

The European Union and the Alternative Sources of Energy

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Rezumat

Articolul prezintă o analiză detaliată a surselor alternative de energie utilizate și utilizabile în perspectivă imediată în țările Uniunii Europene. De asemenea, prezintă unele comparații între țările Uniunii Europene și alte țări cu economii puternice în privința utilizării eficiente a surselor alternative de energie.

The European Union invests a great deal of energy into developing efficient alternative sources of energy and into ensuring a continuous supply of energy to all its member states. These objectives are motivated mostly by the ever rising energy addiction, by the desire to reduce climate changes and freeing the energy markets as can be seen from **The Green Book "Towards a European strategy for safety in energy supply"**.

This document considers that: renewable resources of energy can make a large difference in the increase of internal energy sources for the European Union; and it defines these new and renewable energy sources as a **public priority**. Using renewable resources of energy is also a response to the desire that the Union has to limit its dependency on external sources of energy – especially for gas and petrol from Russia; but also it is a way to respect the environmental protection measures assumed through the Kyoto Protocol, ratified by the European Union on the 15th of March 2002.

The term "**renewable energy**" refers to a type of energy produced from a large spectrum of sources, all of them having the capacity to renew themselves, as an example we offer the hydraulic type of energy, the solar type, the wind powered type, the geothermal type and the biomass type of energy (which refers to the leftovers and the trash made by house activity, and by the industry and agriculture). These sources of energy can be used to generate electric energy in all sectors of activity; also it can generate thermo energy necessary for industry usage and for heating houses and apartments, but also it can be used in the public transportation system.

Also, **the new U.E. politics regarding alternative sources of energy integrates perfectly with the sustainable development spirit**. The concept of sustainable development refers to that type of economical development which ensures the satisfaction of the needs of the present generation without affecting those of the future generations.

Sustainable development concentrates primarily on a number of clearly determined objectives when it comes to the energy industry like: reorienting the energy producing technologies and keeping an eye on them in the future; the conservation and enrichment of all sources of energy; reducing de CO emissions; developing renewable sources; unifying the energy decision process regarding the energy issues, the economy and the environmental protection especially.

In order to protect and develop these objectives an action plan called "**Intelligent energy for Europe**" was put together. This plan promotes the implementation of The Green Book's strategic measures concerning the years 2003-2006. According to this program, a very special and distinct place is taken by the **ALTENER** program which has a budget of 86 million Euros and it monitors the renewable energy usage across Europe.

Ever since December 1997, The White Book for a Communitarian Strategy and Action Plan "Energy for the future: renewable resources" has defined the strategy in this field of interest and has launched the "Campaign for action" concerning the investments. The strategic objective proposed by The White Book is to double the contribution of the renewable types of energy in the overall energy consumption of the E.U. member state, from 6% to 12% to be more exact, by the year 2010.

The most important legislation in this field is "**The 2001/77/EC European Directive**" from the 27th of September 2001 concerning the promotion of the electric energy produced from renewable resources on a common energy market.

One objective is to increase the contribution of the renewable energy sources from 14% to 22% concerning the electric energy consumption, also by the year 2010. The directive imposes a series of clear measures in order to encourage the production of electric energy from renewable sources and the creation of different advantages for economic agents which sell or add value to this kind of resources.

The energetic technologies based on renewable sources generate a reduced quantity of waste and pollution - which contributes to acid rain, urban smog, or contributes and determines health problems and imposes high costs in order to reverse the effects of polluting the environment or for the storage of waste. The possessors of energetic systems which work on renewable resources must not be troubled by the potential global changes in the climate generated by the excess CO₂ and other polluting gases. The solar, wind based or geothermal energetic systems do not generate CO₂ in the atmosphere, but the biomass absorbs CO₂ when it regenerates and that is why its entire generating and regenerating process leads to close to 0 CO₂ global emissions.

In the present a lot of renewable, alternative energetic technologies already exist, and they can replace the classic ones which are based on the burning of fossil fuels. These modern technologies are based on the hydraulic, nuclear, geothermic, solar, biomass etc. types of energy.

Promoting renewable sources of energy has become more and more popular in the past few years, mostly because these renewable types of energy are available all over the globe and are in plenty amount, in comparison to the classic types of energy. In table number 1 we can find information concerning the available annual quantity of energy, per square kilometer of the globe's surface, for 5 different types of renewable types of energy.

The annual available energy supply, per square meter of the globe's surface

Table 1

No.	Renewable type of energy	The annual energy delivered (kWh/square meter)
1	Aeolian (intermittent)	11 (at the minimum wind speed)
		18 (at the maximum wind speed)
2	Solar (depending on the latitude, altitude and degree of cloud covered sky on a scale from 5 to 10)	600...2600
3	Geothermal (geysers)	160...200
4	Photovoltaic (intermittent)	50...100
5	Biomass	15 (low caloric power)
		45 (high caloric power)

From the point of view of the perspectives for obtaining electric energy from renewable resources, the situation is presented in the next figure.

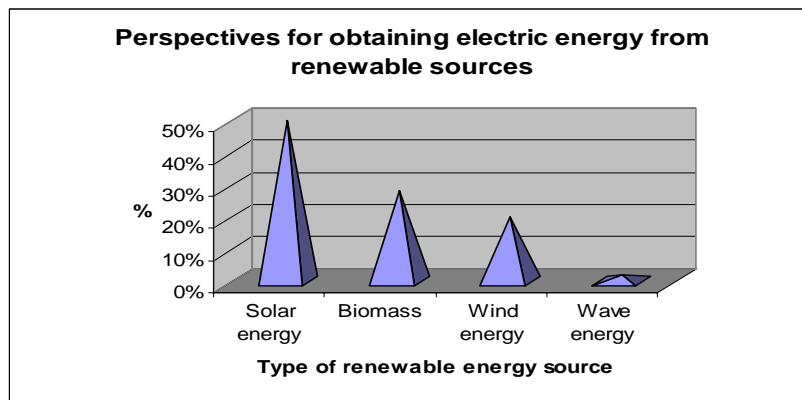


Figure 1 The perspectives for obtaining electric energy from renewable sources of energy

As can be seen in the figure, the most powerful source for alternative energy is the sun. Although, maybe the best and most relevant example of successful promotion and development for renewable types of energy is that of the **Aeolian** or wind generated **type of energy** – which is the technology with the highest rate of development in the last few decades.

So, the income from sales of the Aeolian types of applications was about 5.8 billion. Euros in the year 2002. Also, in the next table you can see the complete situation for the year 2002, with the mention that the European market has grown 35% in the past 5 years – strengthening its global leader position in the field of Aeolian energy; and that the global energy market might value about 25 billion euros per year by the year 2010.

The wind generated type of energy for the year 2002 in the E.U.

Table 2

2002		
Increase in the installed power compared to the year 2001	Percentage increase compared to the year 2001	Total capacity of the wind passed systems
5.871 MW	31%	23.056 MW

But, unfortunately, although the energy produced this way is the equivalent with burning 20 million tones of coal in a conventional system for producing electric energy, the installed power in such generators does not replace the necessary power that is installed in conventional sources, including hydro with accumulation. There must be a reserve that is capable of covering the electro-energetic system's needs in case of atmospheric calm. The Aeolian energy can be in the best case an auxiliary source of energy; it presents weak chances and perspectives for resolving the global energetic crisis – because on the globe, with all of its present technologies, it does not exist so many areas where the wind is so strong that it is capable to cover the entire energetic supply of the planet.

Another powerful source of unconventional energy source is the **hydraulic** one. In table 3 we have the technological successes in the field of hydro energy and their place on the globe.

The global positioning of the hydraulic renewable type of energy¹

Table 3

Zone	Installed capacity [MW]	Electric energy produced [GWh]
North America:	160.113	711.225
• USA	79.511	319.484
• Canada	66.954	341.312
America:	106.277	495.016
• Brasilia	57.517	283.603
	174.076	567.501
• China	65.000	204.300
• Japan	27.229	84.500
• India	22.083	82.237
• Turkey	10.820	34.678
Europe:	214.368	735.655
• The Russian Federation	44.000	160.500
• Norway	27.528	121.824
• France	25.335	77.500
• Romania	5.795	17.857
Total per globe	692.420	2.633.908

The conversion of hydraulic energy into electric energy does not pollute, it has a low maintenance cost, it does not present any problems concerning making it and it represents a valuable, lasting solution, but, also, it creates a number of clearly determined ecological problems concerning the surface of the accumulation lakes etc.; and it needs high investments in special equipment.

¹ http://www.tehnicainstalatiilor.ro/nr_13/articol-ti-13,-26.php

That is why maybe the most promising unconventional source of energy that does not need high investment and does it is not responsible for any ecological problems is the geothermal energy.

The geothermal energy is the result of 2 very different phenomenon's: natural radioactivity of the soil and the presence of hot rocs in the vicinity of lava areas. Geothermal energetic resources include overheated vapors, hot water, hot and dry rocs, hot magma and hot areas of the Earths' surface. The cost of electric energy geothermal produced was about 0.05...0.08 dollars per kWh in 2001. The carbon dioxide emissions are considerably low – up to 25% in comparison to the gas ones and about 50% in comparison to the coal ones.

The geothermal energy can be of 2 kinds: **the high temperature type** – characteristic to the volcanic areas, a number of clearly determined water webs that reach up to a few hundred degrees, managing a partial vaporization witch is used in electric plants: and **low temperature type**, accessible all over the globe, by taking in consideration that the Earths crust temperature grows by 3°C every 100m, this difference in temperature can be used in heating by recycling the fluid in heat pumps, but can be used less in the making of electric energy.

The European countries have already taken to the European strategy in this field. A clear example is France, where the government has established a large investment plan for the production of electric energy from sustain alternative sources, some of which we have already talked about, as can be seen from this next table.

The French strategy concerning renewable sources of energy

Table 4

Renewable resource	Installed power in France Objective for the year 2007 MW
Aeolian	2000 - 1000
Hydro	200 – 1000
Biomass	200 - 400
House garbage	100 - 200
Geothermal	10 - 60
Solar and others	1 - 50

The geothermal energy has a great energetic potential and that is why we will next concentrate on the presentation of the potential of this type of energy which is still at the beginning of its exploitation, and presenting also the possibilities of using the Earth's intense internal heat in geothermal systems, as a source of alternative energy making.

In the order of the importance of the potentially valuable renewable sources of energy, **the geothermal energy** – or the read coal, **having a giant tank of heat right under the Earth's crust** as can be seen from this next figure, is in the second place, after the solar energy.

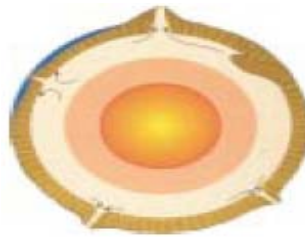


Figure 2 Section in the Earth's interior ²

It is the only renewable source of energy that does not depend on the sun. It appears that at the origin of this intense heat are nuclear disintegration processes, which explain the fact we can never run out of this type of energy.

By geographical areas, the geothermal power plants value the energy of geothermal fields which exist at the border line of tectonic plates situated on the eastern shore of Asia, in the "Ring of Fire" of the Pacific, in the middle zone of the Atlantic, in the north-west of Africa. This geothermal power plants can be found in the USA, in Filipinas – were in the present it is undergoing one of the most advanced projects ever, which consists in the building of 2 major power plants in Tiwi; in Island; in Russia – Kamchatka: in New Zealand: in Mexico etc.

² http://www.gps.caltech.edu/~dla/Anderson_Feature_E&S.pdf

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| ❖ The "Ring of Fire" area has about 60% of the global geothermal potential , including other areas as well, like the Indonesian archipelagos, the Filipinas and Hawaii. |
| ❖ The, there is the Atlantic dorsal – with the Azores island and Island – cumulating about 14% of earth's potential. |
| ❖ In the U.S. the oldest used region is San Francisco, having a geothermal power plant of 58MW dating since 1960; other plants can be found in California – the biggest number of geothermal power plants, cumulating about 500MW. Other zones are in Oregon, Idaho and Nevada. |

In table number 5 and figure 2 there are mentioned the main electro-geothermal power plants, as well as their installed power.

The main electro-geothermal power plants in the world

Table 5

Localities	Country	Temperature steam - grade Celsius -	Depth - meters -	Power installed - MW -
Lororello	Italy	200	1000	390
Waikakei	New Zealand	245	800	290
The Gazers	USA	245	1500	600
Cerro Pristo	USA	300	1500	75
Matsukawa	Japan	230	1100	20
Otake	Japan	140	500	13

The electric-geothermal power plants use water and natural steam which can be found at a high temperature in the Earth's interior in order to activate their electricity producing generators.

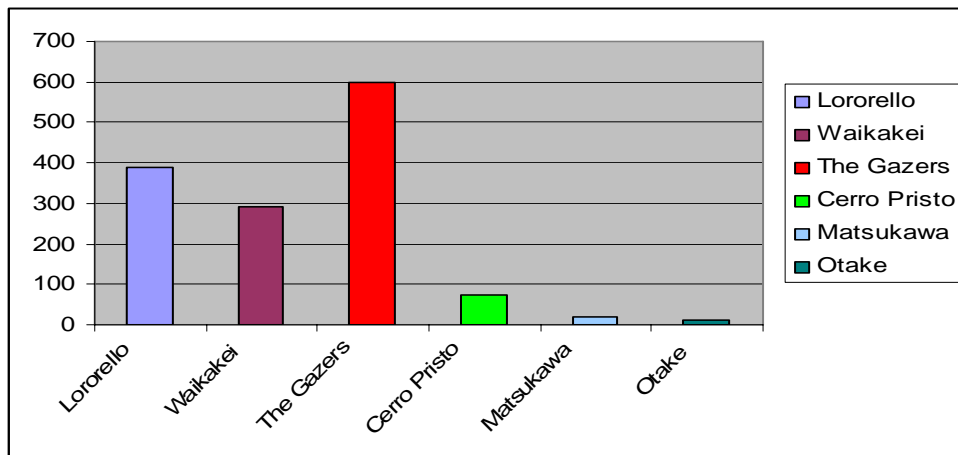


Figure 3 The main electro-geothermal power plants in the world

Concerning the usage of the renewable geothermic energy directly or for electricity production, we conserve sources that are not renewable and that are polluting our atmosphere, like those of fossil origin and the uranium. The direct usage installations have no effect on the environment. Nor the electric-geothermal power plants don't have a strong impact on the environment and can function with no problems anywhere. Unlike the classical power plants that use fossil sources, in the case of geothermal power plants there is no fuel burn, no gas emissions, only water vapors.

Ways to treat the geothermal water have been used to solve pipe corrosion and exfoliation problems. For example, there have been developed techniques to eliminate siliceous biocide from tanks with a high concentration.

Although the first geothermal power plant was built in the first years of the last century, the interest for this source of energy has increased after the year 1970, because of the petrol crisis. Still, even today, their percentage in the global energy production is still low – 0.3%.

The global geothermic production of energy in the year 2000 was 9.930 MWh, the main producers were:

1. SUA – 3.395	2. Filipinas – 1.945	3. Italia - 856	4. Japan - 600
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A considerable evolution has occurred especially considering that in 1990 the geothermal potential of Earth was estimated at 300.000MW, and the installed power in this type of plants was about 1.200MW.

Specialists estimate that by the year 2020 it is possible that the geothermal plants will generate about 5-10% of the total global electricity.

Also, in 1960 at Wairakei in New Zealand, very near the volcano bearing the same name was built a 192MW power plant. And in the same Pacific space there is Japan with its archipelago which has more than 1700 hot springs. The city of Marioka was the first one where the electric energy came from geothermal energy, to be specific: from a 20MW power plant. Another country how has important high capacity geothermal hot springs and a 75MW power plant is Mexico.

So, the geothermal energy reserves are not to be neglected, and in the case of our country we have to mention that we have geothermal energy reserves the equivalent of about 900.000 tones of conventional fuel or even more.

In Romania, the research and exploitation regarding geothermal sources dates back to the years 1960-1965, today the number of such exploitation centers has increased to over 200. Through the exploitation of a number of 65 areas we extract water with temperatures of about 55-115°C. The main beneficiaries are the living spaces who have their heat and hot water provided this way – Oradea, Salonta, the Săcuieni greenhouses, Cefa, Breveni etc. About 30 pumps produce thermal water with temperatures of about 40-60°C, used in therapeutically purposes for 16 balneoclimateric spas - Felix, Tinca, Calacea, Călimănești, Cozia etc.

So, in Romania, the geothermal sources that are being used have relatively low temperatures – 55-105°C – and as a consequence can only supply thermal energy. Its energetic potential is located especially in The Western Plain – where the best known resources are being exploited, in the Rumanian Plain – where a high potential has been confirmed around Bucharest, but also in the Meridian Carpathians.

Still, in our country in 1988 about 14.000 oil pumps were functioning, about 10.000 produced fewer than 2 tones of petrol per day. In comparison, a geothermal energy pump produced under 30l of water per second, at a temperature of about 60-65°C, which was the equivalent of about 8 tones of petrol per day, proving the functionality of the geothermal source of energy.

As a first conclusion regarding the geothermal sources of energy in Romania we can underline these ideas:

- ◆ The potential for this type of energy is unlimited. From the present contribution of about 1PJ/year, we can realistically expect a double or triple amount in the next 10 years;
- ◆ There already exist industrial domains involved in using this type of energy on a day to day basis. Even if the equipment for using this potential and for modernizing this domain is not entirely modern and up-to-date, they are however produced here, in Rumania, and a base for further development does exist.

Taking into consideration the progress of the manufacturing technologies in the electric energy obtaining domain from unconventional sources, as well as the advantages for the human kind – does not pollute, is renewable, high territorial spread etc. – the global energetic forecasts estimate that in the period 200-2050 we will see a constant growth in exploitations of these renewable sources of energy and a decrees in their cost.

The preoccupation for using geothermal energy does not stop only at producing electric energy. It was established that it can be used successfully and with low costs in refrigeration and air conditioning, drying and salting, as well as in setting up tourist attraction sites and spas.

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