

**Opera suspicionată (OS)****Suspicious work****Opera autentică (OA)****Authentic work**

OS	RACOCEANU, C. and POPESCU, L. Study on the use of renewable energy sources. <i>Annual of the University of Mining and Geology "St. Ivan Rilski"</i> . Part III, Mechanization, electrification and automation in mines, Vol. 54, 2011, 53-56.
OA	POPESCU, L.; GORUN, A.; POPESCU, C. and RACOCEANU, C. Possibilities of producing green energy by installing solar panels on the dumps career Roșia. <i>9th IASME / WSEAS International Conference on heat transfer, thermal engineering and environment</i> , (HTE '11). Florence, Italy. August 23-25, 2011. Disponibil / Available: <a href="http://www.naun.orgwww.naun.org/multimedia/NAUN/energyenvironment/20-671.pdf">http://www.naun.orgwww.naun.org/multimedia/NAUN/energyenvironment/20-671.pdf</a> , p.367-273.

**Incidența minimă a suspiciunii / Minimum incidence of suspicion**

p.54:14s - p.54:42s

p.368:07d – p.368:45d

p.54:01d - p.54:08

p.369: 01-p.369:10

p.54:Table 1

p.369:Table no.3

Fișa întocmită pentru includerea suspiciunii în Indexul Operelor Plagiate în România de la [www.plagiate.ro](http://www.plagiate.ro)

## STUDY ON THE USE OF RENEWABLE ENERGY SOURCES

*Cristinel Racocceanu*<sup>1</sup>, *Luminița Popescu*<sup>2</sup>

<sup>1</sup> University "Constantin Brâncușii" of Târgu Jiu, Romania, *cristi@utgjiu.ro*

<sup>2</sup> University "Constantin Brâncușii" of Târgu Jiu, Romania, *luminita@utgjiu.ro*

**ABSTRACT.** This paper examines the possibilities of producing electricity and heat using renewable energy in Romania. Total energy demand in 2030 will be around 50% higher than in 2003 and oil will be around 46% higher. Known oil reserves could sustain current levels of consumption only until 2040, and the natural gas until 2070, while world coal reserves provide a period of more than 200 years even in an increase in operating. European Commission (EC) considered essential for the EU to promote a common energy policy based on energy security, sustainable development and competitiveness.

### ПРОУЧВАНЕ ИЗПОЛЗВАНЕТО НА ВЪЗОбНОВЯЕМИ ЕНЕРГИЙНИ ИЗТОЧНИЦИ

**Кристинел Ракоцчану**<sup>1</sup>, **Люминита Попеску**<sup>2</sup>

<sup>1</sup> Университет "Константин Бранкуш", Таргу Жиу, Румъния, *cristi@utgjiu.ro*

<sup>2</sup> Университет "Константин Бранкуш" Таргу Жиу, Румъния, *luminita@utgjiu.ro*

**РЕЗЮМЕ.** В този доклад е извършено проучване на възможностите за производство на електрическа и топлинна енергия от възобновяеми енергийни източници в Румъния. Общото търсене на енергия през 2030 година ще бъде с около 50% по-високо от потреблението през 2003 година, а потреблението на нефт с около 46% по-високо. При известните нефтени запаси съществуващата степен на консумация може да се поддържа само до 2040 г., а на природен газ до 2070 година, докато запасите от въглища са осигурени за период от повече от 200 години, дори при увеличаване на добива. Европейската Комисия поддържа позицията, че насърчаването на обща енергийна политика на базата на енергийната сигурност, устойчивото развитие и конкурентоспособността е съществено за целия Европейски съюз.

### INTRODUCTION

In accordance with the new energy policy the European Union (EU) developed in 2007, the energy is an essential element of development of the Union. But equally a challenge in the energy sector impacts on climate change, increasing dependence on imported energy and increasing energy prices. To overcome these challenges, the European Commission (EC) considers that the EU should promote a common energy policy based on energy security, sustainable development and competitiveness.

With regard to energy supply security, the EU expects natural gas import dependence will increase from 57% currently to 84% in 2030, and for oil from 82% to 93% for the same period.

Regarding sustainable development, should be noted that, in 2007, was the energy sector at EU level, one of the leading producers of greenhouse gases. In case of failure to adopt drastic measures at EU level, at the current rate of evolution of energy consumption and taking into account existing technologies, emissions of greenhouse gases in the EU will increase by about 5% and 55% globally 2030. Nuclear power is now in Europe one of the largest energy resources without CO<sub>2</sub> emissions.

European Commission proposes a set of documents that are new EU energy policy following objectives:

- reducing greenhouse gas emissions by 20% by 2020 compared with 1990.

- increasing the share of renewables in total energy production from more than 7% in 2006 to 20% of its energy sources by 2020;
- increasing the share of biofuels to at least 10% of total fuel use by 2020;
- reduce global primary energy consumption by 20% by 2020.

### STATE ENERGY SYSTEM IN ROMANIA

Romania's energy strategy objectives are:

#### 1. Energy security

- Increasing energy security by ensuring the energy needs and limiting dependence on imported energy resources,
- Raising adequate national transport networks for electricity, natural gas and oil,
- Critical Infrastructure Protection.

#### 2. Sustainable development

- energy efficiency improving,
- promoting energy production based on renewable resources,
- promoting the production of electricity and heat in cogeneration plants, including high efficiency cogeneration plants,
- support research and development and dissemination of research results applicable,
- reducing the negative impact of the energy sector on the environmen.

### 3. Competitiveness

- developing competitive markets for electricity, natural gas, green certificates, emissions trading greenhouse gas and energy services,
- liberalization of energy transit and permanent and non-discriminatory access of market participants to transmission, distribution and international interconnections,
- further restructuring, reorganization in the sectors electricity, heat and gas,
- further restructuring, reorganization, for the lignite industry in order to increase profitability and capital market access.

Hydrocarbon deposits are limited, due to a decline in domestic production and provided that no new deposits have been identified with significant potential. Current oil reserves are estimated at 73.7 million tons.

Natural gas deposits are also limited, and after 1990, domestic production is declining. Current reserves are estimated at 184.9 gas mld.m3. Annual production of natural gas was 12.3 mld.m3 in 2009, which represented 69% of total annual national consumption of natural gas.

Romania's coal resources are 755 million tons known from exploiting in premises leased 105 million tons. Lignite resources in Romania are estimated at mil.tone 1490, in premises leased from exploiting the 445 million tons. Resources located in premises we are concessional 1.045 billion tons. 1.045 billion tons of lignite reserves in the mining basin of Oltenia, 820 million tonnes of perimeters we are located in leased perimeters continuity presenting the most favorable conditions for recovery by extending concessions.

Because of Oltenia lignite deposit consists of 1-8 layers of exploitable coal, turning their upper urgently requires the adoption of regulations to ensure safe operation of the rational, total (minimal) and in terms of efficiency.

Exploitable ore reserves available and the demand for natural uranium to the level of 2017 for operating two nuclear units at the site of Cernavoda.

Potential new perimeters of uranium ore deposits can not significantly change this situation, which requires specific measures to ensure the resources necessary result of natural uranium as nuclear energy development program.

### RENEWABLE ENERGY RESOURCES

Table 1 Renewable hydropower potential of Romania

Source	Annual potential	Application
Solar energy	60 PJ/an= 16,67 TWh 1,2 TWh	Heat Electricity
Wind power (potential theory)	23 TWh	Electricity
Hydropower, of which less than 10 MW	36 TWh 3,6 TWh	Electricity
Biomass and biogas	318 PJ= 88,34 TWh	Heat Electricity
Hydropower, of which less than 10 MW	7 PJ= 1,94 TWh	Heat

Regarding the costs and benefits, excluding large hydropower plants, the costs of producing electricity using renewable units are now higher than for fossil fuel use, according to the European Commission Communication on the promotion of renewable energy, published in December 2005. Promote the use of these sources and to attract investment in energy facilities that use renewable sources of support mechanisms is done in accordance with European practice.

Electricity from renewable sources to gain additional benefit represented by green certificates. A green certificate is a title that certifies renewable energy production of 1 MWh of electricity. Green certificates can be traded separately from the amount of electricity that they represent, on an organized market, under the law. To promote electricity production from renewable energy sources that the system of mandatory quotas combined with green certificates trading.

Electricity from renewable sources receive:

a) a green certificate for each 1 MWh produced and delivered to the electricity grid of hydroelectric stations / groups or new hydroelectric stations / groups of up to 10 MW, refurbished;

b) a green certificate for each MWh delivered two electricity network with an installed hydropower plants between 1 and 10 MW, which do not meet the conditions set out in point. a);

c) two green certificates for every 1 MWh of electricity delivered to the network of hydroelectric plants with an installed capacity of up to 1 MW / unit;

d) two green certificates in 2015, and a green certificate since 2016, for every 1 MWh of electricity delivered to the network of electricity from wind energy;

e) three green certificates for every 1 MWh of electricity delivered to the network of electricity from biomass, biogas, bioliquid, landfill gas, geothermal energy and associated fuel gases;

f) four green certificates for every 1 MWh of electricity delivered to the network of electricity from solar energy.

For the period 2008-2014 the value of trading green certificates range from a minimum of 27 trading euro / certificate and a maximum of 55 trading euro / certificate. RON value will be calculated at the average exchange rate set by the National Bank of Romania set for December of last year.

Renewable energy has a significant impact on national power system, are necessary::

- impact studies conducted takeover electricity with wind turbines, micro hydro and cogeneration using biomass, electricity transmission and distribution network (110 kV and above), in different scenarios, in areas with high potential;
- *development of transport networks and distributed smart grid concept;*
- develop capabilities to counter market and / or limit the negative effects of uncontrollable variability of wind energy.
- The most affordable renewable resources (depending on costs and volume of resource use) are used for SHP electricity production, wind turbines and cogeneration power plants that use biomass to produce heat and are biomass and solar energy.

## Possibilities of producing energy from renewable source

Both rural and urban areas are mainly a variety of forms of renewable energy that can be used to power their:

- Biomass fuel is the main area is used mostly for space and water heating and cooking. Biomass represents 7% of primary energy demand and 50% of Romania's renewable resource potential. All fossil fuels from biomass and biomass can be so easily converted into solid, liquid or gaseous carbon-based. In future, large quantities of biomass fuels may be converted to more convenient. Biogas, with (60-70)% methane, animal manure is produced either directly from landfills can be used to generate electricity for cooking or lighting. Fermentatoarelor the biogas residue is an excellent agricultural fertilize.
- Hydropower. Micro - hydro may be an option to supply the rural areas not connected to networks. To guarantee a continuous and constant food supply inlet must be protected.
- Wind. Romania has the highest potential in southeastern Europe in wind energy, Southeast Dobrogea even placing it second place in the entire continent. Romania's wind potential is estimated at 14,000 MW installed capacity, but current technical capacity of the network allows to connect up to 4000 MW.
- Geothermal energy is suitable for space heating and water. Due to location, the main potential use is in rural areas - housing, greenhouses, aquaculture, pasteurization of milk - at distances of up to 35 km from the place of extraction.
- Solar energy is suitable for water heating and thus reduce CO2 emissions. Because solar energy is in competition with biomass, the main demand of hot water is heated by solar energy in urban areas. Photovoltaic panels are also used mostly in remote, difficult access to transport infrastructure and electricity distribution.

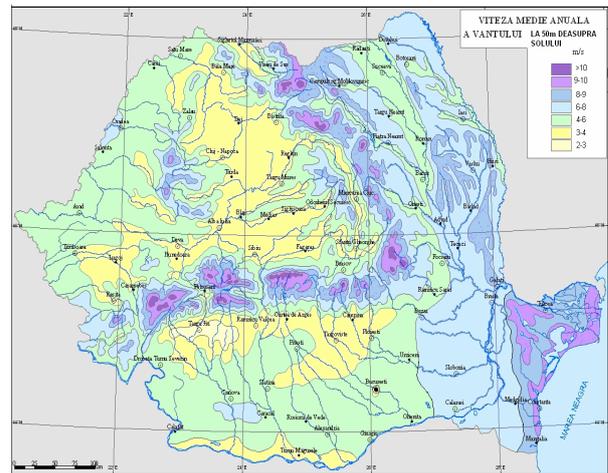


Fig.2 Annual average wind speed distribution for a height of 50 m in Romania

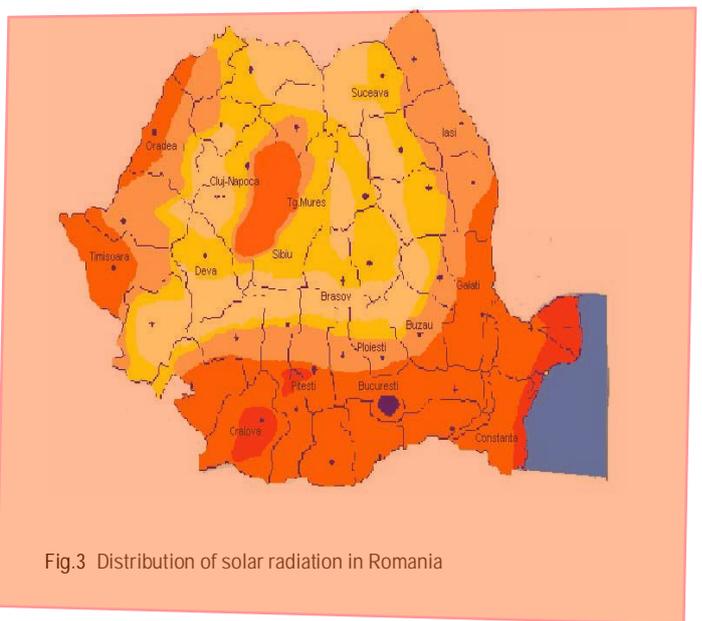


Fig.3 Distribution of solar radiation in Romania

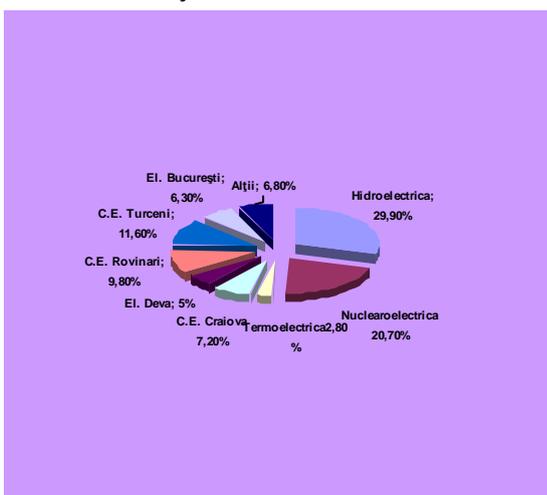


Fig.1 Participation rates for electricity supplied by the manufacturers of networking dispatchable units in 2010

## Conclusions

The priority objectives of energy sector development in Romania are:

1. Securitatea supply
2. Sustainable Development

- Promoting energy production based on renewable resources, so that electricity consumption derived from renewable power to represent 33% of gross domestic electricity consumption of 2010, 35% in 2015 and 38% in 2020.

- Stimulating investment in energy efficiency throughout the chain: resource-production - transport - distribution - consumption;

- Promoting liquid biofuels, biogas and geothermal energy;

- Supporting research and development and dissemination of research results applicable;

- Reducing the negative impact of the energy sector on the environment by using clean technologies.

### 3. Competitiveness

Lines of action of Romania's energy strategy, converging with the EU energy policy are:

- Increasing security of energy supply both in terms of fuel mix and network infrastructure;
- Choosing a balanced energy mix, with emphasis on the use of coal, nuclear energy and renewable energy resources, including untapped hydro potential of using that energy sector competitiveness and provide security of supply;
- Not enough coal and uranium mainly from domestic production and diversification of supply uranium by combining rational exploitation of national resources by the import of uranium;
- The efficient and rational use of safe exhaustible primary energy resources in Romania and maintaining an acceptable level, the economic base, the import of primary energy resources (limited dependence / control);
- Increasing the competitiveness of electricity markets and gas and active participation in the formation of the internal energy market of the European Union and developing cross-border trade with consideration of consumer interests in Romania and Romanian companies;
- Increasing energy efficiency throughout the chain resources, production, transmission, distribution, consumption;
- Promoting use of renewable energy resources;
- Ensuring investment to increase capacity for innovation and technological development;

*Recommended for publication  
of Editorial board*

- The objectives of environmental protection and reduction of greenhouse gas.

### References

1. Popescu, L., Cruceru, M. *Strategia energetică a județului Gorj*, Târgu Jiu, 2010.
2. Sârbu I., Kalmar F. – *Optimizarea energetică*, Editura Matrix Rom, București, 2002
3. World Energy Council – *Survey of Energy Resources*, 2001
4. Lucrările celui de-al XVIII-lea Congres Mondial al Energiei, Buenos Aires 2001
5. [www.greenpeace.ro](http://www.greenpeace.ro) – *Energie curată pentru România*
6. Directiva 77/2001/CE a Parlamentului European
7. *Surse regenerabile de energie* - Monografie realizată de S.C.CHIMINFORM DATA S.A.,București,2004 în cadrul proiectului „BEST RESULT” - Building and Energy Sistem and Technologies in Renewable Energy Sources Update and Linked Trainig
9. GIEC *WG III Climate change:mitigation* , Cambridge University Press, 2001
10. ADEME *Les enjeux de long terme de la maîtrise de l'énergie*, Paris 2003-05-11
11. ADEME *Les enjeux « renouvelable » du débat national sur l'énergie*, Paris, 2003.
12. Bauquis, P.R., *Un point de vue sur les besoins et les approvisionnements en énergie a l'horizons 2050*, Revue de l'Energie, nr.509, 1999.