# Romania

## Systematic Country Diagnostic

### BACKGROUND NOTE

### Energy

June 2018

# Acknowledgments

This note was prepared by Paivi Koljonen, Dejan Ostojic and Rome Chavapricha.

# Table of Contents



## Figures



## Tables

# Overview

1. **Romania is endowed with diversified local energy sources**, including natural gas, coal, oil, bioenergy, nuclear, hydro, and renewable energy. The country's primary energy supply in 2015 was 31.9 million tons of oil equivalent[1] (mtoe), of which one-third was imported, and the rest supplied by domestic sources, with oil and gas as the top two at 27 percent each, followed by coal at 18 percent, biofuels at 12 percent, nuclear power at 9 percent, hydro at 4 percent, and geothermal/wind/solar at 2.5 percent.

2. **Electricity generation was 62 billion kilowatt hours in 2015, of which about 17 percent is exported.** The residential sector is the largest energy consumer, accounting for one-third of total energy consumption, followed by industry, transport, commercial services, and agriculture.

3. **Energy use per GDP is higher than the EU average.**[2] Romania uses more energy per GDP than its peers in the EU, although the intensity of energy use has been declining. In contrast, energy consumption per capita is half that of EU–28 average, implying that Romanian households use much less than households in other EU countries.

4. **Romania's power and gas networks are connected with neighboring countries**. The power grid is connected with all five neighboring countries—Hungary, Ukraine, Moldova, Bulgaria, and Serbia—and there are plans for additional connectivity. The gas grid is connected with Hungary and Ukraine for importing gas to Romania. Recently, a gas interconnector was built between Romania and Moldova, but it is not yet operational. For international gas transmission, the network already connects Ukraine, Romania, and Bulgaria, with more connectivity being planned.

5. **Romania is a net importer of petroleum products**. In 2016, energy imports accounted for 6 per cent of total merchandise imports, at US$4.2 billion, while energy exports accounted for US$2.3 billion, or 4 per cent of merchandise exports. Natural gas exports are expected to increase in the next 5–10 years as the Black Sea gas fields commence production. However, Romania is a net exporter of electricity.

6. **Regulatory framework is fragmented**. There are three regulatory agencies: Romanian Energy Regulatory Authority (ANRE), Romanian National Regulatory Authority for Municipal Services (ANRSC), and the National Agency for Mineral Resources (ANRM). The regulatory framework is fragmented, and lacks clarity about the future directions for renewable energy and other segments of the energy sector.

7. **The World Bank has had a significant engagement in the energy sector in Romania, although the level of engagement has declined in the recent years.** The latest investment project was the € 66m Energy Community of South East Europe Project (APL1)—closed in 2010—which financed the rehabilitation of the 510 MW Lotru hydro power plant and related TA. Also, two DPLs (1st and 2nd Fiscal Effectiveness and Growth Development, the 2nd one closing in December 2017) contain energy policy triggers. The IFC's latest energy investments were for district heating projects in Botosani and Timisoara cities in 2014. Currently, there are no World Bank Group-financed energy activities under implementation or preparation in Romania.

## Energy Sector Reforms

8. **Energy sector reforms have been comprehensive**. The energy sector has gone through a series of reforms, including corporatization of former state-owned energy monopolies, commercialization of energy companies, opening up the sector for private investments, deregulating energy prices, and introducing a competitive energy market.

9. **The electricity sector is self-financing**. Because of the reforms, the energy sector is largely self-financing and does not require large central government subsidies.[3] Electricity prices are liberalized and commercial consumers pay a premium, which is used to subsidize household consumers. Prices of natural gas are expected to be liberalized in 2018 in accordance with the gas market law, which is aligned with the EU 3rd energy package. However, prices for residential district heating are controlled by government, though there are plans to liberalize them. Given that district heating systems are run by municipalities as a public service, further assessment is required to understand their financial viability.

10. **Transmission, distribution, and supply have reformed the most**. Most reform progress has been made in electricity transmission, distribution and supply. Transmission is a regulated natural monopoly and the transmission company Transelectrica is listed on the stock exchange. Distribution and supply are liberalized, with more than 40 private providers. Electricity is traded on the Romanian Electricity and Gas Exchange Market Operator (OPCOM) platform.

11. **Reforms in generation have been limited**. The reform progress has been limited in electricity generation—especially coal, gas, and hydro—where most generation capacity remains under Government ownership. The state-owned enterprises (SOEs) Termoelectrica and Hidroelectrica own older assets, most of which require an upgrade or need to be decommissioned. Their financial position is weaker than other entities in the electricity supply chain, partly because of less-performing assets, which constrain commercial financing options. However, large private wind and solar generation capacity has been added in recent years, supported by the Green Certificate subsidy scheme, which helped Romania exceed the EU renewable energy target.[4] Thus, Romania has a significant overcapacity in the power generation and became a net exporter of electricity in the region.

12. **District heating is controlled by local governments and municipalities**. District heating (DH) entities are largely owned by local governments and municipalities. However, the government has implemented various models—such as concessions and management contracts—of private participation in secondary cities. As a result, the DH sector is fragmented, and recent attempts to harmonize DH regulation across the country and assure sustainability of DH systems have not yet proven successful.

13. **Natural gas supply is liberalized**. In the natural gas sector, reform is progressing well across the value chain in line with the EU 3rd energy package. Gas transmission is a regulated monopoly, managed by Transgaz, which is listed on the stock exchange. Gas distribution is liberalized, although the market remains concentrated, with the top two distributors (GDF Suez and E.On) having 97 per cent of market share for households, and the top four distributors (Petrom, Romgaz, GDF Suez, and E.On) serving 90 percent of commercial customers.

14. **Energy poverty is substantial**. Despite reforms, energy poverty remains substantial in Romania. EU proxy statistics put 25–40 percent of households under energy poverty—falling back on bill payments; incomes less than 60 percent of the national median; 30 percent of homes with poor insulation; and 25

percent of homes with inadequate heating. And as many as 100,000 households have no access to electricity.

## Government Energy Strategy

15. **The Government's Energy Strategy for 2016–2030 contains five key strategic goals:** i) Energy security; ii) Competitive markets; iii) Clean energy; iv) Modernization of the energy governance system; and v) Reduction of energy poverty and protection of vulnerable consumers. They are to be achieved through five main areas of state intervention:

1) Refurbishment of electricity generation plants;

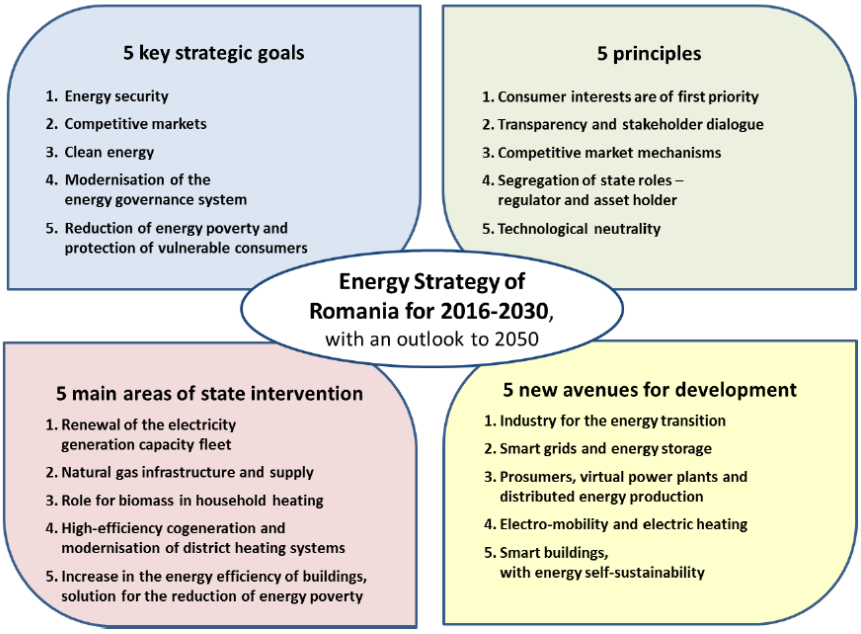
2) Improving natural gas infrastructure and supply;

3) Increasing the role of biomass in household heating;

4) Transitioning to high-efficiency cogeneration and modernization of district heating systems; and

5) Improving energy efficiency of buildings and developing solutions for reducing energy poverty.

**Figure 1. Elements defining the Energy Strategy of Romania for 2016–2030, with an outlook to 2050**



## Challenges and Opportunities

16. **The key challenges in the energy sector are**:

- Delays in modernization of energy infrastructure, particularly in the DH sector, which is facing risks of further decline and loss of financial viability because of an increasing rate of disconnections by better-off segments of the consumer population;
- Vulnerability of the energy poor to further degradation of DH services;
- Backlog of investment needs in power and gas transmission infrastructure;
- Fragmentation of regulatory framework and lack of clarity about the future directions for renewable energy and other segments of energy sector, which will be a subject of deliberation/agreement in the upcoming EU 4$^{th}$ Energy Package aiming to create an EU-wide Energy Union.

17. **There are multiple opportunities to further the development of the energy sector**, including:

- To increase self-sufficiency in natural gas through private sector investments in off-shore gas production and public investments in gas infrastructure;
- To replace outdated and low-efficiency combined heat and power (CHP) plants with high-efficiency combined cycle gas turbines (CCGT) co-generation, heat pumps, and other modern heating solutions, including biomass (woodchips), boilers, etc.;
- To introduce smart-metering and develop the next generation of demand-side energy efficiency applications for heat and power;
- To scale up regional (cross-border) energy trading through stronger interconnections, and regulatory harmonization with neighboring countries, including gas transmission capacity on the Bulgaria–Romania–Ukraine–Austria (BRUA) corridor, and a gas interconnector for Romania–Serbia, as well as power interconnections with Bulgaria and Moldova.
- Strengthen capacity and independence of ANRE and develop the next generation of regulations, particularly for the support of renewable energy and the replacement of green certificates with a more sustainable renewable energy policy in line with the EU practices.

## Conclusions and Priorities

18. **Building on the ongoing reform of the energy sector, and aligning with the strategic goals of the Energy Strategy of Romania for 2016–2030, the following measures emerge as priorities for the further development of the energy sector**:

- The highest priority is to improve the living standards of poor and vulnerable people. This would involve improving the functioning of the district heating systems, starting with a stock-taking of the status of fiscal and technical aspects, and achievements in country-wide district heating systems, through a diagnostic exercise. The outcome would outline household heating options and ensure the sustainability of DH systems, which has been undermined by consumers switching to individual gas heating in recent years. The optimization of a district heating system is particularly urgent for larger cities, including Bucharest, where a DH system is the most economic option for heat supply to densely populated areas, and is often the only viable option for poor and vulnerable consumers.
- In addition, a review of the role of biomass energy for households that are not connected to a district heating system or power grid should be carried out, to identify the impact of using biomass energy on peoples' health and wellbeing, and to outline measures to improve the situation.
- The next priority is to strengthen Romania's connectivity with neighboring countries, to monetize its energy resources and improve the financial viability of its energy companies.
- Another priority is a cross-cutting area of technical assistance, to strengthen the energy regulator ANRE, building on the diagnostic on district heating for which ANRE is a key counterpart. Also, a review should be made of energy tariffs and social networks to protect poor households from excessive energy payments.
- There is a need to improve the energy efficiency of buildings.
- Finally, given Romania's escalated risk for natural disasters and climate change, policy options would need to be explored to increase the resiliency of energy installations such as power substations, natural gas distribution centers, etc.

# Annex

**The Energy Sector—Resilience to Natural Disaster and Climate Change Risks**

1. Magnitude of disaster and climate risks

There is a risk of energy supply disruption following disaster and climatic events. For electricity and heating, such disruptions are limited, thanks to the diversified major electricity sources in Romania—coal, hydro, gas, nuclear, renewables, and biomass—import options, and back-up availability of power and natural gas networks. For petroleum products, disruptions are mitigated through in-country production, reserves, and imports from neighboring countries.

The physical resiliency of energy infrastructure helps mitigate risks inherent in hydro dams and nuclear plants, and other power and natural gas grids.

2. Economic impacts associated with observed and anticipated risks

Direct economic impacts from energy supply disruptions could be viewed from the annual value of various energy supplies in the country, by deriving one day's worth of supply as a proxy for supply disruptions.

For instance, in 2016:

- Import of energy commodities and products totaled US$4.2 billion—oil $3.5b, gas $0.35b, coal $0.23b, electricity $0.13b—about 2.2 percent of GDP.
- Energy exports totaled US$ 2.3 billion—oil $1.9b, electricity $0.33b, gas$ 84m—about 1.2 percent of GDP
- Value of electricity traded in the domestic power exchange
  - € 884.6m -- day-ahead market
  - € 586m -- bilateral contracts
  - € 3.7m – intraday market
- Economic value of domestic electricity generation, which reached 60 billion kilowatt-hours, valued at more than € 1.6 billion[5]
- Economic value of natural gas supply in Romania, which reached 12.1 billion cubic meters (~131 TWh; 447 trillion BTU; valued at more than € 2 billion[6])

3. Disaster risk management and energy sector

Building on the expected World Bank-supported disaster risk management project, there will be areas to improve energy sector resiliency during disaster events. From power stations to power lines to power substations, or from a natural gas field to gas plants to gas substations, or from an oil refinery to oil depot to oil pipeline to filling stations, the resiliency improvement list is long. Disaster risk management should continue to be on the development agenda for future energy engagements in Romania.

**Figure A1. The Electricity Transmission Grid of Romania**

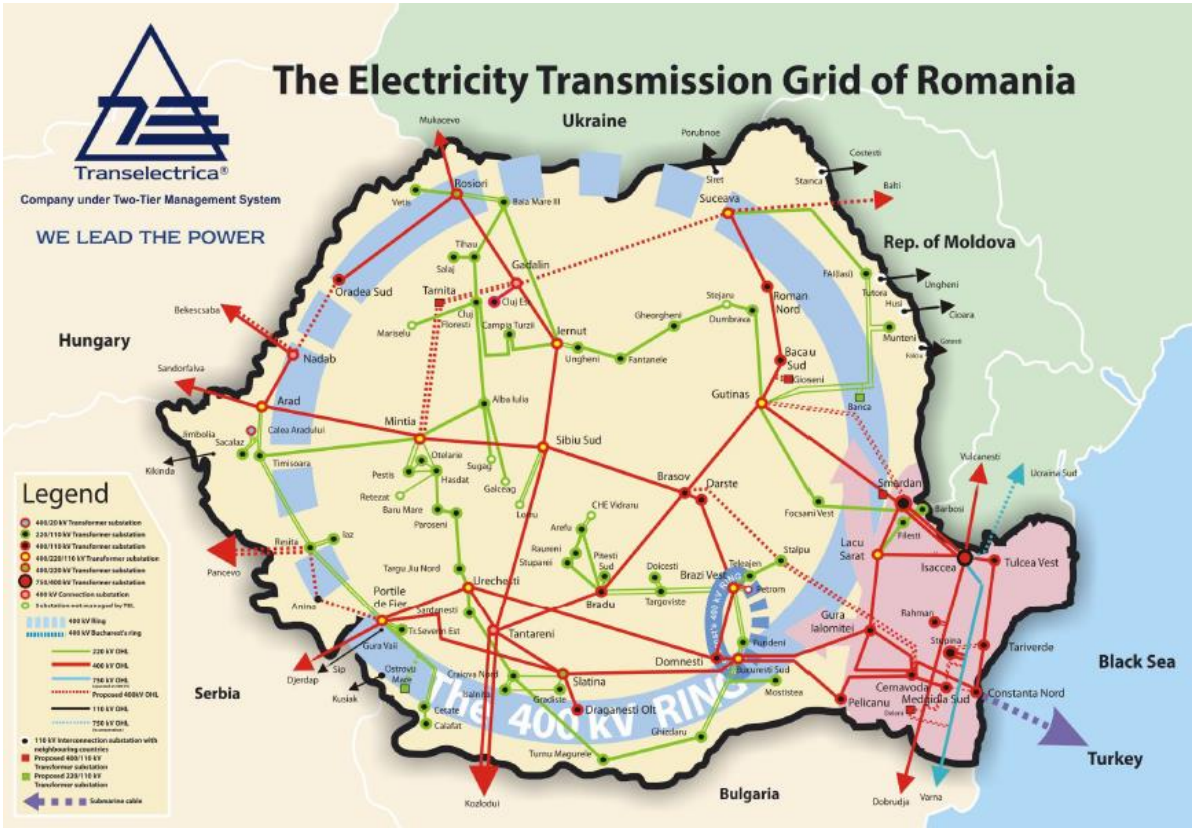
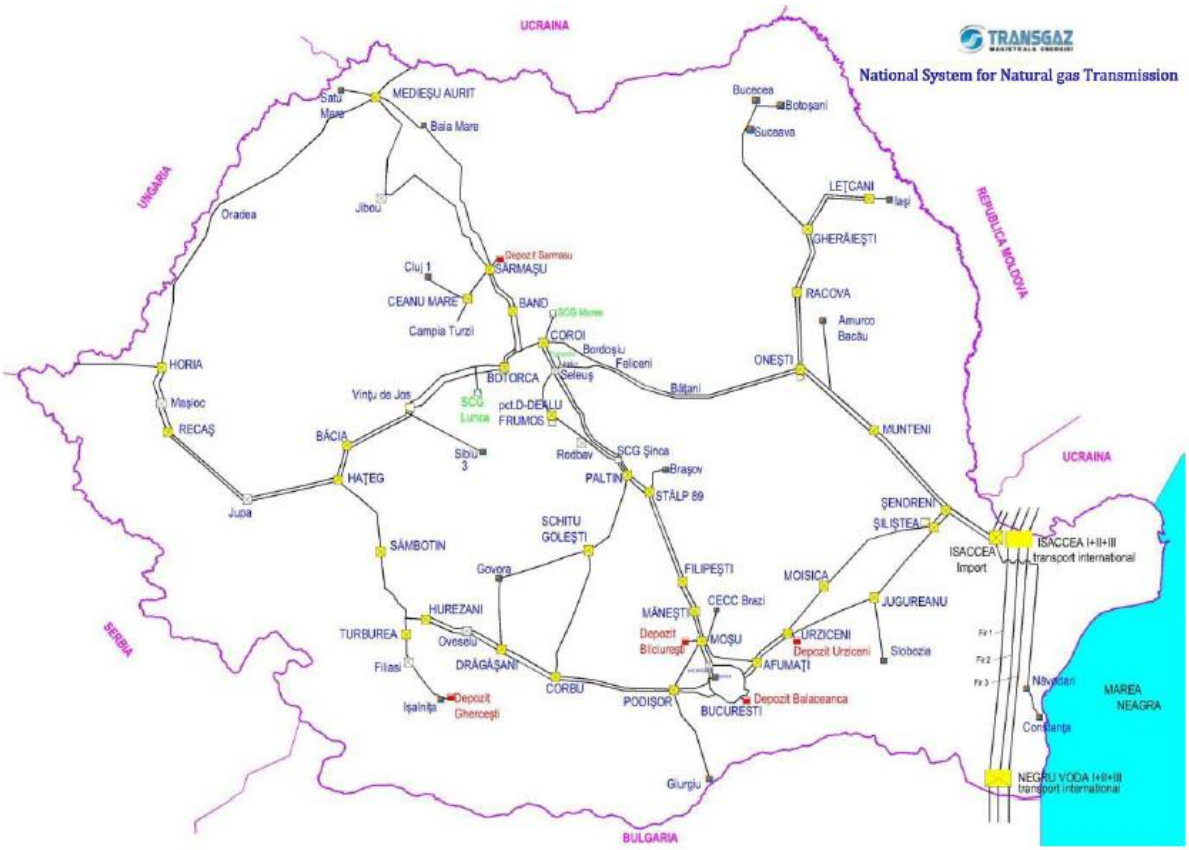


**Figure A2. Romania Natural Gas Transmission System**




**The main components of the National Gas Transmission System** are:

- 13,112 km of main transmission pipelines and connections for gas supply, of which 553 km of pipelines for the international transmission of gas;
- 1,119 gas regulating - metering stations;
- 6 gas metering stations for international transmission;
- 3 metering stations for imported gas (Isaccea, Medieşu Aurit, Csanadpalota);
- 5 gas compressor stations with a total power of 32 MW (GCS);
- 1,007 cathodic protection stations (CPS);
- 48 valve stations / technological nodes.

**The total design capacity of the NTS is of approximately 30 bcm/year (not including the international gas transmission pipelines, which have a total design capacity of 27.7 bcm/year and a total technical capacity of 21.35 bcm/year, at the current operating pressure).**

***Cross-border interconnection points***

At present, the gas imports to Romania are ensured through 3 cross-border interconnection points:

**UKRAINE**

**Orlovka (UA) – Isaccea (RO)**
Diameter = 1,000 mm
Capacity = 8.6 bcm/year
$P_{max}$ = 55 bar

**Tekovo (UA) – Medieşu Aurit (RO)**
Diameter = 700 mm
Capacity = 4 bcm/year
$P_{max}$ = 70 bar

**HUNGARY**

**Szeged (HU) – Arad (RO)- Csanadpalota**
Diameter = 700 mm
Capacity = 1.75 bcm/year
$P_{max}$ = 63 bar

## OPCOM

### Table A1. Power Exchange Statistics

**Day-Ahead Market (DAM)**

**Spot Market relevant figures for the year 2016:**

| | |
|---|---|
| Number of registered participants until 31 December 2016: | 337 |
| Number of active participants [participants/year]: | 283 |
| Average price [RON/MWh]: | 149.74 |
| Average price [EUR/MWh]: | 33.33 |
| Weighted average price [RON/MWh]: | 154.00 |
| Weighted average price [EUR/MWh]: | 34.27 |
| Total traded volume [MWh]: | 25,809,567.6 |
| Average traded volume [MWh/h]: | 2,938.2 |
| Market share [%]: | 47.01 |
| Value of transactions [RON]: | 3,974,713,504 |
| Value of transactions [EUR]: | 884,609,761 |

## International Energy Agency

### Table A2. Romania Energy Balances

Romania: Balances for 2015

*in thousand tonnes of oil equivalent (ktoe) on a net calorific value basis*

2015 | Indicators | Balances | Coal | Electricity and Heat | Natural Gas | Oil | Renewables and Waste

| | Coal* | Crude oil* | Oil products | Natural gas | Nuclear | Hydro | Geothermal, solar, etc. | Biofuels and waste | Electricity | Heat | Total** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Production | 4786 | 3929 | 0 | 8783 | 3033 | 1430 | 807 | 3770 | 0 | 0 | 26539 |
| Imports | 1055 | 7274 | 2420 | 161 | 0 | 0 | 0 | 191 | 386 | 0 | 11488 |
| Exports | -67 | -93 | -4768 | -1 | 0 | 0 | 0 | -151 | -965 | 0 | -6045 |
| International marine bunkers*** | 0 | 0 | -45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -45 |
| International aviation bunkers*** | 0 | 0 | -201 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -201 |
| Stock changes | 175 | -68 | 87 | -21 | 0 | 0 | 0 | -4 | 0 | 0 | 170 |
| **TPES** | **5949** | **11042** | **-2507** | **8923** | **3033** | **1430** | **807** | **3807** | **-579** | **0** | **31906** |
| Transfers | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Statistical differences | 46 | -24 | -208 | 25 | 0 | 0 | 0 | -19 | -9 | 45 | -143 |
| Electricity plants | -3503 | 0 | -3 | -946 | -3033 | -1430 | -778 | -31 | 4830 | 0 | -4895 |
| CHP plants | -1461 | 0 | -173 | -1403 | 0 | 0 | 0 | -112 | 839 | 1515 | -796 |
| Heat plants | -12 | 0 | -55 | -354 | 0 | 0 | -9 | -48 | 0 | 315 | -163 |
| Gas works | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Oil refineries | 0 | -11505 | 11789 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 284 |
| Coal transformation | -252 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -252 |
| Liquefication plants | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Other transformation | 0 | 494 | -386 | -101 | 0 | 0 | 0 | 0 | 0 | 0 | 7 |
| Energy industry own use | -42 | 0 | -851 | -440 | 0 | 0 | 0 | -12 | -765 | -232 | -2343 |
| Losses | -19 | 0 | -1 | -71 | 0 | 0 | 0 | -1 | -616 | -369 | -1077 |
| **Total final consumption** | **707** | **7** | **7605** | **5631** | **0** | **0** | **20** | **3584** | **3701** | **1273** | **22529** |
| **Industry** | **615** | **7** | **943** | **2237** | **0** | **0** | **1** | **312** | **1765** | **271** | **6150** |
| **Transport** | **0** | **0** | **5071** | **1** | **0** | **0** | **0** | **202** | **93** | **0** | **5367** |
| **Other** | **84** | **0** | **748** | **3060** | **0** | **0** | **20** | **3070** | **1842** | **1002** | **9826** |
| Residential | 76 | 0 | 244 | 2242 | 0 | 0 | 4 | 2950 | 1040 | 801 | 7358 |
| Commercial and public services | 0 | 0 | 82 | 750 | 0 | 0 | 15 | 6 | 723 | 184 | 1761 |
| Agriculture / forestry | 8 | 0 | 280 | 67 | 0 | 0 | 0 | 8 | 79 | 17 | 459 |
| Fishing | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Non-specified | 0 | 0 | 142 | 0 | 0 | 0 | 0 | 106 | 0 | 0 | 248 |
| **Non-energy use** | **8** | **0** | **843** | **334** | **0** | **0** | **0** | **0** | **0** | **0** | **1185** |
| *-of which chemical/petrochemical* | *0* | *0* | *21* | *334* | *0* | *0* | *0* | *0* | *0* | *0* | *354* |

**ANRE**

**Electricity Generation in 2015**

The following table presents the yearly quantities of electricity produced by the producers owning dispatchable units, in a downward list. In comparison with the individual data in the previous year, it appears that over 68% of production was carried out by the 3 classic producers, Hidroelectrica (hydropower), CE Oltenia (thermoelectric) and Nuclearelectrica (nuclear power), the rankings order of the top 3 producers remained the same as in 2014. It also notes that the first 8 generators have produced over 1 TWh in 2015 and represented a cumulative rate of over 85% of the yearly output of producers registered as holders of dispatchable units, according to the monthly reported data.

**Table A3. Yearly quantities of electricity generated by producers with dispatchable units**

| Dispachable producer | Electricity produced | |
|---|---|---|
| | TJ | GWh |
| Hidroelectrica SA | 4481 | 16132 |
| Complexul Energetic Oltenia SA | 4155 | 14957 |
| SN Nuclearelectrica SA | 3233 | 11640 |
| OMV Petrom SA | 962 | 3463 |
| Electrocentrale Bucureşti SA | 611 | 2199 |
| Complexul Energetic Hunedoara SA | 512 | 1842 |
| Romgaz SA | 499 | 1798 |
| Enel Green Power Romania SRL | 369 | 1330 |
| Tomis Team SRL | 216 | 777 |
| CET Govora SA | 171 | 614 |
| Ovidiu Development SRL | 149 | 535 |
| Veolia Energie Prahova SRL | 126 | 454 |
| Other (with market shares under 0.5%) | 1912 | 6883 |
| **TOTAL** | **17396** | **62624** |

*Source: Monthly reports of the dispatchable electricity producers*

[1] 7.15 barrels of oil in a metric ton.

[2] The ratio of gross inland energy consumption and GDP.

[3] Total budgetary subsidies are estimated at 0.8 percent of GDP in 2017 according to IMF.

[4] By 2015 Romania achieved 24.8% share of renewable energy in gross final energy consumption. This exceeded the 24% national action plan in support of the EU-wide Renewable Energy Directive target of 20% by 2020.

[5] Estimated based on OPCOM trade data.

[6] Estimated based on CEGH Gas Exchange data.