly spread across the Southern, Western, and Northwestern states

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