

## Impact of Wind Energy on sustainable Environment

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### ABSTRACT

Energy is closely linked to economic development and environment quality though India ranks sixth in the world so far as the total energy consumption is concerned. It still needs much more energy to keep pace with its development aspirations. Energy scarcity is becoming a major barrier and could obstruct the stream of development due to the fundamental and structural difference between conventional and renewable energy. Therefore the developing countries like India could well and build their own systems especially in rural areas. Further, wind energy is a potential choice for its short installation time, easy operations. Conventional power plants that are using fossil fuels (coal, oil, fossil gas) emit the greenhouse gas carbon dioxide, sulphur oxides and nitrogen oxides, volatile organic compounds (hydro-carbonates etc.) heavy metals (lead, cadmium, mercury) as well as soot and particles. The exploitation of fuel from mines, oil wells and gas wells, has serious local impacts on the environment. The risks for damages from climate change, acidification and the impacts from this on agriculture, forests, lakes, landscape and human health decrease. From an environmental point of view, wind power is the best option to produce electric power. Development of wind power contributes to reduce the negative impact from power production on global environment, since carbon dioxide emissions that can change the global climate are reduced. It contributes to reduce emissions of air pollution from sulphur oxides and nitrogen oxides that cause acidification, and other environment impacts on the regional level. Thus, the study focuses the impact of wind energy on sustainable environment with the help of published sources of secondary data.

### INTRODUCTION:

Energy is the key ingredient to any economic activity. Adequacy of energy supply is important for acceleration of economic development. Significant growth in energy consumption in developing countries will be both essential and inevitable in the coming decades in order to support their development aspirations. But increased energy consumption will also lead to the degradation of environment, which should be taken as a matter of serious concern. This study examines the evils of conventional energy sources affecting the environment and analyses about the impact of wind energy as an alternative source protecting the environment. Thus the study can be viewed as follows.

### EVILS OF CONVENTIONAL ENERGY SOURCES

With the cost of fossil fuels that have been traditional sources of energy, such as, coal, gas and crude oil depleting the world over. Use of coal and other fuels in increased quantities by the major energy intensive sectors like power generation, cement, steel, paper and chemical and fertilizers contribute to the emission of local pollutants like sulphur dioxide, methane and nitrous oxide causing global pollution and global climate change. For example, fossil fuels such as coal and oil are associated with high levels of gaseous emissions during the energy production process, notably carbon dioxide and other green house gases that have been linked

with climate change. Unfortunately energy requirements are fulfilled through coal based fossil fuel till the year, 2035. This contrasts with nuclear fuel, which produces no greenhouse gas emissions, but uses uranium and results in the production of radioactive wastes that are highly dangerous to all life forms and take a long time to decay. Thus the focus is now shifting more and more towards renewable sources of energy.

### **GLOBAL AND INDIAN ENERGY SCENARIO – A DIRECTIONAL SHIFT TOWARDS RENEWABLE ENERGY**

Although renewable energy currently constitutes a small portion of the global energy scenario, its importance has been rising due to surging crude oil prices, increasing energy demand and stringent pollution emission norms. Moreover, renewable energy offers various benefits such as sustained availability, lower operational cost, and little or no pollution.

The share of renewable energy in total energy consumption increased from 6.5% in 1980 to 7.8% in 2007. As per EIA estimates, global energy consumption is expected to grow at a CAGR of 2.5% from 474 quadrillion btu in 2007 and to 511 quadrillion btu in 2010.

The relevance of renewable energy lies in its potential usage as an alternative to transportation fuel as well as a means to fulfill the escalating demand for electricity. Biofuels are used in conjunction with traditional fuels such as gasoline and diesel, thereby aiding a marginal reduction in the consumption of conventional resources. Other sources of renewable energy, such as wind, solar, hydel and tides, are used to meet electricity needs. These sources are also used for other daily applications such as heating, drying, cooking etc. While they are employed for other purposes too, their share in the same has been marginal.

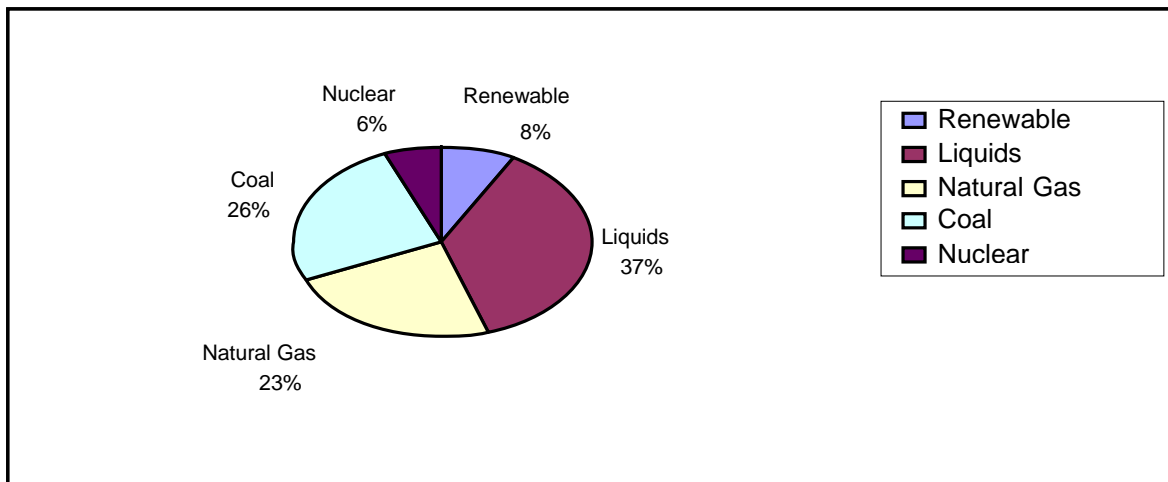
Energy consumption in India has moved in line with the global trend. The renewable energy program received the required focus in the Tenth Plan; during this period, wind power and small hydro electric capacity additions have been higher due to favourable policies. Wind energy accounts for 48% of the power generated from renewable energy sources, followed by small hydel projects at 25%.

Therefore the total energy demand and the share of renewable energy at the global and as well as in India is ascertained from the following data and pie diagram

<b>Total Energy Demand</b>	<b>Renewable</b>	<b>Liquids</b>	<b>Natural Gas</b>	<b>Coal</b>	<b>Nuclear</b>
Global Energy Demand	8%	37%	23%	26%	6%
Indian Energy Demand	6%	32%	8%	51%	3%

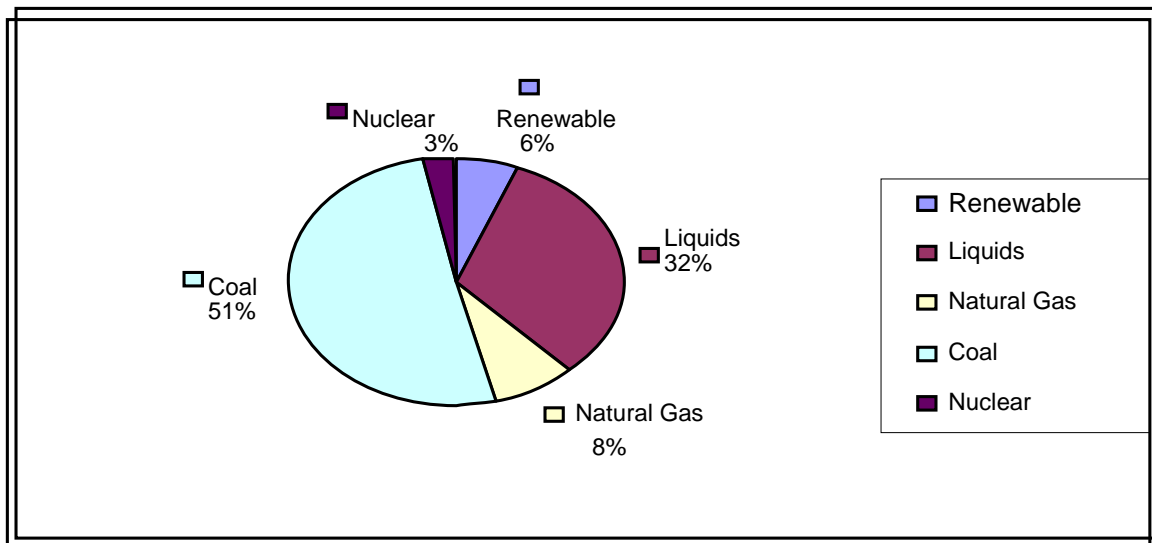
(Source: EIA, CRISIL Research Report 2011)

## GLOBAL ENERGY DEMAND



(Source: EIA, CRISIL Research Report 2011)

## INDIAN ENERGY DEMAND



(Source: EIA, CRISIL Research Report 2011)

Among the renewable source of energy wind energy is expected to be the most competitive and productive source energy due to the following important considerations.

- It is one of the most environment friendly, clean and safe energy resources.
- It has the lowest gestation period as compared to conventional energy.
- Equipment erection and commissioning involve only a few months.
- There is no fuel consumption, hence low operating costs.
- Maintenance costs are low.
- The capital cost is comparable with conventional power plants. For a wind farm, the capital cost ranges between 4.5 crores to 5.5 crores, depending on the site and the wind electric generator (WEG) selected for installation.

## **WIND IS THE ONLY SOURCE TO PROTECT THE ENVIRONMENT**

Compared to the environmental impact of traditional energy sources, the environmental impact of wind power is relatively minor. Wind power consumes no fuel, and emits no air pollution, unlike fossil fuel power sources. The energy consumed to manufacture and transport the materials used to build a wind power plant is equal to the new energy produced by the plant within a few months. While a wind farm may cover a large area of land, many land uses such as agriculture are compatible, with only small areas of turbine foundations and infrastructure made unavailable for use.

Wind power consumes no fuel and no water for continuing operation, and has no emissions directly related to electricity production. Wind turbines produce no carbon dioxide, carbon monoxide, sulfur dioxide, nitrogen dioxide, mercury, radioactive waste, particulates, or any other type of air pollution, unlike fossil fuel power sources. Wind power plants consume resources in manufacturing and construction. During manufacture of the wind turbine, steel, concrete, aluminium and other materials will have to be made and transported using energy-intensive processes, generally using fossil energy sources. The wind turbine manufacturer Vestas states that initial carbon dioxide emissions "pay back" is within about 9 months of operation for off shore turbines.

A 2006 study found the CO<sub>2</sub> emissions of wind power to range from 14 to 33 tonnes (15 to 36 short tons) per GWh of energy produced. Most of the CO<sub>2</sub> emission comes from producing the concrete for wind-turbine foundations.

A study by the Irish national grid stated that "Producing electricity from wind reduces the consumption of fossil fuels and therefore leads to emissions savings", and found reductions in CO<sub>2</sub> emissions ranging from 0.33 to 0.59 tonne (0.36 to 0.65 short ton) of CO<sub>2</sub> per MWh.)

### **Ecological impact on wildlife**

Environmental assessments are routinely carried out for wind farm proposals, and potential impacts on the local environment (e.g. plants, animals, soils) are evaluated. Turbine locations and operations are often modified as part of the approval process to avoid or minimize impacts on threatened species and their habitats. Any unavoidable impacts can be offset with conservation improvements of similar ecosystems which are unaffected by the proposal.

### **Birds**

A study estimates that wind farms are responsible for 0.3 to 0.4 fatalities per gigawatt-hour (GWh) of electricity while fossil-fueled power stations are responsible for about 5.2 fatalities per GWh. The study therefore states that fossil fuel based electricity causes about 10 times more fatalities than wind farm based electricity, primarily due to habitat alteration from pollution and mountain-top removal for coal mining. In Denmark, where wind turbines generate 9% of electricity, wind turbines kill about 30,000 birds per year. In the United States, the U.S. Fish and Wildlife Service estimated in 2009, the turbines kill 440,000 birds per year, though mortality is expected to increase significantly as wind power generation expands by 2030 to levels about 12 times higher than 2009 levels. In comparison, 80,000 birds are killed by aircraft,[33] and 500 million killed by cats every year. Even greater numbers of bird deaths are attributed to collisions with buildings. Other studies have stated that 57 million are killed by cars, 97.5 million killed by collisions with plate glass, and

hundreds of millions killed by cats. An article in Nature stated that each wind turbine kills an average of 4.27 birds per year.

### **Bats**

The numbers of bats killed by existing onshore and near-shore facilities has troubled bat enthusiasts. A study in 2004 estimated that over 2,200 bats were killed by 63 onshore turbines in just six weeks at two sites in the eastern U.S. This study suggests some onshore and near-shore sites may be particularly hazardous to local bat populations and more research is needed. Migratory bat species appear to be particularly at risk, especially during key movement periods (spring and more importantly in fall). Lasiurines such as the hoary bat, red bat [disambiguation needed] , and the silver-haired bat appear to be most vulnerable at North American sites. Almost nothing is known about current populations of these species and the impact on bat numbers as a result of mortality at wind-power locations. It has been suggested that bats are attracted to these structures in search of roosts. Offshore wind sites 10 km (6 mi) or more from shore do not interact with bat populations

In April 2009 the Bats and Wind Energy Cooperative released initial study results showing a 73% drop in bat fatalities when wind farm operations are stopped during low wind conditions, when bats are most active.

### **Aesthetics**

Newer wind farms have larger, more widely spaced turbines, and have a less cluttered appearance than older installations. Wind farms are often built on land that has already been impacted by land clearing and they coexist easily with other land uses (e.g. grazing, crops). They have a smaller footprint than other forms of energy generation such as coal and gas plants.[http://wiki.ask.com/Environmental\\_impact\\_of\\_wind\\_power](http://wiki.ask.com/Environmental_impact_of_wind_power) - [cite\\_note-The\\_wind\\_energy\\_fact\\_sheet-67](#) Wind farms may be close to scenic or otherwise undeveloped areas, and aesthetic issues are important for onshore and near-shore locations.

### **Noise**

Modern wind turbines produce significantly less noise than older designs. Turbine designers work to minimize noise, as noise reflects lost energy and output. Noise levels at nearby residences may be managed through the siting of turbines, the approvals process for wind farms, and operational management of the wind farm.

Renewable UK, a wind energy trade organization, has said that the noise measured 305 metres (1,000 ft) from a wind farm is less than that from normal road traffic or in an office; some physicians and acoustic engineers have reported problems from wind turbine noise, including sleep deprivation, headaches, dizziness, anxiety, and vertigo.

## **SUGGESTIONS AND CONCLUSION**

To conclude, Wind power plants have a positive impact on environment. This is one of the main reasons to develop this renewable energy source. There are some impacts on the local environment, but not at the eco-system level. There could be impacts on health, comfort and cultural values, like the view of the landscape. Although these impacts are more ‘virtual’ than real, developers should consider them and minimize these impacts as much as possible. Wind power should not only be clean, but also beautiful.

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