

Energy Industry in Romania



General State of the Economy

Romania is a European country located in the southeastern part of the continent. It borders Bulgaria in the south, Ukraine in the north, Hungary and Serbia in the west, Moldova in the east, and is washed by the Black

Sea in the southeast. Romania is the 83rd largest country in the world and as of 2023 is home to more than 18 million people. In terms of population density the country is 130th in the world [1,2].

Romania is a semi-presidential republic with its capital in Bucharest and Romanian as the official language.

Romania		
Capital: Bucharest	Density: 79.9/km ²	Currency: Romanian leu (RON)
Official languages: Romanian	Life expectancy at birth: 74.92 years	GDP (PPP): \$780.860 billion (2023 est.)
National Day: 01 December	Area (land): 238,394 km ²	GDP - per capita (PPP): \$40,672 (2023 est.)
Population: 19,053,815 (2022 est.)	Coastline: 245 km	Internet country code: .ro

Source: [1,2,3,4,5]

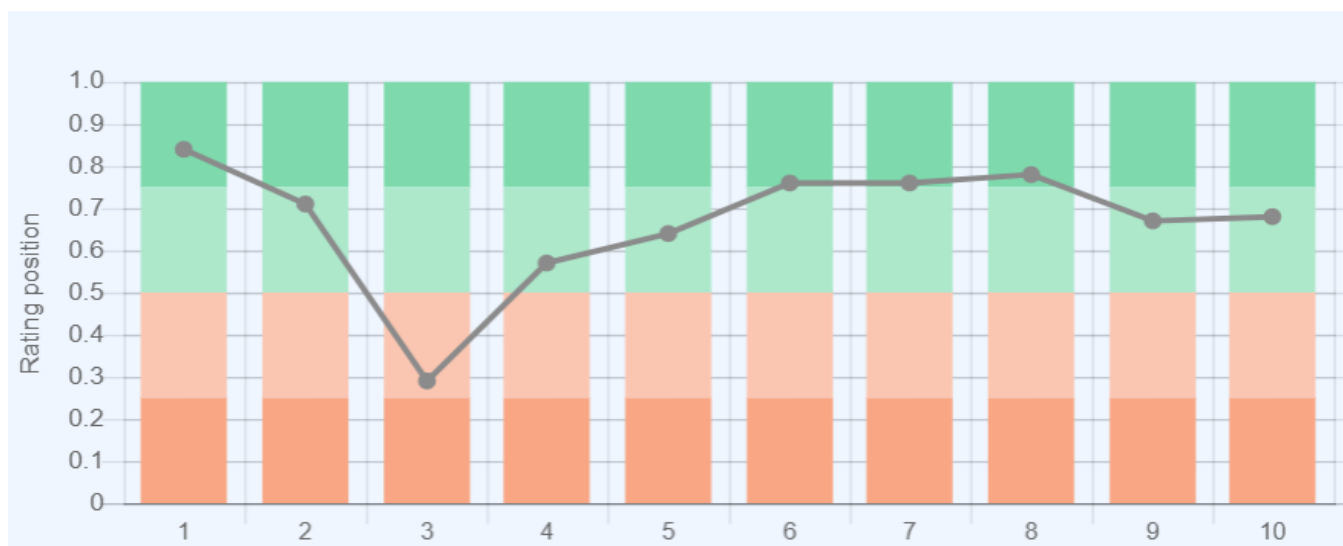
The administrative map of the country is divided into 41 counties [3].

Rating positions of Romania relative to other countries have been determined for an extensive list of economic, energy, innovative and educational indices, as well as for metrics reflecting the state of the environment. The economic indices include, for example, GDP per capita, annual average GDP growth, high-technology exports, and others. The list of energy indices includes proven reserves of oil, gas and coal, production-consumption ratio combined, and energy use, etc. Each of the indices has a ranked list of included member countries. Since the number of countries in each rating is different for each index, the positioning of the country of interest is displayed on

a special chart, where the vertical axis is a uniform relative scale from 0 to 1, whereas the horizontal axis denominates the various indices and respective numbers relating to the descriptions given underneath.

Thus, in such a relative "0-1" diagram, the country's position is marked with a dot in proportion to its location in the original rating list. If the country is among the leaders regarding the selected indicator, it will be marked close to 1 in the upper green zone on the relevant chart "0-1", if the country is an outsider in the rating list, then it will be marked in the lower red zone of the chart "0-1", etc.

Ranking position of Romania for list of economic indices:



Sources:

1. GDP (purchasing power parity), 2020 est. / The World Factbook/Library/Central Intelligence Agency *228

2. GDP - per capita (PPP), 2020 / The World Factbook/Library/Central Intelligence Agency *229

3. Inflation rate (consumer prices), 2019 est. / The World Factbook/Library/Central Intelligence Agency *228

4. Charges for the use of intellectual property, receipts (BoP, current US\$), 2020 / International Monetary Fund, Balance of Payments Statistics Yearbook, and data files. / License: CC BY-4.0 *88

5. The Global Competitiveness Index 2019 / Rankings / Reports / World Economic Forum *141

6. High-technology exports (current US\$) 2019-2020 / United Nations, Comtrade database through the WITS platform / License: CCBY-4.0 / Data *134

7. 2021 Index of Economic Freedom / International Economies / The Heritage Foundation *178

8. Reserves of foreign exchange and gold, 2017 est. / The World Factbook / Library / Central Intelligence Agency *195

9. Annual average GDP growth in %, for the last 10 years (2011-2020) / World Bank national accounts data, and OECD National Accounts data files / License: CC BY-4.0 *206

10. Public debt (% of GDP), 2017 est. / The World Factbook / Library / Central Intelligence Agency (from smallest to largest) *210

* Total number of countries participating in ranking

Figure 1. Economic indices of Romania

For the majority of indices the positioning of the country is higher than the world average, for four indices Romania is placed among the top quarter of the world's countries included in the rating. Of the indices presented, the country has the highest values for GDP (0.84), High tech-

nology exports and Reserves (0.76) of foreign exchange and gold (0.78). The weakest spot within Romanian economics is the Inflation rate (0.29), the only one indicator where the country takes up a position below the middle of the rankings.

Energy resources

Romania has moderate fossil fuel reserves. The share of gas reserves is 0.05% of the world's total, the share of oil – 0.035%, and the share of coal – 0.028%. The share of the population of Romania is approximately 0.25% of the world's population. Oil and gas reserves in Romania are significantly lower than those of the world leaders. However, with regard to the region, Romania's gas reserves

are comparable to those of Ukraine or Poland, and the coal reserves of these countries are much higher than those of Romania [6].

In terms of tons of oil equivalent, according to 2022 data, conventional proved reserves by fuel type were: 53.5% – coal, 25% – natural gas, and 21.5% – oil (Fig.5). In Romania, the indices of renewable resources, except for hydro, show relatively low values. The solar potential (GHI) is predominantly in the range 3.5-3.8 kWh/m²/day,

Table 1. Fossil energy resources of Romania

Resource/explanations	Crude oil*	Natural gas*	Coal*	Shale Gas	Tight Oil	Coal mine methane
Value	0.6 (0.035%)	3.725 (0.05%)	320.77 (0.028%)	50.7	0.3	0.19-0.84
Unit	billion bbl	Tcf	million short tons	Tcf	billion bbl	bcm
Year	2021	2020	2021	2015	2015	2017
Source	[6]	[6]	[6]	[7]	[7]	[7,8]

*share of the country's reserves in world total is provided in brackets

which allows the development of solar power at a lower or medium efficiency level. For the installation of wind farms the area in the east-south of Romania along the

coastal line with the Black Sea is predominantly used, where the average wind speed reaches 6 m/s at a height of 50 m.

Table 2. Renewable energy resources of Romania

Resource/explanations	Solar Potential (GHI)*	Wind Potential (50 m)*	Bio Potential Agricultural area	Bio Potential Forest Area	Geothermal Potential	Municipal Solid Waste
Value	3.5-3.8	5.0-6.0	59.1	30.1	significant for low enthalpy (50-120°C)	302
Unit	kWh/m ² /day	m/s	% of land area	% of land area	-	kg per capita
Year	2020	2020	2020	2020	-	2021
Source	[9]	[10]	[11]	[12]	[13]	[14]

*for the majority of the territory of the country

There are many fairly water-rich rivers in Romania, the largest of which are the Danube and Mures. Hydropower accounts for about 32% of electricity produced in the country. A rather extensive agricultural and forest area

forms a decent resource base for the development of a number of bioenergy technologies, in particular, the production of biogas, bioethanol or biodiesel.

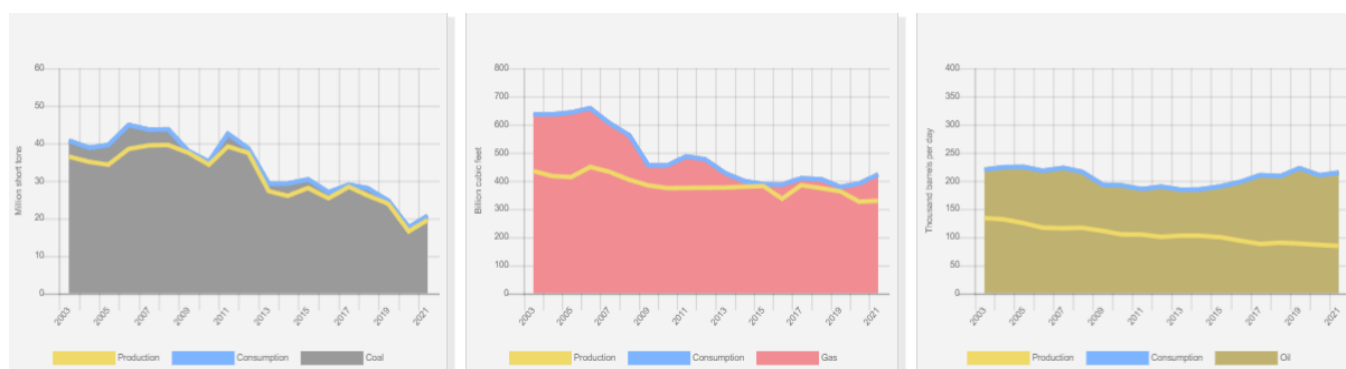
Energy balance

According to [6], the total primary energy production in Romania in 2021 was 0.959 Btu and consumption was at 1.385 Btu. The share of domestic production in primary energy consumption was 71,1%, which makes Romania dependent on energy imports.

According to the Statistical Review of World Energy 2022, primary energy consumption in Romania in 2021 amounted to 1.40 exajoules and was dominated by oil –

33% , followed by natural gas – 29%, coal – 12%, hydro-power – 11.5%, nuclear and renewables – about 7% each [15].

For the last twenty years, Romanian oil production has been steadily declining, while consumption is two and a half times higher than production. Natural gas has also been characterized by a constant decline in production, with consumption exceeding production by almost 30% in 2021.

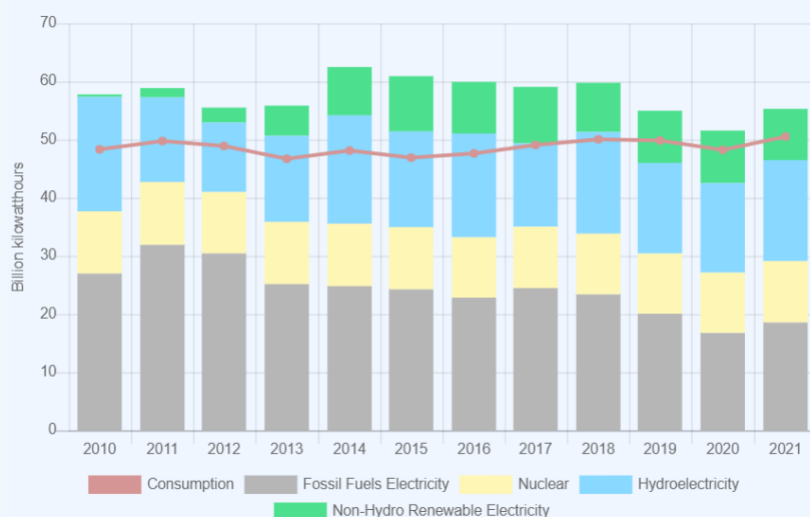


Source: U.S. Energy Information Administration (Dec 2022) / <https://www.eia.gov/>

Figure 2. Production and consumption of fossil fuels in Romania (left–coal, in the center– gas, right–oil)

Over the past two decades, coal production has almost halved, while consumption has almost equaled production. Romania's electricity indicators have been fairly stable over the past decade, both in production and consumption. It is worth noting some increase in the electricity generation from renewable sources, and consequently a decrease in the share of fossil fuels. Romania is

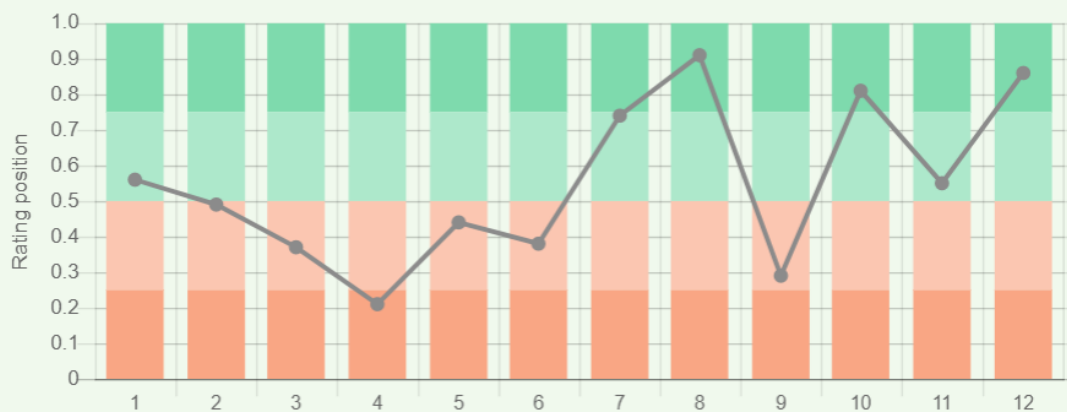
fully self-sufficient in electricity through domestic generation.



Source: U.S. Energy Information Administration (Dec 2022) / <https://www.eia.gov/>

Figure 3. Electricity production in Romania

Graph of the energy indices of Romania is presented in the figure below:



Sources:

1. Crude oil proved reserves, 2021 / International Energy Statistic/Geography / U.S. Energy Information Administration (Nov 2021)*98
2. Natural gas proved reserves 2021 / International Energy Statistic / Geography / U.S. Energy Information Administration (Nov 2021) *99
3. Total recoverable coal reserves 2019 / International Energy Statistic / Geography / U.S. Energy Information Administration (Nov 2021) *81
4. Combination production-consumption for Crude oil 2018 / International Energy Statistic / Geography / U.S. Energy Information Administration (Nov 2021) *219
5. Combination production-consumption for Natural gas 2019 / International Energy Statistic / Geography / U.S. Energy Information Administration (Nov 2021) *123
6. Combination production-consumption for Coal 2019 / International Energy Statistic / Geography / U.S. Energy Information Administration (Nov 2021) *128
7. Electricity – from other renewable sources (% of total installed capacity), 2017 est. / The World Factbook / Library / Central Intelligence Agency *170
8. GDP per unit of energy use (PPP per unit of oil equivalent), 2020 *66
9. Primary energy consumption – BP Statistical Review of World Energy 2021/BP/GDP (purchasing power parity) - The World Factbook/Library/Central Intelligence Agency
10. Energy use (primary energy use of oil equivalent per capita) 2020 *127
11. Primary energy consumption – BP Statistical Review of World Energy 2021; Population - United Nations, Department of Economic and Social Affairs, Population Division (2019). World Population Prospects 2019, custom data acquired via website. Retrieved 15 November 2021*66
12. The Global Energy Architecture Performance Index Report (EAPI) 2017 / Rankings / Reports / World Economic Forum
11. Electric power consumption (kWh per capita), 2016 *217
- Electricity Consumption - The World Factbook / Library / Central Intelligence Agency; Population - United Nations, Department of Economic and Social Affairs, Population Division (2019). World Population Prospects 2019, custom data acquired via website. Retrieved 15 November 2021
12. Combination of electricity production-consumption (kWh)/The World Factbook/Library/Central Intelligence Agency *216

* Total number of countries participating in ranking

Figure 4. Energy indices of Romania

Romania is slightly above the middle (0.56) in terms of oil reserves, although the combined crude oil production-consumption figure is the lowest (0.21) on the chart. The country is relatively well-positioned in the Electricity from other renewable sources (0.74) and The Global

Energy Architecture Performance Index (0.81). In terms of such indices as GDP per unit of energy use (0.91) and the Combination of electricity production-consumption (0.86) Romania is among the global leaders.

Energy Infrastructure

A territorial map showing distribution of the largest infrastructure projects of the fossil fuel sector in Romania is displayed in Figure 5. As mentioned earlier, coal reserves account for 53.5% of all proven reserves of fossil fuels, natural gas – for 25%, and oil – for 21.5%.

Natural gas production in Romania takes place mainly in Transylvania, especially in the counties of Mure and Sibiu, where the main extraction fields are located. The largest natural gas field in Romania is the Deleni gas field with proved reserves of 85 billion cubic meters or 3 trillion cubic feet [16].

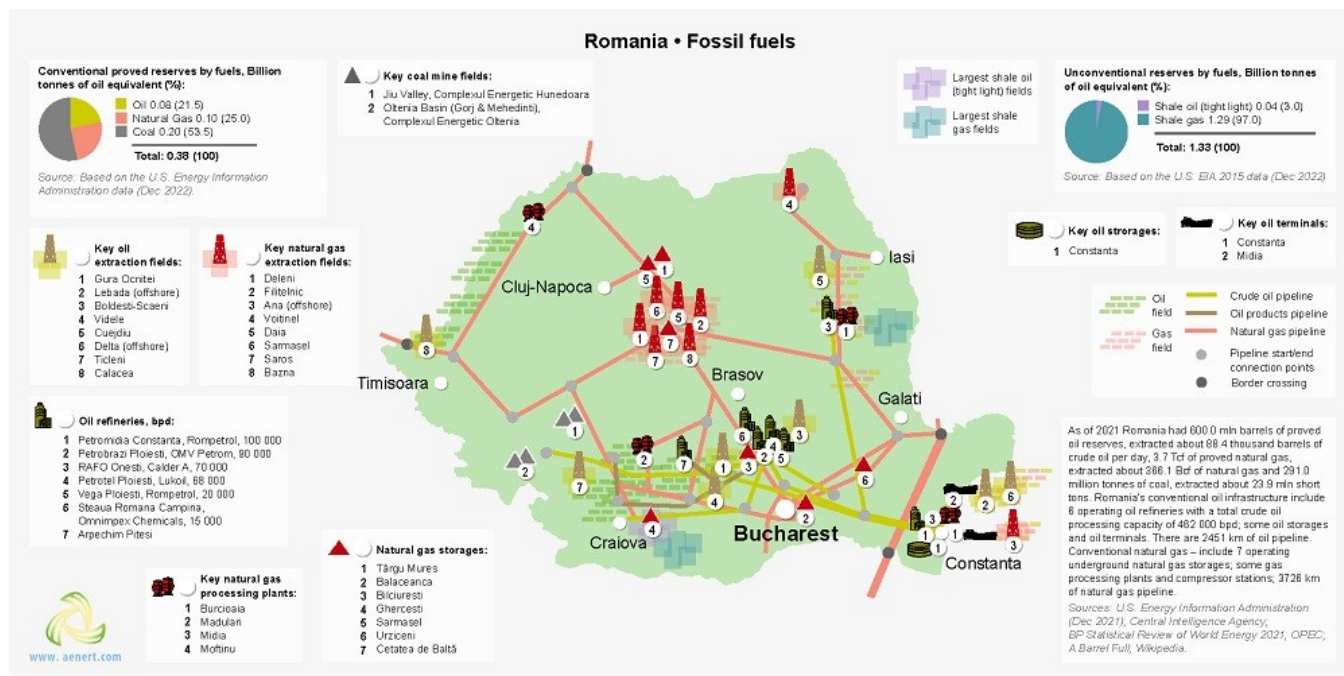


Figure 5. Basic infrastructural facilities of the fossil fuel sector in Romania

The total length of natural gas pipelines is about 3726 km. Romania has 600 million barrels of proved oil reserves as of 2021, the fourth-largest reserves in Europe.

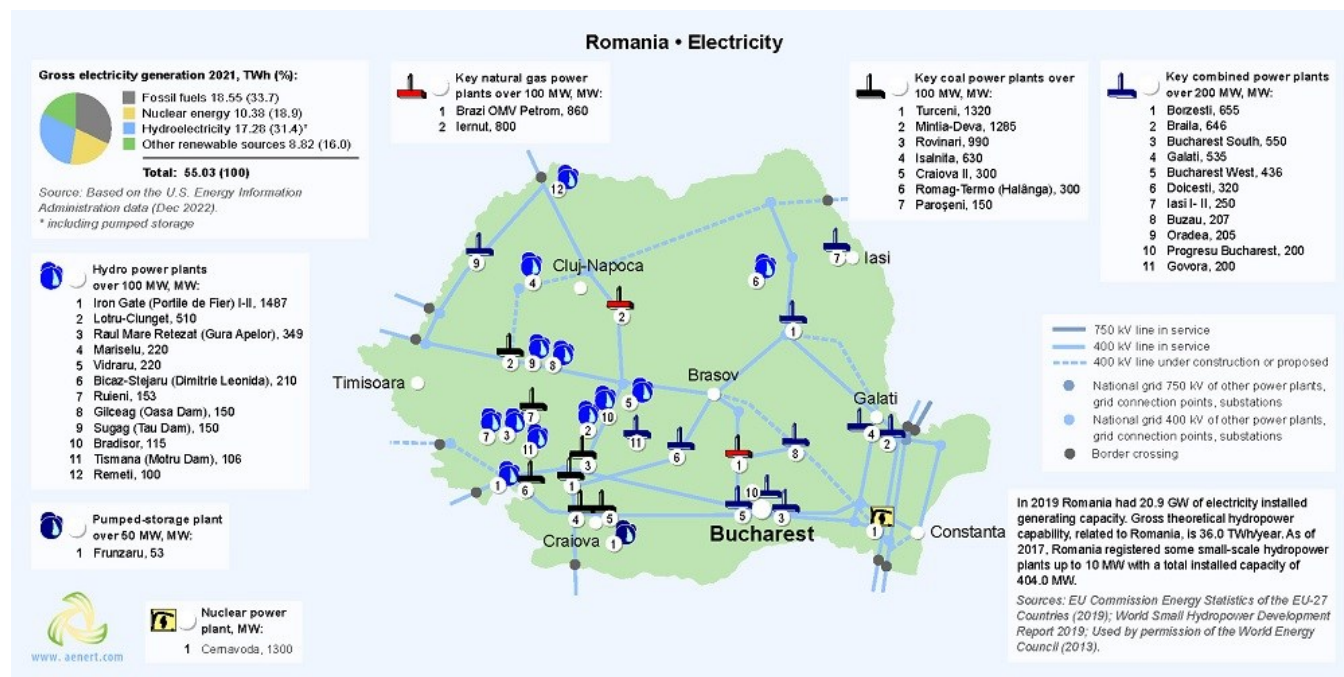


Figure 6. Electricity production in Romania

Romania's traditional oil infrastructure includes a some refineries, the largest of which is the Petromidia refinery on the Black Sea coast in Constanta County, with an annual processing capacity of 4.8 million tons/year. There are 2451 km of oil pipeline.

Electricity generation in Romania is to about 34% provided by fossil fuel-fired power stations. Romania's largest electricity generation plant, The Turceni Power Station situated in Gorj County, is coal-fired.

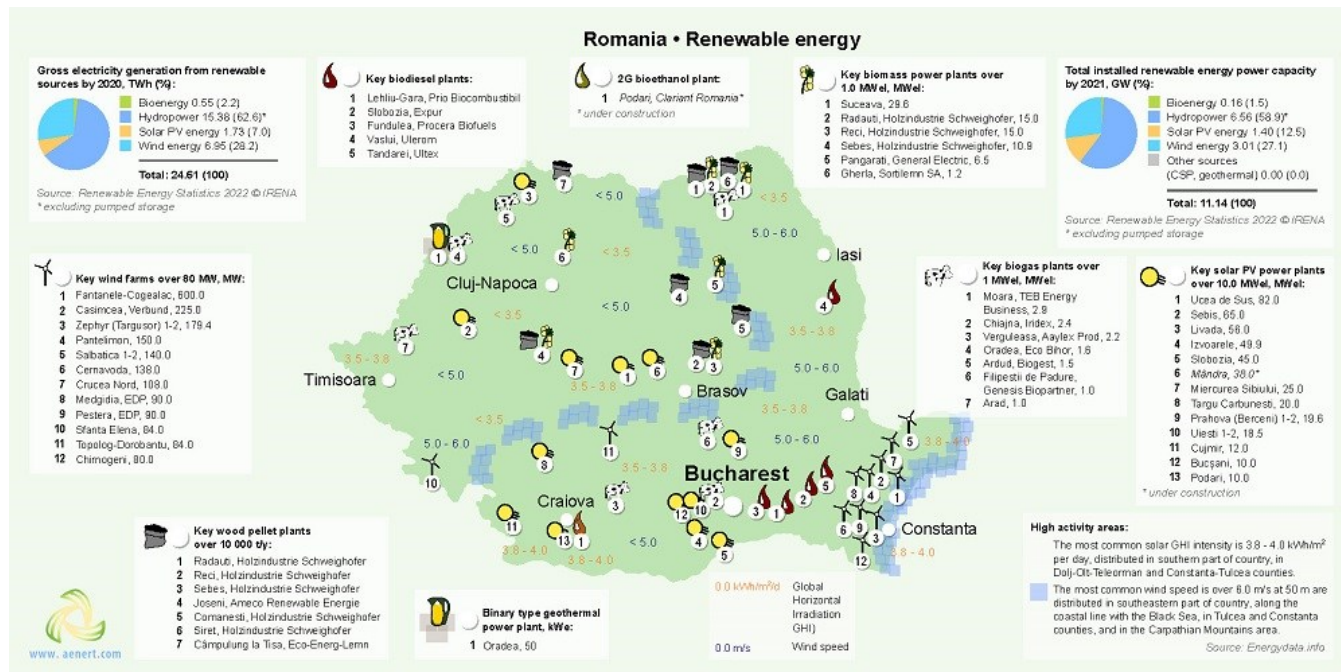


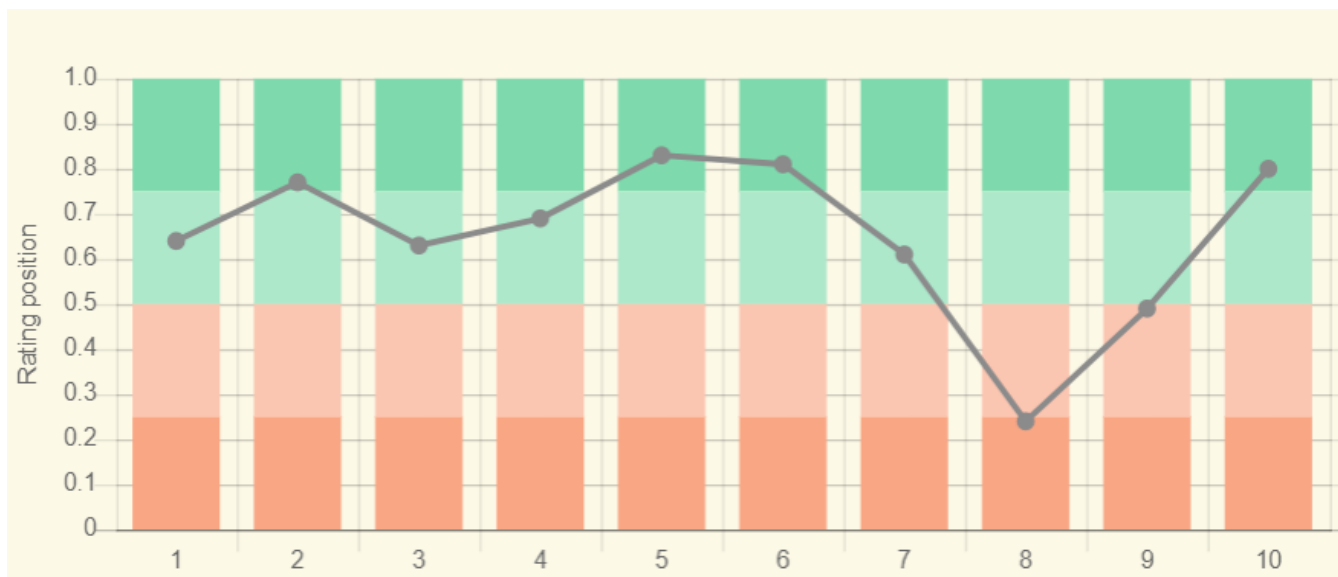
Figure 7. Renewable energy in Romania

Hydropower also plays a significant role, accounting for about 31% of Romania's generation capacity with Iron Gate I Hydroelectric Power Station on the Danube River as a biggest hydroelectric station in the country and one of the largest in Europe. As of 2017, Romania registered some small-scale hydropower plants up to 10 MW with a total installed capacity of 404.0 MW.

The Romanian government has set ambitious goals to increase the share of renewable energy sources, excluding hydropower, in its total electric power mix to 35% by 2030. To achieve this, numerous policies have been announced to support the renewable energy sector, especially solar energy. One of the biggest projects is a 1,044 MW photovoltaic plant planned to be built in Arad County and is expected to be the largest PV plant in Europe. In addition, the country has great potential or further development of hydropower, the total potential of which is estimated at more than 9 GW [17].

Education and Innovation

The following chart shows Romania's positions in terms of education and innovation:



Sources:

1. The Global Innovation Index 2021, Rankings / Knowledge / World Intellectual Property Organization / Cornell University, INSEAD, and WIPO (2021): Energizing the World with Innovation. Ithaca, Fontainebleau, and Geneva *132
2. Patent Grants 2011-2020, resident & abroad / Statistical country profiles / World Intellectual Property Organization *185
3. Patents in Force 2020 / Statistical country profiles / World Intellectual Property Organization *109
4. QS World University Rankings 2022 *97
5. SCImago Country Rankings (1996-2020) / Country rankings / SCImago, (n.d.). SIR-SCImago Journal & Country Rank [Portal]. Retrieved 17 Nov 2021 *240
6. Internet users in 2018 / The World Factbook / Central Intelligence Agency *229
7. Internet users in 2018 (% Population) / The World Factbook / Central Intelligence Agency *229
8. Government expenditure on education, total (% of GDP), 2019 / United Nations Educational, Scientific, and Cultural Organization (UNESCO) Institute for Statistics. License: CCBY-4.0 / Data as of September 2021 *177
9. Research and development expenditure (% of GDP), 2018 / UNESCO Institute for Statistics. License: CCBY-4.0 / Data *119
10. Scientific and technical journal articles, 2018 / National Science Foundation, Science and Engineering Indicators. License: CCBY-4.0 / Data *197

* Total number of countries participating in ranking

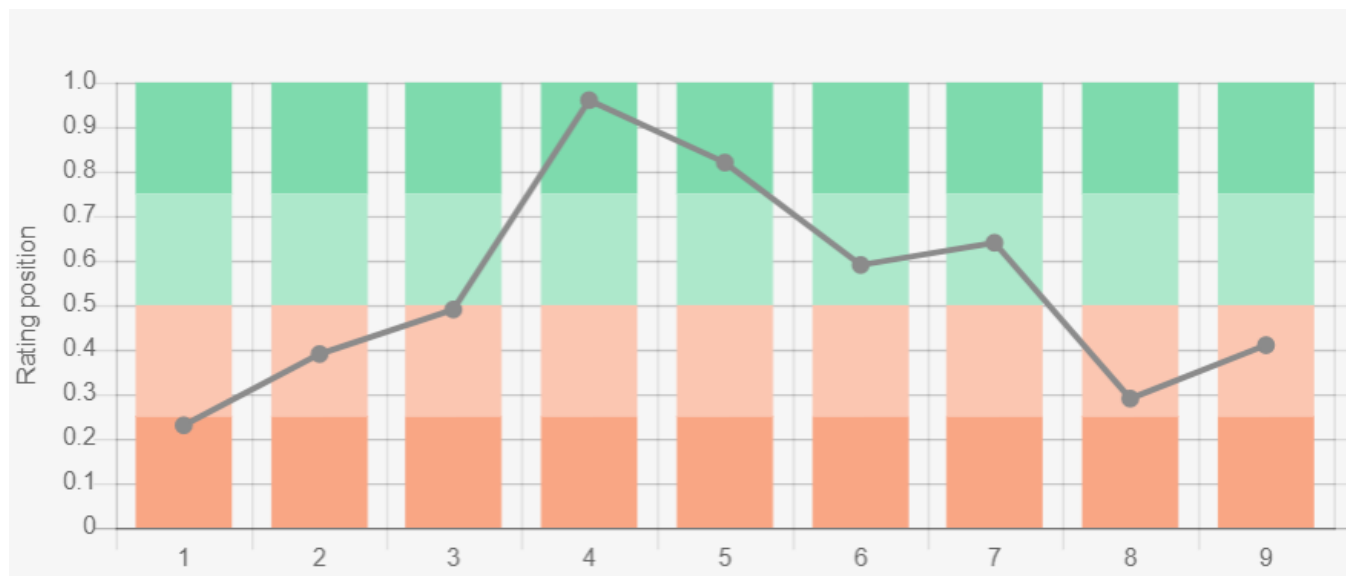
Figure 8. Indices of education and innovation in Romania

The majority of indices describing the country's positioning in the various international rankings related to education and innovation are above average. Romania has the highest rankings in SCImago Country Rankings (0.83), Internet Users (0.81), and Scientific and technical journal articles (0.80). According to two indices – government expenditure on education (% of GDP) and Research and

development expenditure (% of GDP) – Romania's positions are below the world average.

Ecology and Environment Protection

Indicators related to environmental issues are presented in the following diagram:



Sources:

1. CO2 total emission by countries 2020 / European Commission / Joint Research Centre (JRC) / Emission Database for Global Atmospheric Research (EDGAR)*208
 2. CO2 per capita emission 2020/European Commission/Joint Research Centre (JRC) / Emission Database for Global Atmospheric Research (EDGAR) *208
 3. Forest area 2020 (% of land area) / The Global Forest Resources Assessment 2020 / Food and Agriculture Organization of the United Nations *234
 4. Forest area change 2010-2020 (1000 ha/year) / The Global Forest Resources Assessment 2020 / Food and Agriculture Organization of the United Nations *234
 5. The Environmental Performance Index (EPI) 2020 / Rankings / Yale Center for Environmental Law & Policy / Yale University *180
 6. Annual freshwater withdrawals (m3 per capita), 2017 *179
 7. The National Footprint Accounts 2017 (Biocapacity Credit / Deficit) / Global Footprint Network *188
 8. Methane emissions (kt of CO2 equivalent), 2018 / Data for up to 1990 are sourced from Carbon Dioxide Information Analysis Center, Environmental Sciences Division, Oak Ridge National Laboratory, Tennessee, United States. Data from 1990 are CAIT data: Climate Watch. 2020. GHG Emissions. Washington, DC: World Resources Institute. Available at: License : Attribution-NonCommercial 4.0 International (CC BY-NC 4.0) *191
 9. The Climate Change Performance Index (CCPI) 2022 / Overall Results / Jan Burck, Thea Uhlich, Christoph Bals, Niklas Höhne, Leonardo Nascimento / Germanwatch, NewClimate Institute & Climate Action Network *60
- * Total number of countries participating in ranking

Figure 9. Environmental indices of Romania

Romania belongs to the group of countries with high carbon dioxide and methane emissions. These facts also contribute to the country's below-average ranking in the Climate Change Performance Index 2022 (0.41). Among the country's positive environmental characteristics are the change in forest area between 2010 and 2020 (0.96) and relatively high scores in the Environmental Performance

Index-2020 (0.82). In general, the environmental situation in the country requires significant improvement.

References

- [1] List of sovereign states and dependencies by area / Wikipedia / https://en.wikipedia.org/wiki/List_of_sovereign_states_and_dependencies_by_area
- [2] List of countries and dependencies by population density / Wikipedia / https://en.wikipedia.org/wiki/List_of_countries_and_dependencies_by_population_density
- [3] Romania / The-world-factbook / Library / Central Intelligence Agency / <https://www.cia.gov/>
- [4] GDP, PPP (constant 2011 international \$) / World Bank, International Comparison Program database. License: CC BY-4.0 / Data / The World Bank / <http://www.worldbank.org/>
- [5] GDP per capita, PPP (current international \$)/ World Bank, International Comparison Program database. License: CC BY-4.0 / Data / The World Bank / <http://www.worldbank.org/>
- [6] International Energy Statistic / Geography / Romania / U.S. Energy Information Administration (Dec. 2022) / <http://www.eia.gov/>
- [7] World Shale Resource Assessments / U.S. Energy Information Administration (September 24, 2015) / <http://www.eia.gov/>
- [8] Potential for the utilization of coal methane / aenert.com/technologies/fossil-fuel/unconventional-gas/coal-seam-methane/
- [9] Solar resource data obtained from the Global Solar Atlas, owned by the World Bank Group and provided by Solargis / Global Solar Atlas / <http://globalsolaratlas.info/>
- [10] Ireland Wind Map / Global Wind Atlas 2.0, a free, web-based application developed, owned and operated by the Technical University of Denmark (DTU) in partnership with the World Bank Group, utilizing data provided by Vortex, with funding provided by the Energy Sector Management Assistance Program (ESMAP). For additional information: <https://globalwindatlas.info>
- [11] Agricultural land (% of land area) / Food and Agriculture Organization, electronic files and web site. License: CC BY-4.0 / Data / The World Bank / <http://www.worldbank.org/>
- [12] Forest area (% of land area) / Food and Agriculture Organization, electronic files and web site. License: CC BY-4.0 / Data / The World Bank / <http://www.worldbank.org/>
- [13] Geothermal energy in Romania/ geodistribution.ro/geothermalRomania.htm
- [14] Municipal waste statistics Updated / 19 July 2018 / Full list / Statistics Explained / Eurostat / ec.europa.eu
- [15] BP Statistical Review of World Energy 2020 - 2022 (PDF) / BP / <https://www.bp.com/>
- [16] Natural Gas /World Energy / www.worldenergy.org/assets/images/imported/2013/10/WER_2013_3_Natural_Gas.pdf
- [17] Romania Renewable Energy Market - Growth, Trends, and Forecasts (2023 - 2028) / Mordor Intelligence / www.mordorintelligence.com

The sources of charts and curves are specified under the images.

[For more information about the energy industry in Romania see here](#)
