

## THE SUSTAINABILITY OF RENEWABLE ENERGY – THE CASE OF WIND ENERGY

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### Abstract

*This research article analyses how the renewable energy sector in unfolding worldwide and enters the area of influence of one of the most attractive solution available for emerging countries, the case of wind energy. The sustainability of the entire mechanism is unfolded from the idea that this is a solution implemented on the long run and with the best return on investment available in the market. Romania's renewable energy sector is addressed too, by comparing the built capacity in Romania and compared with what it is available in the European Union and worldwide. The entire research represents the starting point in a new path developed towards a better and more specialized approach for the energy industry and its renewable sector.*

### Keywords:

*Wind energy, sustainability, renewable energy, economic development*

### Introduction

In the current context, characterized by the alarming increase of pollution caused by energy production from fossil fuels, it is also becoming quite important to reduce dependence on these fuels. Wind energy has already proved to be a very good solution to the global energy problem. Using renewable resources is addressed not only to produce energy, but is also the particular way of generating restates and development model by decentralizing sources.

Wind energy is a renewable energy source generated and accelerated from the power of the wind. The kinetic energy of the wind is used to rotate turbines that are capable of generating electricity.

Using wind to generate electricity was a technique much used in ancient times. When the wind used to turn the blades of windmills and spins a turbine inside a small generator the process resulted in the creation of electricity, like coal used inside a power plant. A regular, small windmill on a farm or ranch develops a small amount of electricity – enough to feed some agricultural machinery. To produce enough electricity for a lot of people that live in a city or for a group of energy intensive companies, power companies build "wind farms" with tens or hundreds of huge wind turbines. Wind farms are built in flat, open areas where wind blowing at least 20 km/h.

In the end of 2014, the world capacity of wind generators was 93.904 MW, producing slightly more than 1% of the total global electricity (Bloomberg, 2015, Chiras, 2010). It is believed that the global technical potential of wind energy could and should provide 400 percent more energy than is consumed today. This level of exploitation would require 12.7% of the land surface (excluding oceans) to be covered by turbines, understanding that the land would be covered with 6 large wind turbines per square kilometer. These figures do not take into account technological advance of turbine efficiency and new technical solutions used.

In recent years, use of wind recorded a great progress. Thus, between 1995 and 2015, the annual growth rate of roughly 30%, leading to a total installed power of 42,000 new MW,

ie double the field of nuclear energy in the same period. In the past 35 years, energy efficiency has doubled and the cost of a kWh produced euro fell from 0.7 to about 0.25 euros today (Bloomberg, 2015).

According to the study conducted by the European Wind Energy Association, the largest producer of wind power in the EU is Germany with 28,777 MW installed in 2014, followed by Spain with 22,149 MW and 5,850 MW Italy. Poland had last year 725 MW, 201 MW in Hungary and Bulgaria has 177 MW (EWEA, 2015).

### **1. The economic output of wind power**

The wind speed is taken best at a height of 80 meters, because that is the height of the modern turbine of 1500 kW that has a diameter of 77 meters (Tureac, et al., 2011, pp. 137-142).

Worldwide, about 13% of all weather stations forecasted and foreseen average annual wind speeds at 80m  $\geq$  6.9 m/s. Those areas and heights could be considered suitable for producing wind energy at a low cost. This estimate is considered conservative and realistic. On all continents, North America has the largest number of stations of the highest power and efficiency, a total of 453 and Antarctica has the highest percentage in covered area, of 60%. Areas with great potential are found also in Northern Europe along the North Sea, the southern tip of the South American continent, the island of Tasmania in Australia, the Great Lakes and the coast of northeast and northwest of North America.

At the end of 2014, total worldwide capacity of wind generators was 189.2 gigawatts of (GW). Energy production was 540 TWh, which is about a percentage of 3% of electricity usage worldwide (EWEA, 2015). Also, this type of alternative energy increases rapidly, doubling in the past three years. Several countries have reached relatively high levels of penetration of wind power (with large government subsidies), such as 30% of electricity production steady in Denmark, 25% in Portugal and Spain, 17% in Ireland and 12% in Germany. Since May 2015, 120 countries around the world are using wind power on a commercial basis.

### **2. Wind power – the energy of tomorrow, a picture from Romania**

Romania practically relies on internal resources of oil, coal and natural gas, but those are falling faster and Romania is dependent on the imports also, an addiction that tends to widen dramatically in the coming years. Based on alarming statistics, that resulted from the energy strategy for 2007-2020, resulted that renewable energy is one of the most effective ways of protecting consumers and industry from the double impact of increased energy imports and rising fuel prices (Dolghin, 2004). In 2007, Romania has pledged that by 2010 the energy from green sources represent 33% of national consumption, this level was reached in the year 2012 and surpassed exponentially by the year 2015, when in its peak reaches a level of 40% (Bloomberg, 2015).

In 2015, wind energy was used in an insignificant percentage. In early 2015, Transelectrica said that in the past five years, more companies had the intention to get involved in wind power. But wind projects submitted exceeded eight times the installed power of Transelectrica. In the past two years, Transelectrica has received requests for connection of wind power plants totaling 27,800 MW. This significant volume application installed wind power far exceeds current capacity adjustment of the national electricity system. Maximum power installed in wind power plants is 7,660 MW (as of 2015).

European and global level, using alternative forms of energy is an important solution for both the environment and also to protect the resource, which is the main reason that it is already a significant part of the future European energy strategy (EWEA, 2015).

Romania was the first country in Eastern Europe which joined the Partnership for Renewable Energy and Energy Efficiency. According to the Ministry of Environment, Romania's potential in the production of green energy is as follows: 65% – biomass, 17% – wind, 2% – solar energy, 4% – small hydro, 1% + 1% + voltaic geothermal (Tureac, et al, 2011, pp. 137-142). The distribution of this potential is highlighted by Tureac, et al. (2011, pp. 137-142) and is described as following:

- Danube Delta – solar energy;
- Dobrogea – solar and wind;
- Moldova – micro-hydro, wind, biomass;
- In the Carpathians – potential for biomass and micro-hydro;
- Transylvania – potential for micro-hydro;
- The Western Lowland – the possibilities for geothermal energy;
- In Sub-Carpathian – potential for biomass and micro-hydro;
- Plain Southern – biomass, geothermal, solar.

Harnessing wind power potential in terms of economic efficiency requires the use of appropriate technologies and equipment (wind generators with 750 kW rated power of up to 2000 kW). Worldwide, wind energy is in a stage of technological maturity, but in Romania the share of electricity from wind power balance remains under the actual possibilities of efficient capitalization of the exchange or with the 2015 start to appear mainly foreign investors interested in investing in wind farms (Bloomberg, 2015). The off-shore, from 3 km to 5 km of coastline on the continental shelf (up to 5 m water depth) are considered effective long-term (over 15 to 20 years).

### **3. The advantages offered by wind energy**

These advantages can be summarized as follows (Tureac, et al. 2011, pp. 137-142, Dobrescu, 2009):

- Wind energy is an inexhaustible source of energy. It will exist as long as Earth receives energy from the Sun;
- Producing electricity with wind energy source does not cause environmental pollution. In a world that is out of control for the management of their metabolic products, this becomes every day more important. Expenditure should be made for the rehabilitation of extraction areas, such as mining or the oil has been exploited, are so high that no company can afford;
- Compared with oil or gas, getting energy from wind resources in any way threaten people's lives. It is not conceivable that there will be wars to ensure wind resources, as is the case with oil or natural gas, and malfunction of the wind turbines will not lead to ecological disasters that endanger human life;
- Wind energy is available in all season, two thirds even in the cold season, which makes wind energy complementary to hydropower, water resources greatly decreasing during cold;
- Production of electricity from wind resources is at no cost "outsourced". Externalities are costs that cannot be found in bills of electricity consumers, but are borne by society, such as costs due to environmental pollution, health costs, accidents, transportation costs and secure transport of energy resources, costs due to disasters such as the Chernobyl accident, military spending etc. Externalized costs are clearly associated with traditional technologies for producing energy from fossil fuels or nuclear and costs to date were "hidden". The pressure on society became, however, increasingly larger, so not much over time they will need to be introduced in energy

prices. If you do this, the price of electricity will double in power plants, according to a study developed in the European Union. Total externalities (not including costs associated with climate change) is estimated at about 1-2% of EU GDP – the equivalent of 170 billion euros (EWEA, 2015);

- Technology for producing wind energy is a safe technology, having reached maturity, which has steadily improved in recent times and the costs of which have experienced a dramatic decline. The necessary investments in wind power are about 1 million / MW installed: an installed capacity of 100 MW for an investment of about 100 million euros. Although it seems a high figure, it should be noted that the investment would be returned in about 7 years term for an extremely reasonable energy investment;
- The costs of producing electricity from wind resources are now comparable to those of energy from traditional fuels. Without taking into account what I have outlined above, these namely costs are externalized. If you take into account wind power as one of the cheapest forms of energy we should realize that it represents a sustainable solution on the long term.

### Conclusions

Energy, whatever form it takes, is a vital necessity to society, both in terms of comfort people, and as a factor of production. The degree of economic and social development is greater, the greater the demand for energy. The Development Department in the future energy system is linked to economic development and openness of the energy market.

Increased investment, in special, consists of energy efficiency and integration of renewable energy that should create jobs, promote innovation, and create a revolution in the knowledge-based economy within the EU. The European Union is already the global leader in renewable technologies, accounting for a turnover of 30 billion euros and 350,000 employees. For example: almost two thirds of the global wind power is owned by enterprises in the EU (EWEA, 2015, Bloomberg, 2015).

Wind energy is used extensively today, and new wind turbines are being built worldwide, because of this fact wind energy evolved and represents the energy source with the fastest growth in recent years.

In the end, the advantages offered by wind energy are based on the idea that wind energy is an inexhaustible source of energy and electricity production, the source wind power does not cause environmental pollution compared to oil or natural gas.

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