

# Romania

## Country Profile

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### 1. Overview of Electricity Supply

Electricity in Romania is primarily generated from thermal power plants (coal, natural gas, and oil), with the balance of production from hydroelectric facilities and a recently commissioned nuclear power plant.

The energy sector in Romania is supervised currently by the Ministry of Industry and Trade. The National Electricity Company, CONEL, is responsible for electricity transmission, and is also the system and market operator.

The whole economic and technical operation and development of the electricity sector is regulated, ruled, supervised and monitored by the National Electricity and Heat Regulatory Authority (ANRE), set up by an Emergency Ordinance in October 1998 as a public institution, independent and autonomous.

Although the government still owns a large portion of industrial assets, privatization of the energy sector has begun, and major upgrades to the energy sector are planned over the next ten years.

In the 2002 regular report on Romania's progress towards accession to the EU, the EU commission came to the conclusion that Romania does not devote the necessary resources to improving energy efficiency and promoting renewable energy. Efficiency of energy production and transportation networks is poor due to lack of maintenance and investment.

After years of delay, the government is moving quickly to privatize the state-owned power and gas assets in an effort to meet loan conditions set by the International Monetary Fund (IMF). In 2004, the government made substantial progress in fulfilling IMF loan conditions by selling stakes in regional gas and power distribution companies.

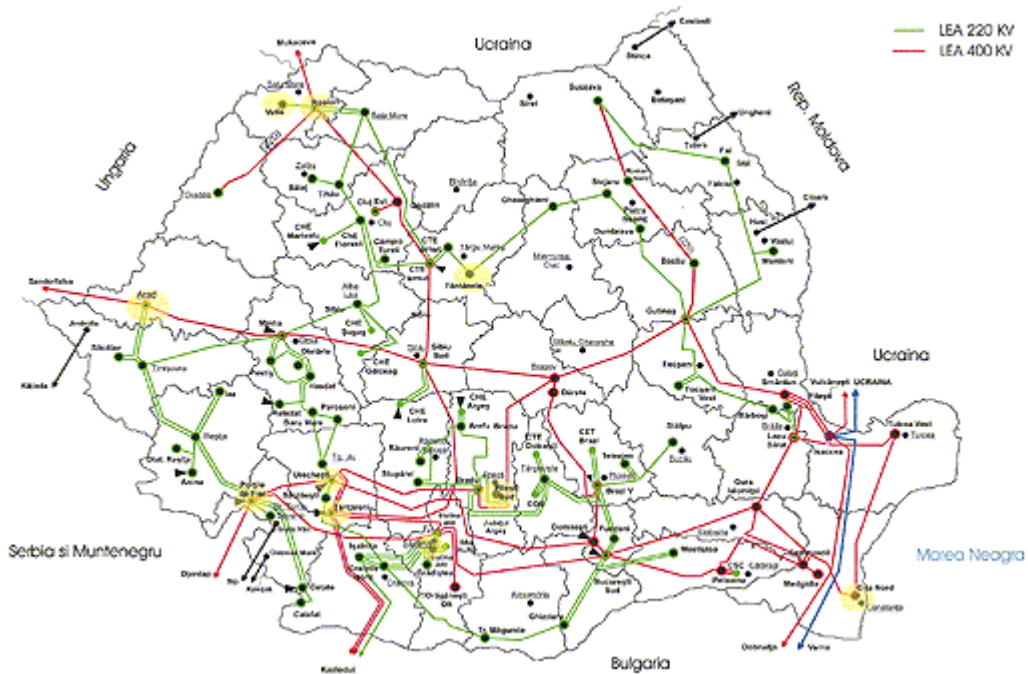
<b>Demographical Information</b>	
Population, millions (2009)	22.2
Land area, thousand Ha (2009)	238
<b>Macroeconomic Information (2008)</b>	
GDP, billion US\$	271
Real GDP growth rate, percent	7.6
Foreign direct investment (net), million US\$ (2007)	9,712
<b>Electricity disposition, billion kWh (2006)</b>	
Generation	58.25
Consumption	48.43
Exports	3.36
Imports	1.28
<b>Generation capacity, GW (2005)</b>	
Nuclear	0.71
Thermal	12.23
Hydro	6.28
Other renewables	0.00
<b>Total</b>	<b>19.22</b>

*Sources: CIA World Factbook, U.S. Energy Information Administration, United Nations Conference on Trade and Development.*

### Romania Country Summary Table

The following map displays the 220 kV and 400 kV transmission lines throughout Romania.

### Electricity Map of Romania



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## 2. Energy Policy, Barriers and Incentives

On January 1, 2007, Romania entered the European Union, so Romania must take part in and follow the EU's energy policy and legislation. In negotiations for EU entrance, Romania agreed to privatize their energy sector. Programs have been launched for the sale of electricity production and distribution companies (IEA, 2009).

The Electric Power Law no.13/2007

- Ensures the non-discriminatory and regulated access for all participants on the electric power market and the public electric network.
- Demands the transparency of the taxes and prices for electric power.
- Promotes using new and renewable energy sources.
- Promotes local and global environmental protection.
- Ensures the safety of commercial electric power for the consumer.

Romania's renewable energy target for 2020 is 38 percent renewable consumption. In order to meet these goals and set standards for Romanian renewable energy, Romania created a renewable energy law, Law no. 220/2008. Parliament passed the law in October of 2008. The law includes

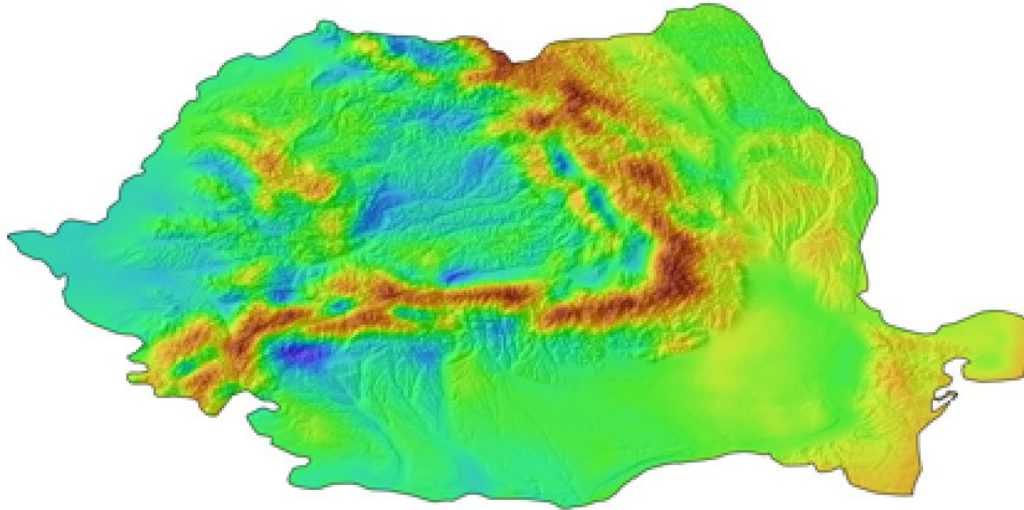
- Incentives for small hydro, solar, wind, geothermal, biomass, biogas, and waste water sludge and gas projects. Incentives are offered for 3 years after completion of small hydro refurbishments to 15 years for new power plants.
- An outline for a green certificate trading market. Typically one certificate represents 1 MWh of electricity that can be traded. Suppliers must meet the annual mandatory target for green certificates; if they do not fulfill the target, they must pay a counter-value.
- Priority access for electricity produced by renewable energy sources, as long as such priority does not affect the safety of the National Energy System.
- Loan guarantees and tax exemptions for renewable energy investments.

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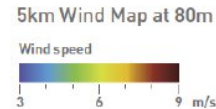
## 3. Wind

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 (UDI, 2009). However, Romania currently has approximately 636 MW of wind capacity under construction. A majority of the capacity under construction is from the Fantanele and Cogealeac 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 (Realitatea, 2009).

# Romania Wind Map at 80m



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## 4. 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. The entirety of that biomass potential went to the production of heat. Heat generated from wood biomass was approximately 54 percent, and heat generated by agricultural biomass was about 46 percent.

Direct burning in the kilns, stoves for space heating, cooking and hot water preparation is about 95 percent of the biomass use. These furnaces have a nominal capacity between 0.8 kW to 4 kW and are hand stocked and with an average efficiency between 15 to 50 percent. 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. In sawmills, the average installed capacity is 3.3 MW and in other in other industries 4.7 MW.

In Romania over 550 industrial hot water and steam boilers run on fuel wood. In 2004 the total installed capacity for cogeneration units reached 4,100 MW.

Firewood and agricultural waste account for about 80 percent of the total waste. About 66 percent of the firewood and wood waste is located in the Carpathians and Sub-Carpathians, and about 58 percent of agricultural waste is located in the South Plain, West Plain, and Moldavia. Approximately 63,700 square km of Romania is covered by forests, which is

approximately 27 percent of the total land. The exploitable potential of the Romanian forests is estimated at 20,000 cubic meters (Intelligent Europe, 2005).

Large amounts of small-sized wood is obtained in wood industry, but utilization of this wood for energy purposes is insufficient due to difficulties related to gathering, processing and transportation. Studies show that these wood wastes are economically viable resources.

<b>Biomass resource type</b>	<b>Total production</b>	<b>Production density</b>
<b>Total land area covered by</b>	(avg. 2006–2007, km <sup>2</sup> )	(avg. 2006–2007, %)
Arable Land	87,460	37
Permanent Crops	4,645	2
Permanent Meadows and Pastures	45,820	19
Forest Area	63,712	27
Other Land	28,298	12
Inland Water	8,455	4
<b>Primary crop production</b>	(avg. 2006–2007, tonne)	(tonne / 100 km <sup>2</sup> )
Total primary crops (rank among COO)	23,856,036 (23)	10,357 (20)
<b>Top 10 primary crops</b>		
Maize	6,335,616	2,751
Wheat	4,196,212	1,822
Potatoes	3,757,171	131
Cabbages and other brassicas	1,116,338	485
Sunflower seed	1,023,861	444
Sugar beet	925,388	402
Grapes	866,845	376
Tomatoes	695,206	302
Barley	638,309	277
Watermelons	613,878	267
<b>Animal units, number</b>	(avg. 2006–2007, number)	(number / 100 km <sup>2</sup> )
Cattle	2,898,000	1,258
Poultry	95,271,500	41,361
Pigs	6,718,500	2,917
Equivalent animal units	6,538,115	2,838
<b>Annual roundwood production</b>	(2006–2007, m <sup>3</sup> )	(m <sup>3</sup> / 100 km <sup>2</sup> )
Total	14,655,500	6,363
Fuel	4,142,500	1,798
Industrial	10,513,000	4,564
Wood-based panels	1,319,500	573
	(2006–2007, tonne)	(tonne / 100 km <sup>2</sup> )
Paper and paperboard	495,000	215
Recovered paper	276,500	120

*Source: Food and Agriculture Organization of the United Nations*

#### **Romania Biomass Resource Data**

## 5. Solar

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.

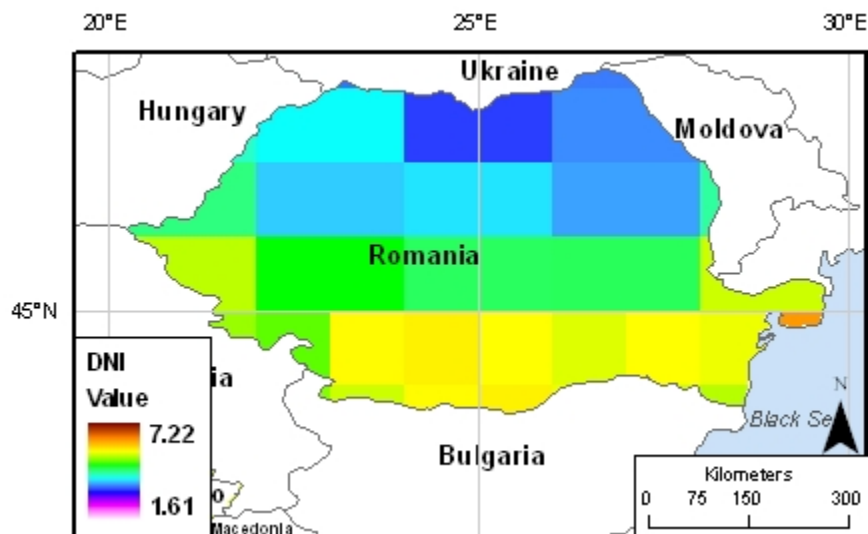
The average solar radiation in Romania ranges from 1.100 to 1.300 kWh/m<sup>2</sup> per year for more than half of the country's surface (Energetica no 6, June 1999). If the solar resource in Romania was used solely for solar thermal applications, the country would have a potential of 60 PJ per year. Romania's solar electricity potential is approximately 1,200 GWh (UKraine Biofuel Portal, 2007).

Area	Size [MJ/m <sup>2</sup> /year]
Black Sea coast	5.384
South plain	5.147
Danube Delta	5.046
Western plain	4.815

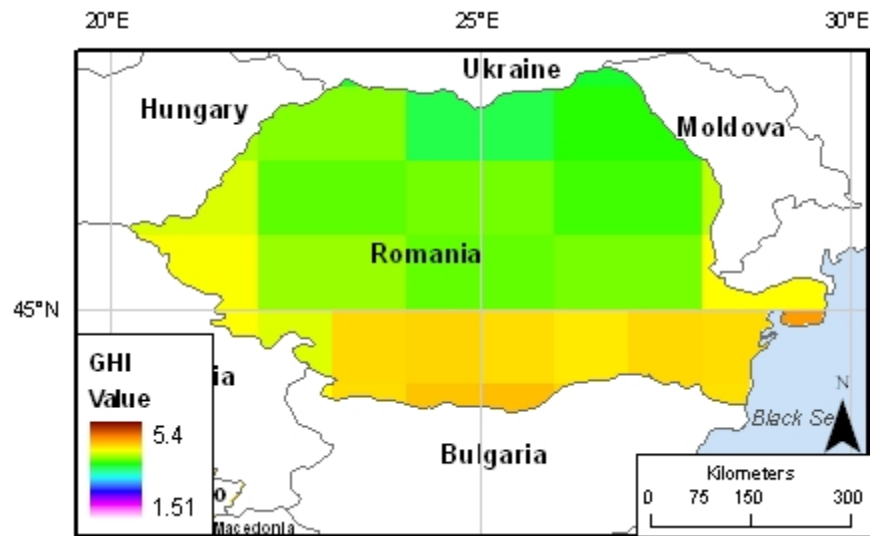
### Romanian Areas/Projects with High Potential for Solar Energy

The following figures display the solar insolation values for Romania. Romania has moderate solar potential throughout the whole of the country. Its best solar resource is located in the southern portion of the country.

Romania Solar Direct Normal Insolation (Source: NASA)



### Romania Global Horizontal Irradiance (Source: NASA)

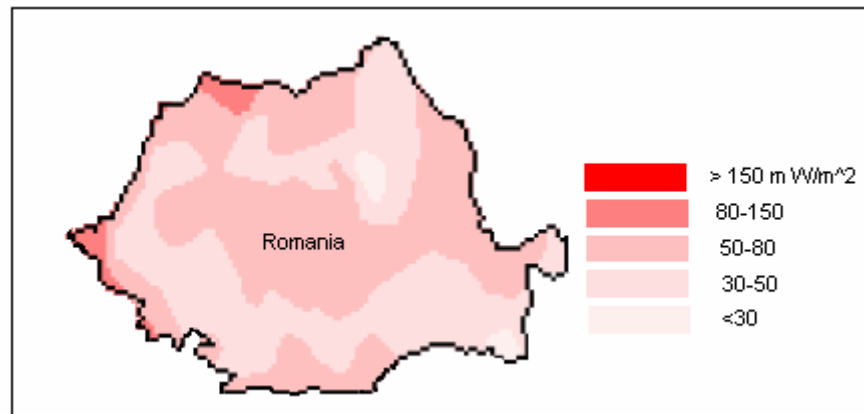


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## 6. Geothermal

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. The heat flux contour map for Romania is shown below.

### Heat Flux of Romania (Source: Energie-Atlas GmbH, 2005)



At present Romania has a total geothermal installed capacity of about 145.1 MWt producing 2,841 TJ/year. This energy is produced from about 96 direct-use wells with hot water in the temperature range of 55-115 °C. Of the 96 direct-use wells, 37 are used exclusively for health and recreational purposes. There have been no reports of geothermal pump usage in the area. The exploited and unexploited geothermal resource can be seen in the map below.

## Geothermal Resource Map



Romania's highest enthalpy geothermal resource of 3,000 °C was identified at Tusnad-Bai. Five sites have a temperature over 100 °C.

The main technical potential areas include:

- Western Plain with 4,300 TJ/year potential energy production.
- Southern Carpathians (at the contact with the Getical Subcarpathians) with 270 TJ/year potential energy production.
- South Plains with 720 TJ/year potential energy production.

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## 7. Hydroelectric

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. Other hydrographic resources include the more than 2,500 lakes, ranging from the glacial lakes of the mountains to those of the plains and the marshes of the Danube delta region. The main effort since the 1940s, however, has been on the Arges, Bistrita, Lotru, Olt, Mare, Sebes, and Somes rivers as well as on the Danube at the Iron Gate.

The Romanian government has encouraged foreign investment in hydropower through Hydroelectrica, the state-owned hydropower producer. Hydroelectric has 150 small hydro power plants, which they must sell as a commitment assumed by Romania in negotiations for EU accession. As of March 2009, Hydroelectrica had sold 87 small hydro power plants to private investors (Curierul National, 2009).

Romania has a total of at least 767 hydroelectric power plants. A majority, 621, of these plants are small hydroelectric plants, with less than 10 MW of capacity. The small hydroelectric plants in Romania have a total capacity of 1,125 MW. At least 146 large hydroelectric plants are operating in Romania. The large plants have a capacity of approximately 5,550 MW (UDI, 2009). Hydroelectric plants in Romania produce about 6.28 billion kW of electricity each year (EIA, 2007).

The hydroelectric sector in Romania also has some new construction. Approximately 110 MW of capacity are currently under construction, and another 462 MW of capacity have been delayed after the start of construction (UDI, 2009). Information regarding the delays could not be acquired.

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## 8. Relevant Links

Please see webpage for relevant links.

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## *10. Country Contacts*

Contacts made in the preparation of this assessment are gratefully thanked for their contribution to this report. Please see webpage for contacts listing.

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