

Environmental Affects of Wind Energy

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Abstract— Human being has captured the energy in wind for many of years, both for sailboats and powering wind engines at land. Of all non-conventional energy resources, wind power is the grown up in terms of commercial growth. This resource of energy is fascinating due of its renewable nature and its free of cost availability. Strength for growth is larger, and the world's capacity is far greater than the world's total energy utilization. Globally, a total capacity of around about 435 GW has been set up so far, with a yearly growth of about 100 TWh. The most difficult tasks for more growth are attached to economy, use of land, environment affects and grid strength. The development of non-conventional energy resources has never before seen over the last 30 years. Wind energy and solar power are in service with double figure development rates since 2000. No other part of the energy zone has grown this kind of faster growth. Wind power is the most economical and more developing power plant technology, because of lowering set up costs, no fuel costs are required as wind is freely available and time required for construction is also smaller a year or so , in comparison to over 10 to 15 years to construct a nuclear power plant. The impacts of wind energy on the environment most of the time are taken to be positive, by means of the production of non-conventional energy and the potential movements of mining works, air pollution, and release of greenhouse gases is linked with conventional energy sources such as fossil fuels like coal and petroleum. The deep knowledge understanding of the environmental and economic impacts of any one energy resource lies in complete knowledge of how that energy resource moves or is moved by various energy resources, and it in turn lies with more complete understanding of the environmental and economic impacts of all other energy sources available. This study gives an analysis to understand those environmental impacts, both positive and negative in nature.

Key words: Environmental Effects, Ecological Impacts, Renewable Energy, Wind Energy, Human Health

I. INTRODUCTION

In more recent times, the development of capacity to produce electrical power from wind energy has been very fast, To the great degree that wind energy lowers the requirement for electricity production employing other resources of energy, it can lower the negative environmental effects of those other resources, such as release of atmospheric pollution and water pollution, also taking into account greenhouse gases; production of nuclear hazards; deterioration of portion of land due to mining work; and damming of rivers also causes weakening of land portion around the dam. Production of electric power by means of wind energy has the strength to lower environmental effects, because unlike conventional generators that employ fossil fuel, it does not result in the production of atmospheric impurities or thermal pollution, and it has been desirable to many governments, organizations, and individuals. But

others have targeted on antagonistic environmental effects of wind-energy facilities, which take into visual and other affects on human beings; and effects on environmental conditions, such as the killing of wildlife, most importantly birds and bats, some environmental impacts of wind-energy facilities, particularly those concerning means of conveyance.

II. NON-CONVENTIONAL ENERGY RESOURCES

At this time, the renowned choices to energy generation of conventional sources are non-conventional energy sources and nuclear energy. There lie a lot of social and environmental issues with nuclear energy. Non-conventional energy sources are suitable due to their offerings to lower greenhouse gases and national safety of energy supply without the mix up of nuclear energy. Official definitions of non-conventional energy resources vary from one nation to the nation, but there is great understanding with the entities that wind energy, photovoltaic, and solar thermal energy is considered to be renewable forms of energy. Other resources that are most taken as renewable take into account hydropower and biomass. Greater reliance on renewable energy sources is mix up by different restrictions to put into practice. Most of the non-conventional energy technologies come across cost drawbacks in comparison with the traditional conventional energy technologies. Following points are noted about the non-conventional energy resources:

- The non-conventional energy resources are freely available in nature. With regard to the energy experts the renewable energy potential of India is estimated as 95,000 MW.
- These are renewable sources of energy and can be renewed with minimum effort and money.
- The non-conventional energy resources are pollution free and eco-friendly.

III. WIND ENERGY

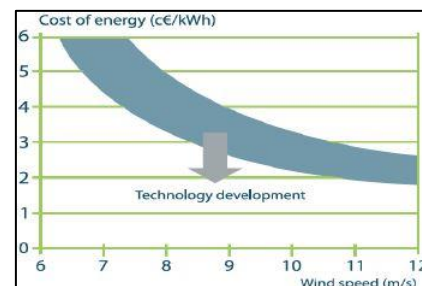


Fig. 1: Cost of Wind Power Related to Annual Mean Wind Speed.

Source: SINTEF Centre for Energy Research.

Wind power is a somewhat developed technology. It contends emulously with various energy sources in terms of cost, environmental impacts and state of being usable. With the exception of hydro power, wind power is closer to

commercial profitable than any of the other non-conventional energy sources, however better project economy is a greater incitement for wind power [2]. Wind energy is broadly usable because wind resources are available in most of the countries. Among the non-conventional energy technologies, wind energy is somewhat developed and many nations have find a solution of cost and technology challenges [3].

Wind is clean, free of cost, native to a land or region and unlimited available in plenty. Wind turbines do not require any type of fuel as in conventional system, so there are no environmental threats or deterioration from the examination, lineage, transportation, processing or arrangement of fuel. Not only is generation produced with zero release of carbon dioxide but it also does not emit harmful pollutants such as mercury or conventional air pollutants such as smog-forming nitrogen dioxide and acid rain-forming sulphur dioxide[4]. Wind energy power projects must be placed in relation with the planning act of the regional and the municipal plans. The regional plans stipulate general sites for wind power projects and various rules and regulations for integrating wind turbines with other land-uses. The municipal plans stipulate objectives and desires in connection to wind energy and give a more complete basis for turbine site, number of turbines, height of turbine, appearance and positioning of turbine [5]. Wind energy is very clean and environmentally compatible technology that generates electric power. Its renewable nature and the objective consensus it does not pollute the atmosphere during its working time makes it one of the most encouraging and inspiring energy systems for lowering environmental issues both at global, national and local levels.

IV. ENVIRONMENTAL AFFECTS OF WIND ENERGY

Working of wind power has zero release of harmful substances and pollutants into the atmosphere and its surrounding. It does not add to the rising concern of global warming, the fuel is available freely in nature, and is distributed quite evenly globally. The energy required to produce and set up the turbine amounts to three months of turbine production. But, as with other resources of energy, wind power also have an environmental affect. The affect on wildlife is likely low considered to other forms of human and industrial activity. Nevertheless, negative effects on certain populations of sensitive species are possible, and struggle to resolve these effects should be taken into account in the planning phase. Wind energy, like any other industrial work, may lead to affects on the environment and its surrounding which should be examined and resolved [6].

A. Environmental Benefits

What are the benefits to the environment that is caused by wind energy? The most basic is, wind energy do not cause water or air pollution, and do not generate any type of hazardous waste material as well. Nevertheless, wind power does not employ natural resources like oil, gas or coal and hence will not lead to any harm to the environment by means of resource transportation and lineage and also do not require consequent amounts of water at the time of working [5].

Wind energy is not only a favourable electricity production technology that lowers the release of other pollutants such as carbon dioxide, sulphur dioxide and nitrogen oxide it also abstain notable amounts of external costs of traditional conventional fossil fuel-based electricity production[6]. The large scale utilization of wind energy should be made so as to solve the issue of global warming which is the main concern of environmental threat to the modern world around the globe. Wind energy power plants are regarded a green power technology because it has only a very small affects on the environment and its surroundings. A wind energy power plant doesn't generate air pollutants or greenhouse gases [7].

Wind energy is a flawless renewable energy because of the following mentioned points:

- It is a free from pollution, greatly sustainable form of energy
- It doesn't require fuel as air freely and abundantly available in nature around the globe
- It doesn't create harmful greenhouse gases due to which there is no threat to the atmosphere
- It doesn't generate toxic and harmful radioactive waste as air is the natural fuel

B. Disadvantages

Energy production by any means affect the atmosphere in some way or the other, and wind energy is no different from that. Like every other means of energy technology, wind power plants do have some impact on the environment. Wind turbines cause almost no release of harmful waste at the time of their working and very small at the time of their manufacture and designing, setup, maintenance and removal. As Compared to the environmental effects of conventional energy resources, the environmental effects of wind power is somewhat minor.

Wind farms are mostly setup in areas that has previously been influenced by land clearing. The vegetation clearing and ground perturbations need for wind farms smaller as compare to conventional coal mines and coal-fired power plants [7]. If wind farms are dismantled, the land shape can be turn back to its already existing condition. The most difficult task is to employ wind as a source of power is that the wind is stopping and starting at intervals and it does not always produce an air current when power is required. Wind energy cannot be stored directly unless batteries are employed; and not all winds can be utilized for doing useful work to meet the timing of power requirements [3].

Good wind locations are mostly sited in inaccessible locations, far away from cities where the electric power is required in greater capacity. Wind resource implementation may contend emulously with other uses for the land and those alternative uses may be more largely valued than power generation from the wind [4]. In spite of wind power plants have however smaller affect on the environment in comparison to the other traditional conventional power plants, there is some issues over the noise generated by the rotor blades, aesthetical affects, and sometimes the birds have been killed by flying into the rotors of the wind turbine. Most of these concerns have been solved or greatly lowered by means of technological implementation or by suitably siting and sizing of wind

power plants on a rated scale. To the greater range that we understand how, when, and where wind-energy implementation most unfavourable impacts on organisms and their natural habitat, it will be feasible to reduce future affects by means of careful siting and sizing choices.

V. ECOLOGICAL AFFECTS

There are two different ways that wind-energy implementation may affect ecosystem structure and functioning by means of direct affects on every organisms and by means of affect on their natural living structure and functioning. Environmental concerns of wind-energy system can spread across a broad area of space scales, from the area of a single turbine to portion of land, regions, and the planet, and an area of lasting scales from short-term loud to long-term effects on natural living structure and effects on presence of living creature [5]. The ecological affects of wind-energy facilities are not simpler, and can change with space and lasting scale, site, season, weather, type of ecosystem, group of living organisms, and other factors. Furthermore, most of the affects are likely incorporates current and previous data and ecological effects can act in complex modes at wind energy facilities and at other locations linked with changed land-use practices and other anthropogenous perturbations [4].

Wind turbines cause death of many birds and bats by means of striking, most of the time with the blades of turbine. Species differ in their susceptibility to injury, in the probability that causes death will have greater current and previous living communities, and in the range to which their deaths are exposed[7]. The data are not sufficient to guess comparative threat to perching bird and other small birds. It is discovered that as turbines become bigger and acquire a higher speed, the threat to the more number of bats and other night moving passerines at these height will rise [1]. The construction and systematic functioning facilities also changes ecosystem structure by means vegetation clearing, soil disorder and potential for erosion, and noise. Changing of vegetation, taking into account forest clearing, shows the most important potential change by means of fragmentation and loss of natural living places for some species [6]. Alterations in forest formation and the discovering of different bigger climatic conditions and rise in the amount of forest edge. Different living components in the entire ecosystem answer differently to these alterations. There might also be significant mix up between natural living places changes and the risk of deaths, such as bat searching for food behaviour near wind turbines [6].

A quality research should be conducted before siting, sizing and manufacturing and after construction of wind-energy facilities to explain the strength and make real ecological affects of wind growth [3]. Pre-siting and sizing research study should explain the potential for affects to occur and the possible to incorporate current and existing data affects in the background of other locations being developed. Likely affects could be explained in relation to other potentially growth able locations. Post-construction research studies should target on discovering affects, real versus predicted risk problems, source mechanisms of affects, and potential solving techniques to lower risk and recovery of waste land of disturbed locations.

VI. AFFECTS ON HUMAN BEINGS

The affects on human beings take into account affects concerning beauty and appearance; affects on lifestyle resources, such as momentous, holy, study of past, and leisure locations; affects on health of human and prosperity, most importantly from noise in the surrounding and from dark unsteady flash of light; economical and financial affects; and the strength for electromagnetic mix up with TV and radio widespread, mobile phones, and radar. This is not a fully comprehensive list of all possible human affects from wind-energy projects and site locations [6]. Wind energy projects can affect in both positive and negative ways on health of human beings. The positive effects can be acquired by means of improval in air quality, these positive affects (i.e. advantages) to health of humans and prosperity are mixed up; they are feel by people residing in places where traditional methods of power production are employed less because wind energy can be employed as replacement in the regional market. In contrast, to the range that wind-energy projects create negative effects on health of human beings and their prosperity, the affects are feel mainly by people residing closer to wind turbines that are impacted by noise and dark diming of lights.

VII. CULTURAL AFFECTS

Wind-energy facilities put into existence both positive and negative leisure affect. On the positive side of wind energy system, many projects are entered on a list as tourist location: some putforth tours or give notification areas in regard to the wind energy in general; and many are taking into account by mixing number of site centres. There are types of potential negative effects on leisure advancement: direct impacts and indirect impacts. Direct affects can be the outcome when already available leisure activities are either rule out or need changing of route near a wind-energy facility. Indirect affects takes into account leisure affects that may impact the leisure experience. These affects can take place when beautiful or natural values are important to the leisure experience. In studying affects on monomentous, holy, and study of past sites, the basic problem is that no eternal damage should be done that would impact the integrity of the location selected. May or may not a wind-energy project would harm the resource may lies on the particular nature of the momentous resources involved [6].

In contrast with housing growths, wind-energy projects cannot be moved from view, except beyond mediation a precise description of a place and flora and fauna of that particular site. Such problems are likely to be there as wind projects are suggested in lifestyle areas, and knowledge as to what contributes an undue affects to momentous or holy locations and areas will be necessary.

VIII. LOCAL ECONOMIC AND VISUAL AFFECTS

Wind-energy power projects can have a greater potential of economical and financial affects, both in positive and negative modes. Some of those affects are experient at the national or local level; these takes into account, tax credits and other short lived bonus or reward to encourage wind-energy power generation, as well as impacts of wind energy on local energy pricing [6].

Regional identification and clear affects are important environmental issues in finding wind farm functions in relation to wind energy growth as regional and clear impacts are by nature and changing over period of time and place. The distinguishing feature of wind g may cause growth may lead to regional and visual impacts. These feature takes into account the turbines (size, height, number, material and colour), passage and site tracks, substation buildings, compounds, grid connection, anemometer masts, and transmission lines. Another feature of wind farms is that they are not permanently fixed, so the place where the wind farm has been constructed and placed can return to its normal position after the take out of the service phase. While visual effects are very particular to the location at a specific wind farm, several features in the design siting and sizing of wind farms have been located to lower their potential visual affects [4].

IX. AFFECT OF NOISE

Noise from wind turbine growth has been one of the most researched environmental affect of this technology. Noise, as compare to regional and visual effects, can be calculated and obtained fairly by ease. As with any machine having moveable parts, wind turbines produce noise at the time of working [6]. There are two different sources of noise in wind turbines:

- Mechanical noise because of the gearbox and generator associated with wind turbine
- Aerodynamic noise because of mix up of the wind turbine blades with the moving wind.

Experienced gained in progressing wind farms propose that noise from wind turbines is normally very low [7]. The noise from the wind turbine shows that it's a small scale issue in general terms and complaints about the noise also suggest that noise from the wind power projects are very occasional and can normally be solved out with ease.

X. AFFECTS ON USAGE OF LAND USE

National bodies consider the growth of wind farms in their economical and fiscal strategies for wind energy power projects. Decisions on siting and sizing should be made with taking into account to other land users. National and local land-use planners must discuss whether a power project is compatible with already available and planned adjacent uses, whether it will add negatively the overall features of the area nearby, whether it will disturb already set up communities, and whether it will be integrated into the already available areas. Land usage planning rules and regulations in some nations recommend avoiding areas with protected position; in others, particular areas have been marked for potential wind farm implementation [4].

XI. REDUCE THE NEGATIVE ENVIRONMENTAL AFFECTS OF WIND ENERGY POWER PLANTS

The negative environmental and atmospheric effects from wind energy in set up are much reduced in strength than those generated by traditional conventional energies, but they still have to predicted and solved when required. There are particular modes that must be in place before an area can be taken as important and suitable for a wind farm development. These conditions take into account factors

such as: wind climate, a precise description of place, supply line and ecological restrictions.

A strategic environmental assessment (SEA) is the method employed to explain the unfavourable effects of any plans and programs on the environmental conditions. National, regional and local governments must embark SEAs of all wind energy power plans and programs that have the strength for important environmental impacts. The ecological affect of wind-energy facilities are not simpler, and can change with space and land scale, location, season, weather, ecosystem type, species, and other important factors. Furthermore, many of the effects are liable incorporating all current and previous data and ecological effects can act in complex modes at wind energy facilities and at other sites linked with changed land-usage practices and other anthropogenous perturbations. Due to this complexity, explaining ecological affects of wind-energy growth is difficult task and depends on assimilation of knowledge factors that are not sufficiently studied. In spite this, many patterns are starting to rise from the currently existing information. Increased studies employing intense scientific techniques will be very important to filling already available information gaps and enhance dependability of statements.

XII. CONCLUSION

In conclusion, we must resolve that if we have to generate electricity from the wind power, it is absolutely better than some other option to generate it in a way which has the lowest feasible affect on the environmental conditions. From a technical and economical perspective, the most develop form of non-conventional and "clean and green" energy is wind energy. It can significantly chip in to struggle for victory in environmental change while at the same time giving different environmental, social and economic advantages. Conversely, it is important to minimize the affects of the wind energy, especially in relation to environment (preservation of protected areas) and human health (noise and visual impact).

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