Windmill's breakthrough in the governance of energetic landscapes

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ABSTRACT

Mitigation measures of climate changes will have large-scale effects on the landscapes. Resource problems of energy are linked to the economic, environmental and social systems. Landscapes have energetic constraints, so mitigation measures of climate changes, divide landscapes into new categories. As environmental boom, proliferate wind farm projects, clusters of wind turbines, with audio-visual effects are under enquiry. Obsolete and outdated coal-fired backdrop, turns into new environmentalism enriched with top new sustainable technologies and digital discoveries. Placing windmills is conducted through initial project mapping and visualization, by locating appropriate topographic points and mixing criteria.

Keywords
windmills, wind farms, pollution, environment, electrical energy

1. INTRODUCTION

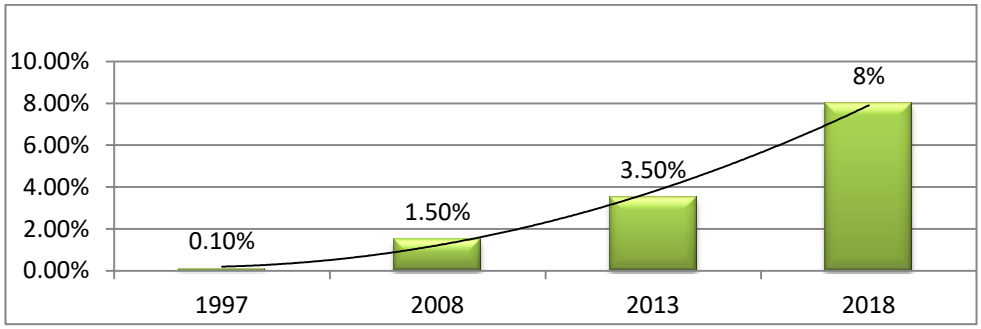
Resource problems of energy are linked to the economic, environmental and social systems. On current trends, humanity will need twice as much energy as it uses today within 35 years. Problem of substituting nonrenewable with renewable resources of energy, is one of the most actual problems today. This substitution will lead to very complex and positive consequences and perspectives - the main pollutants (coal, oil, gas) will be eliminated, the problem of greenhouse effect with warming of the Earth and changing of

climate too. But, there are some effects, like audio-visual, which can be problematic for environment and lanscape.

Wind power plants are one of the most prospective ecological renewable energy sources.

Wind power is the conversion of wind energy, using wind turbines, into more useful forms, usually electricity using. An estimated 1% to 3% of energy from the Sun that hits the earth is converted into wind energy. Most of this wind energy can be found at high altitudes where continuous wind speeds of over 160 km/h occur. Estimation is that global potential of wind energy is about five times total current global energy production, or 40 times current electricity demand. This could require wind turbines to be installed over large areas, particularly in areas of higher wind resources. The use of wind energy is increasing (Figure 1 with parabolic growth line, so it is expected that up to 2018.g. reaches a share of 8% of global electricity production. In Denmark, the figure is 25%, Spain 9%, Colorado 47%, Germany 6%.

Figure 1. *The share of electricity obtained from wind energy in global electricity production*



The price of electricity produced from wind has dropped significantly from 40 cents per Kwh (1990) to the current 5 cents, making it competitive in relation to non-renewable energy sources and lower than sun energy cost. Wind turbines require relatively little cost to maintain and relatively moderate price investments, lower than the converters of solar energy.

Wind power is used in large scale wind farms for national electrical grids (*on-grid* systems) as well as in small individual turbines for providing electricity to rural residences or grid-isolated consumers (*off-grid* systems).

2. THE PRINCIPLE OF CONVERSION WIND ENERGY INTO ELECTRICAL ENERGY

Wind turbine converts the kinetic energy of the moving air (wind) with rotor blades (propellers), the transmission mechanism and generator into electricity.

For wind energy are of particular interest winds in the lower layers of the atmosphere, to a height of 200 m. In this layers are placed, at appropriate locations, turbines that convert wind energy into electricity. Schematic view of a wind turbine for conversion of wind energy into electricity is shown in Figure 2.

There are two main kinds of wind generators: with a vertical axis (Figure 3.a), and with a horizontal axis (Figure 3.b) Wind turbines can be used to generate large amounts of electricity in wind farms both onshore and offshore.

Figure 2. *Schematic view of a wind turbine*

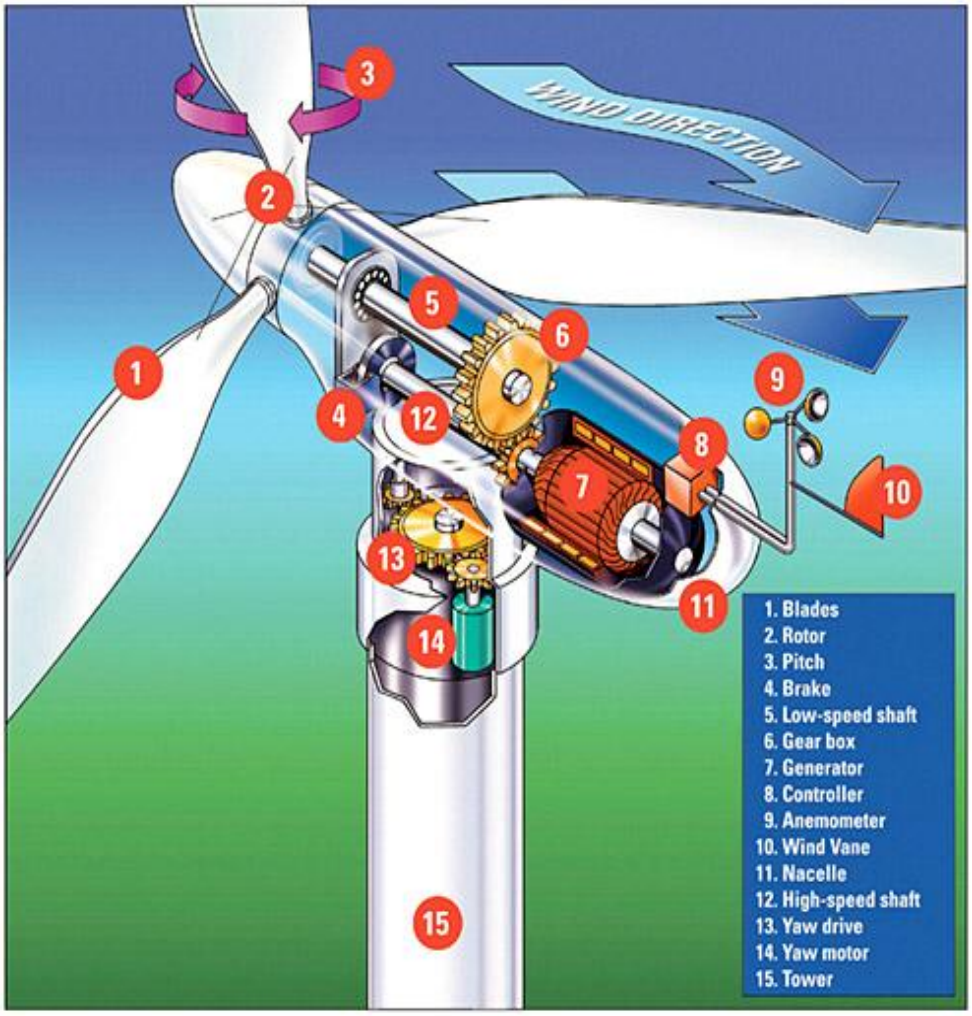


Figure 3. *a)vertical axes* *b)horizontal axes*

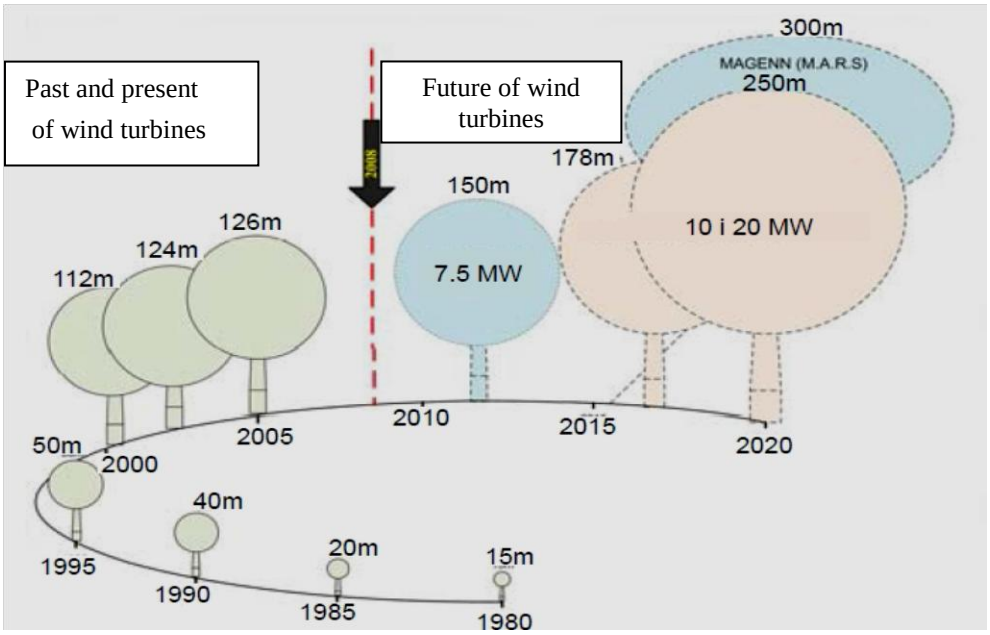
Wind turbines can be used to generate large amounts of electricity in wind farms both on-shore (Figure 3b) and off-shore (Figure 4.)

Albert Betz, a German physicist, determined in 1919 (Betz' law) that a wind turbine can extract at most 59% of the energy that would otherwise flow through the turbine's cross section. The Betz limit applies regardless of the design of the turbine.

Figure 4. *Off-shore wind turbines*

In a world leading role in the production of wind energy in 2012-2013.godini claimed ten countries. The leading place for its production of wind energy in the world belongs China, which is in 2012-2013.godini produced 86.1 gigawatts, followed by USA with 61.1 gigawatts, and the third is Germany with produced 37 gigawatts, followed by Spain, India, UK, Italy, France, Canada and Denmark.
The generating power of wind turbines is increasing from year to year. The increase wind energy production (10-20MW) is provided by a new construction of wind turbine blades, with new materials, with a diameter of blades bigger than 150m. Up to 2020 y. this diameter will go up to 300m. (Figure 5.). To be aware of the size of the blade, for example 80m should be remembered that the wingspan of the airbus A380 is around 80m.

Figure 5: *Historical development of the size of wind power turbines and a scenario for future development*



3. DEVELOPING AND IMPLEMENTATION WIND TURBINES

Wind power plants are built in locations that allow technically and economically justified exploitation of wind. Of interest are the locations where the average annual wind speed measured at 10 m above the ground is Vaverage ≥ 5 m/s, but with maximum Vaverage =20 m/s (for bigger wind speed mechanical construction would be destroyed).

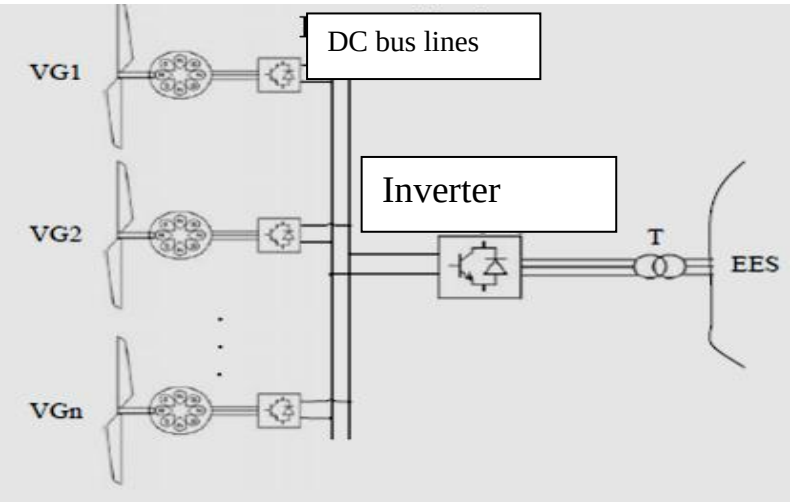
More wind turbines could be assembled in the unit - wind farm (Figure 6). Installed capacity of such a wind farm can be from a few MW to hundreds of MW. In terms of taking up space on the 1 km2 can be installed wind turbines with a total power of 10 to 15 MW.

Wind farms are connected to a common bus cable lines, and by transformer to EES - Electro Energy Supply Figure 6. shows the wind farm with synchronous generators (VG1, VG2,..).

Major problem is stability of power supply by wind generators, because the wind energy is not reliable source of energy. There is also the problem of generating higher harmonics of voltage and current, as a result of operation of power converters (inverters) through which the wind turbines are connected to the grid.

The visual impact, noise, interference with radio and telecommunications the impact on birds, the destruction of flora and fauna in the immediate vicinity are negative characteristics of implementation of wind turbines.

Figure 6. *Schematic diagram for connecting wind turbines to the power grid*



Also, big problem is to ensure local social acceptance and support of local community for deploying wind turbines and wind farms. It is possible by ensuring clear benefits to local communities and engaging them in the process. In Friesland, northern part of Netherland, for instance, rural dwellers voted against wind energy almost twenty years ago, as they did not want to host new turbines in their landscape. Consequently, it is no more possible to deploy new wind turbines or to replace the old ones, regardless that there is plenty of local wind energy sources.

Government support for introducing renewable sources of energy is necessary, through subsidizing. For instance, the level of feed-in tariffs (which compensate producers with a stable, and relatively high price for the renewable energy) can be set for longer periods. In Montenegro this period is 12 years.

4. CONCLUSION

Prospects for the development of wind power as an alternative renewable energy source that does not pollute the environment, are outstanding. The use of wind energy has the greatest growth among renewable energy sources as a result most present decline of the cost of production.

Special attention in the future have to be paid to the development of the increasing power of individual wind farms, further their development of work on mountain locations with harsh climatic conditions and turbulent winds. Further progress is also expected in the efficient design of the blades and their production with new materials, as well as development of electrical generators and power electronics.

There are negative impacts of wind farms on the environment, but these effects are negligible in comparison to the positive side. The visual impact, noise, interference with radio and telecommunications, the impact on birds, the destruction of flora and fauna in the immediate vicinity, are relatively insignificant negative characteristics and can be avoided or reduced.

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