Renewable Energy Sources - Current Situation in Romania

Elena Vladescu
National Vocational College "Nicolae Titulescu"
elenavladescu@yahoo.com

Abstract. *In my school is running a Comenius multilateral project 2009-2011, "Renewable Energy Sources – Friends of the Environment". In this paper I will present our findings on current situation of using renewable energy sources in Romania. The most promising renewable energy resources here appear to be wind, biomass, and hydro. There are well-documented wind resources, including a large off-shore potential.*

Keywords. Comenius, Renewable Energy Sources

1. Introduction

Starting with 2009, in my school is running a Comenius multilateral project, "Renewable Energy Sources – Friends of the Environment". Partners are schools from Romania, France, Italy, Poland and Bulgaria. The schools will work and cooperate when studying the renewable energy sources. The project working language will be English. All the documents will be typed both in English and in the respective national language. The project products will be presented in a school newspaper, a CD and a website. The pupils will work out a multilingual glossary of energy – connected vocabulary with English being the unifying language. They will also draw regional maps with locations and opportunities for creating alternative energy sources on each country's territory.

In this paper I will present our findings on current situation of using renewable energy sources in Romania.

2. What Renewable Energy Means?

Renewable energy is energy generated from natural resources such as sunlight, wind, rain, tides, and geothermal heat, which are renewable (naturally replenished).
Advantages and disadvantages of renewable energy

Advantages:

- minimal environmental impact compared to fossil fuels;
- we can use it repeatedly without depleting it;
- no contribution to global warming;
- no polluting emissions;
- low cost applications when counting all costs;
- saving on health and its costs.

Some of the present disadvantages are:

- solar - panels are expensive. Not all climates are suitable for solar panels.
- wind -turbines are expensive. Wind doesn't blow all the time, so they have to be part of a larger plan.
- waves - different technologies are being tried around the world.
- tides - barrages (dams) across river mouths are expensive to build and disrupt shipping. Smaller turbines are cheaper and easier to install.
- rivers - Dams are expensive to build and disrupt the environment. Smaller turbines are cheaper.
- geothermal - Difficult to drill two or three kilometers down into the earth.
- biofuel - Often uses crops (like corn) to produce the bio-alcohol. This means that more land has to be cleared to grow crops, or there is not enough food, or that food becomes more expensive.

3. Current Situation in Romania

In Romania, the most promising renewable energy resources appear to be wind, biomass, and hydro. There are well-documented wind resources, including a large off-shore potential. Total estimated wind potential is 3 000 MW. There are also good opportunities for biomass development, building off a very large base of existing capacity (over 4 000 MWh). The western region of Romania seems to be a good region for geothermal heat applications. There

Elena Vladescu (2010). Renewable Energy Sources - Current Situation in Romania M. Kalogiannakis, D. Stavrou & P. Michaelidis (Eds.) *Proceedings of the 7th International Conference on Hands-on Science.* 25-31 July 2010, Rethymno-Crete, pp. 310 – 313 http://www.clab.edc.uoc.gr/HSci2010

are very good opportunities to develop small hydro projects in Romania. Over 2 600 MW of Romania's electric capacity is generated from small hydro plants (100 MW or less).

4. Wind Energy

Romania's wind resources are well-documented, and there are a broad range of existing applications from small autonomous units for rural areas to large off-shore potential. Installed wind capacity for the country is approximately 2.5 MW. However, Romania currently has approximately 636 MW of wind capacity under construction. A majority of the capacity under construction is from the Fantanele and Cogeleac wind park, with 600 MW. The wind park is located in the southeastern region of Dobrogea, 17 km from the Black Sea. This park will account for approximately 30 percent of Romania's renewable energy.

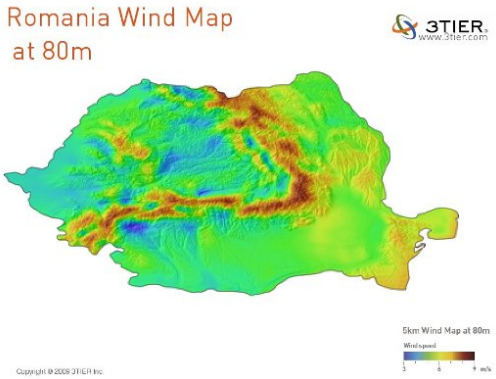

Figure 1. Romania wind map at 80m

Until December 2010, Romania will add around 440 MW to its installed wind capacity from two wind farms: Fântânele and the EDP Medgidia. A total number of 170 wind turbines will be installed in 2010 enough to power over 500 000 homes. The first offshore wind-power project in Romania will be constructed by the United States–based Blackstone Group, which will invest $1.4 billion in a 500 MW wind farm located in the Constanța County sector of the Black Sea on a 40 km2 area situated 6 km from the shoreline. Constanța and Tulcea counties have the second-highest wind potential in Europe. The Romanian company Blue Investment will invest US$ 84 million in a 35 MW wind farm in Baia, Tulcea County that will have turbines with a capacity of 2.5 MW each. Several companies are interested in investing in wind farms in Romania. The Italian company Enel plans to build several wind farms with a total capacity of 350 MW. The Swiss conglomerate Cofra Group will build two wind farms, one that will have a capacity of 700 MW in Dobrogea and one that will have a capacity of 400 MW in Neamț and Suceava counties; the total investment will amount to $1.65 billion.

5. Biomass

Romania has great biomass potential, which is estimated at 88 000 GWh per year. In 2004, about 43 percent of the biomass potential in the country was exploited. Heat generated from wood biomass was approximately 54 percent, and heat generated by agricultural biomass was about 46 percent.

Direct burning in stoves for space heating, cooking and hot water preparation is about 95 percent of the biomass use. The rest of the biomass is used in thermal plants to generate industrial steam and hot water in sawmills and in other industries equals about 5 percent of biomass usage.

The largest biomass plant in Romania is in Radauti. The plant has a total capacity of 22 MW, 17 MW of heat and 5 MW of electricity, and is the outcome of a 20-million-euro investment of an Austrian company.

Figure 2. Radauti biomass plant

6. Solar Energy

Romania has exploited a significant amount of solar resources in the past, but since 1990, the manufacturing, installation and research and development has virtually ceased. The potential market for solar applications is very large but specific incentives will be needed in order for this potential to be realized. The average solar

radiation in Romania ranges from 1 100 to 1 300 kWh/m2 per year for more than half of the country's surface.
Romania has moderate solar potential throughout the whole of the country. Its best solar resource is located in the southern portion of the country.

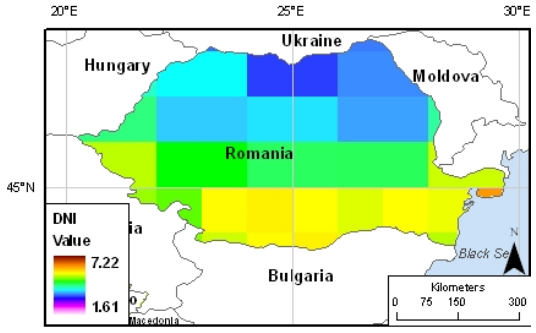

Figure 3. Romania Solar Direct Normal Insolation (Source: NASA)

Area	Size [MJ/m²/year]
Black Sea coast	5.384
South plain	5.147
Danube Delta	5.046
Western plain	4.815

Figure 4. Romanian Areas/Projects with High Potential for Solar Energy

One of the most important solar projects was the installing of a 30 kW solar panel on the roof of the Politehnica University of Bucharest that is capable of producing 60 MWh of electricity per year. Another Romanian city, Alba Iulia, installed a total of 1 700 cells on several public buildings that produce 257 kWh of electricity per year. The Covaci Solar Park will be Romania's largest solar power plant at completion having a total of 480 000 solar pannels with a combined capacity of 35 megawatts and will be located in Timiş County. Another important site is the Gura Ialomiței Solar Park in Ialomița County which will have a capacity of 10 megawatts. Rominterm, a Romanian company, will install until 2011 a total of 600 solar panels in Mangalia, Constanța County that will make the city self sufficient in terms of heated water during the summer months and provide around 70% of heated water in the winter months and another 1 150 solar panels used for the generation of electricity spread over an area of 1 400 square metres.

6. Geothermal Energy

Geothermal energy is energy obtained by tapping the heat of the earth itself, both from kilometers deep into the Earth's crust in some places of the globe or from some meters in geothermal heat pump in all the places of the planet.
Romania has the third highest geothermal potential of European nations, with major potential locations on the Western Plain, South Plains in the region of Bucharest, and in the Carpathian regions. The exploration and research for geothermal resources began in Romania in 1962. Over 200 wells have been drilled, proving the existence of low enthalpy geothermal resources with temperature between 40-120 °C.

Figure 5. Geothermal Resources map for Romania

7. Hydroelectric Energy

The installed capacity of hydropower is 6 715 MW, representing a third of Romania's total installed electricity generating capacity. The country's hydropower potential is extremely large, with an estimated additional potential of over 9 GW. Lack of funding is the greatest barrier to increasing current capacity. The total theoretical hydroelectric potential of Romania, given optimum technological conditions, has been calculated at some 70 billion kilowatt-hours in an average year, but for technical and economic reasons only a fraction of this potential has been developed. Geographically, the hydroelectric reserves of Romania are concentrated along the Danube and in the valleys

of rivers emerging from the mountain core of the country. The most important water basins are: Olt, Lotru, Bistrita, Somes, Dragan, Arges, Dambovita, Raul Targului, Sebes, Raul Mare, Cerna, Bistra, Buzau, Motru, and Danube.

8. Conclusion

I conclude that Romania has a great potential, but, unfortunately, the renewable energy sources are very little used at the present moment.

The results from the project activities will be included in the theoretical and practical training at the school: there will be incorporation into the syllabus of geography classes (opportunities for creating alternative energy sources on the territory of the country (a map of the location of these sources), technical English classes (working out a multilingual glossary of vocabulary connected with the alternative energy sources), computer science classes (preparing Power Point presentations and electronic documents about RES), economics classes (analysis of the economic effectiveness of the various energy sources), chemistry and preservation of the environment classes, vocational subjects classes (study of technical parameters of the systems for production and realization of energy).

This project is a great opportunity for students, teachers and local communities from five countries to work together on renewable energy sources theme.

7. Acknowledgements

I would like to thank the "Hands on Science" coordinator Manuel Felipe Costa for his support and encouragements.

8. References

[1] Final Report, Strategy on Renewable Energy Sources in Romania, EC - DG I PHARE Program, 1995

[2] Intelligent Energy Europe, "Report on the Perspectives to the Development of the Biomass Potential," Accelerated Penetration of Small-Scale Biomass and Solar Technologies, 2005

[3] International Energy Agency (IEA), "Romania," 2009

[4]http://www.ebrdrenewables.com/sites/renew/countries/Romania/default.aspx