WIND ENERGY – ECOSUSTAINABILITY ENGINEERING SOLUTION

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Abstract: *Renewables provides increased safety energy supply and limiting imports of energy resources, in terms of sustainable economic development. The new requirements for sustainable development have determined the world to put the issue of energy production methods and increase the share of energy produced from renewable energy. This paper presents the history of wind power, advantages and disadvantages of renewable energy, particularly wind energy as an alternative source of energy. Windmills can be horizontal axis or vertical axis Savonius and Darrieus rotor. Latest innovations allow operation of variable speed wind turbines, or turbine speed control based on wind speed. Wind energy is considered one of the most sustainable choices between variants future wind resources are immense*.

Key Words: renewable energy, sustainability, wind power, wind

1. SUSTAINABILITY – INTERDEPENDENCE OF ECONOMY –SOCIETY-ENVIRONMENT

Sustainability is the quality of human activities to carry without exhausting the resources available and without damaging the environment, so without compromising possibilities to satisfy the needs of future generations.

World Conference on the Environment in Rio de Janeiro in 1992 has paid attention to this concept, involving a balance between economic growth, environmental protection and finding alternative resources. The famous Brundtland Report, the sustainability as present needs without compromising the ability of future generations to meet their own needs. The three main aspects of sustainability: economy, society and environment are the connection of fig.1.

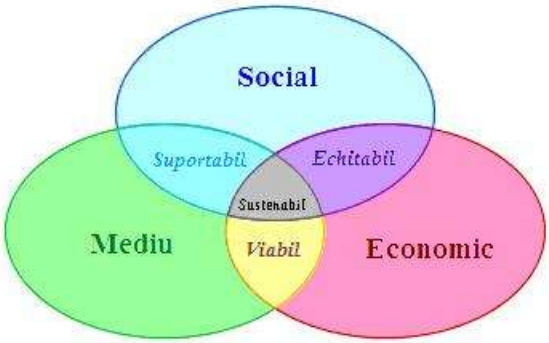


Fig.1. Interdependence of economy –society-environment

Sustainability is a process of decision making which articulates the economic, social and environmental factors, the benefit of all involved. *A sustainable economy* is characterized by ideas and activities that do not deplete natural resources and respects the cultural

experience of the company. *A sustainable society* is a society that lives in harmony with nature and with itself. *A sustainable environment* is that natural resources are able to renew and sustain life on earth, health and acceptable progress.

Eco-development is conceived as economic development in ecological context and involves a good knowledge of natural laws underlying functionality of geosystems, balanced ecosystem on which they depend and their correlation with social structures and specificity of civilizations in each geographic region.

Neconventionale energy sources have an energy potential and offers unlimited availability user locally and nationally. Harnessing renewable energy is based on three major assumptions: accessibility, availability and acceptability. *Renewables provides increased safety energy supply and limiting imports of energy resources, in terms of sustainable economic development.*

The weather in Romania, energy balance in the medium and long taking into account the following types of renewable energy: solar, wind, hydro, and geothermal bioamasa. Program use of renewable energy join the environmental requirements undertaken under the Kyoto Protocol to the Convention - United Nations Framework on climate change ratified by Romania by Law no. 3/2001.

2. ASPECTS REGARDING WIND POWER

The new requirements for sustainable development have determined the world to put the issue of energy production methods and increase the share of energy produced from renewable energy. The Kyoto Protocol commits the signatory to reduce emissions of greenhouse gases, suggesting the adoption of national policies for the development of wind turbines and other sources that do not emit carbon dioxide. Wind pathway is quite developed in Europe, holding top leadership in renewable energy. This type of renewable energy provide sufficient electricity for 10 million and 90% of the producers of medium and large wind power is in Europe (fig. 2).

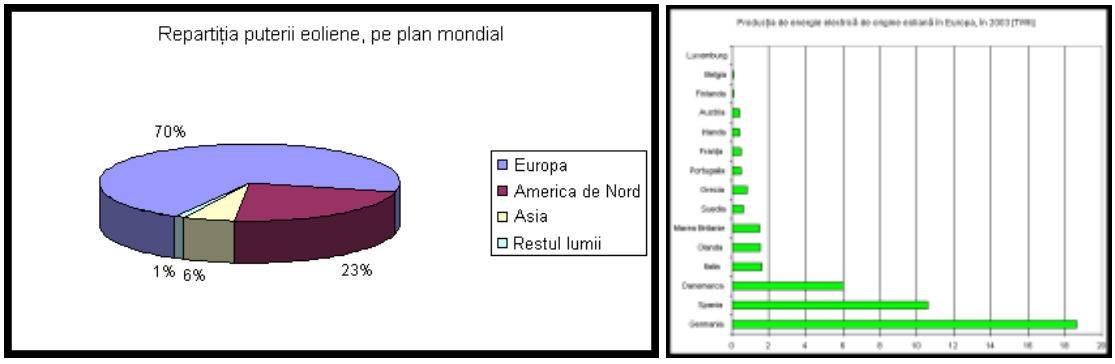


Fig. 2. Distribution of wind power world and in Europe

Distribution of electricity in Europe produced from wind turbines, demonstrate differences between states. Germany is the European market leader, despite a slowdown in 2003 installations. Spain, in the second position, continuous intensive to install wind farms.

Denmark is the third position, having developed offshore wind and passing wind turbines upgrading older than 10 years. Wind energy resulting the difference in potential heat and pressure in the troposphere, as a result of the uneven heating of the atmosphere.The flow of air (wind) has a higher speed,the mechanical effect increases therefore increase the amount of electricity derived. Operation of a wind generator is based on the principle of energy conversion.

On Earth's surface, wind power is manifested unevenly. Wind potential varies latitude and altitude. As the wind power provides less than 0.1% of global electricity, alternatively has proved sufficiently strong for use by the public electricity services. Except sensitive regions global potential of wind energy is five times larger than all of the electricity used on Earth. Europe could get between 7-26% of electricity demand using the air flow, percentage varies depending on the size of protected land aesthetic or environmental reasons.

Disadvantages of using wind as a major source of energy are: wind farms occupy large areas, visual damage to the landscape, pose a threat to birds distances separating large wind potential areas of human and industrial areas are great [1]. Because these areas are sparsely populated and wind generators occupy more visual land surrounding surface can be used for pasture or arable land. In many regions with strong currents regime, their recovery can raise the value of land, the effect of the shield and reducing soil erosion (fig. 3).

Fig. 3. Park wind generators

3. History of wind power

Windmill is the ancestor of wind generators (fig. 4). She appeared in the middle ages in Europe and worked first vertical axis. Later be guided by the wind mills, being mounted canvas, to capture more wind energy.

Fig. 4. Image of windlills

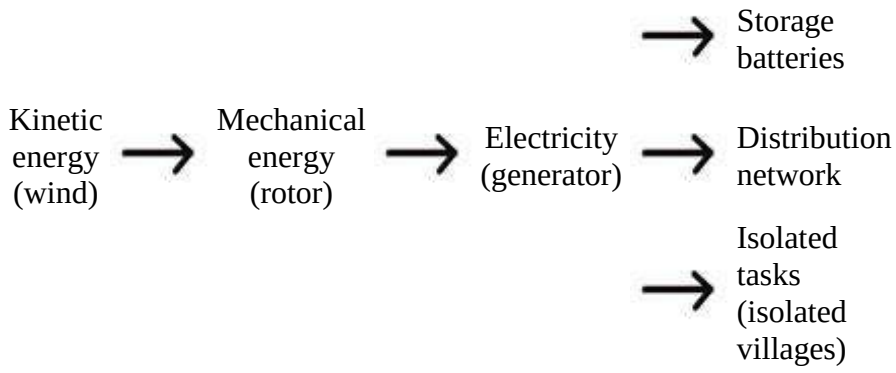
Windmill blades first appeared profiled century – XII [2]. The industrial revolution gave a new beginning for windmills by using metal, which allowed the tower shape (fig. 5). The evolution of electricity in the twentieth century determined emergence of the first modern wind.

Fig. 5. Windmill blades compared to a modern wind

4. WIND POWER

Currently, almost all turbines are horizontal axis, except models with vertical axis Savonius and Darrieus rotor [3]. Latest innovations allow operation of variable speed wind turbines, or turbine speed control, depending on the wind speed.

Operation of wind farms is based on the following flow:



Home energy wind part of renewable energies. Aero-generator uses the kinetic energy of wind to drive the rotor shaft. This is converted into mechanical energy, which in turn is converted into electricity mechanically coupled to the wind turbine generator. This mechanical coupling can be directly (if the turbine and generator have speeds of the same order of magnitude) or by means of a speed multiplier. Using electricity can be stored in batteries, distributed through a grid or fed isolated tasks.

The advantage is that wind occupies a small area on the ground and do not interfere with the installation location, allowing maintenance of industrial or agricultural activities nearby. Wind farms are individual installed in isolated locations or grouped in the form of wind farms. Installations can be made on the ground or on the high seas form of offshore wind farms, where the wind is more regular presence (fig. 6).

Fig. 6. The image of a farm with three-bladed wind of 750 kW on land or offshore (Middelgrunden, Denmark)

a. vertical axis wind

- pillars vertical axis wind turbines are small, with a height of 0.1 to 0.5 of the height of the rotor; it allows placement of the entire energy conversion equipment (multiplier generator) at the foot of wind, facilitating maintenance.
- mild wind is at ground level, resulting in a reduced yield of wind, which is also subject to wind turbulence, the wind must be trained to start and pillar is subjected to significant mechanical stress
- the widest vertical axis wind structure is based on differential thrust or periodic variation in incidence: of Savonius rotor (operation is based on the differential thrust, the stresses exerted by the wind on each side of a curved body have different intensities and resulting torque which causes rotation assembly) and of Darrieus rotor (principle of periodic variation in the incidence, placed in a profile a stream of air to the different angles, is subjected to a force whose intensity and direction vary, and the resultant of these forces causes a torque which rotates the device) (fig. 7)

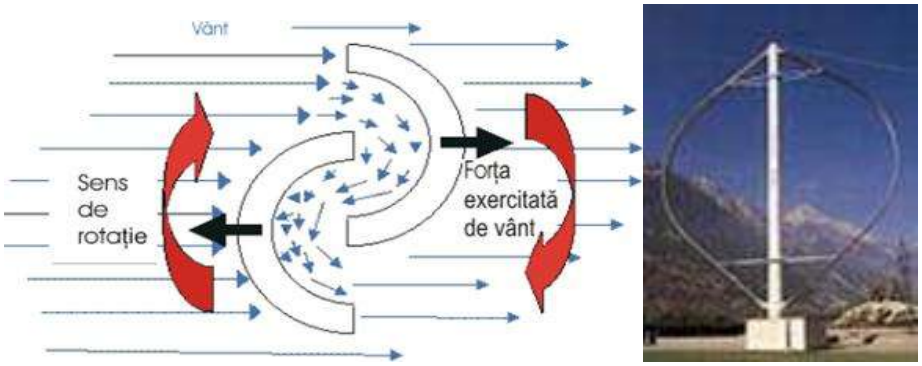


Fig. 7. Schematic diagram of Savonius rotor and image of a Darrieus wind

b. horizontal axis wind

- horizontal axis wind turbines operation is based on the windmills: wind rotor these has three blades with a particular airfoil, since, to obtain a good compromise between the coefficient of power, cost and speed of rotation of the sensor wind and an improvement in aesthetics, the rotor with two blades
- horizontal axis turbines are commonly used because of their aerodynamic efficiency is higher than that of the vertical axis wind turbines, are less subject to significant mechanical stress and have a lower cost [4]
- there are two types of horizontal axis wind: ***upstream*** (wind blows on the blades, to the direction of the nacelle; blades are rigid, and the rotor is oriented using a after windward) and ***downstream*** (wind blowing on the back of the blades, to the platform, and the rotor is flexible and self-guided) (fig.8).

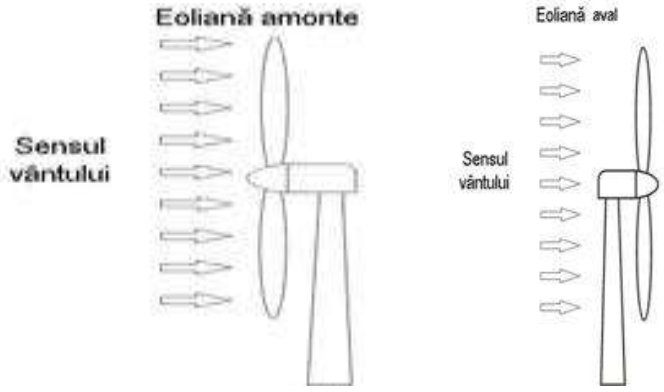


Fig. 8. Scheme horizontal axis wind turbines upstream and downstrem

Layout upstream of the turbine is the most used, because it is easier to and has the best results at high power: no routing area, handling efforts are lower and has better stability. The blades of horizontal axis wind turbines should be oriented depending on the direction and strength of wind. ***Currently, horizontal axis wind turbines propeller-type rotor, the highest interest for electricity production on an industrial scale***.

Wind energy is considered one of the most sustainable options of future versions, wind resources are immense. It is estimated that global recoverable wind energy is approximately 53 000 TWh (TerraWattora) which is 4 times more than the current world electricity consumption. In Europe, the potential is sufficient to provide at least 20% of its electricity 2020 especially if one takes into account the new offshore potential.

5. CONCLUSION

1. Sustainability is the quality of human activities to carry without exhausting the resources available and without damaging the environment, so without compromising possibilities to satisfy the needs of future generations.
2. The Kyoto Protocol commits the signatory to reduce emissions of greenhouse gases, suggesting the adoption of national policies for the development of wind turbines and other sources that do not emit carbon dioxide.
3. Windmill is the ancestor of wind generators, who appeared in the middle ages in Europe and worked first vertical axis.
4. Wind farms are individual installed in isolated locations or grouped in the form of wind farms and installations can be made on the ground or on the high seas form of offshore wind farms, where the wind is more regular presence.
5. Horizontal axis wind turbines propeller-type rotor, the highest interest for electricity production on an industrial scale.
6. In Europe, the potential is sufficient to provide at least 20% of its electricity 2020 especially if one takes into account the new offshore potential.

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