



Brussels, 23.11.2017
SWD(2017) 409 final

COMMISSION STAFF WORKING DOCUMENT

Energy Union Factsheet Romania

Accompanying the document

**COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN
PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL
COMMITTEE, THE COMMITTEE OF THE REGIONS AND THE EUROPEAN
INVESTMENT BANK**

Third Report on the State of the Energy Union

{COM(2017) 688 final} - {SWD(2017) 384 final} - {SWD(2017) 385 final} -
{SWD(2017) 386 final} - {SWD(2017) 387 final} - {SWD(2017) 388 final} -
{SWD(2017) 389 final} - {SWD(2017) 390 final} - {SWD(2017) 391 final} -
{SWD(2017) 392 final} - {SWD(2017) 393 final} - {SWD(2017) 394 final} -
{SWD(2017) 395 final} - {SWD(2017) 396 final} - {SWD(2017) 397 final} -
{SWD(2017) 398 final} - {SWD(2017) 399 final} - {SWD(2017) 401 final} -
{SWD(2017) 402 final} - {SWD(2017) 404 final} - {SWD(2017) 405 final} -
{SWD(2017) 406 final} - {SWD(2017) 407 final} - {SWD(2017) 408 final} -
{SWD(2017) 411 final} - {SWD(2017) 412 final} - {SWD(2017) 413 final} -
{SWD(2017) 414 final}

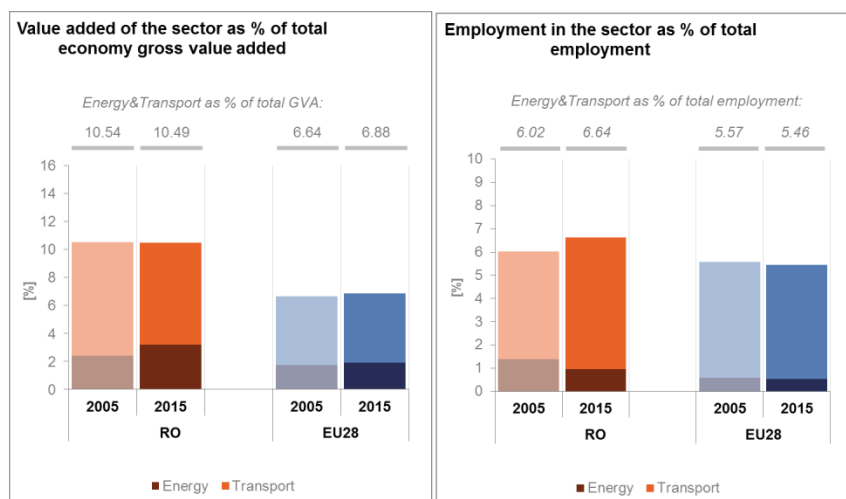


Romania

Energy Union factsheet¹

1. Macro-economic implications of energy activities

Energy and transport are key sectors for the overall functioning of the economy as they provide an important input and service to the other sectors of the economy. Together the activity in these two sectors² accounted for 10.5% of the total value added of Romania in 2015. Similarly, their share in total employment³ was 6.6% in 2015, of which 5.6% in the transport sector and 1% in the energy sector.



(source: Eurostat)

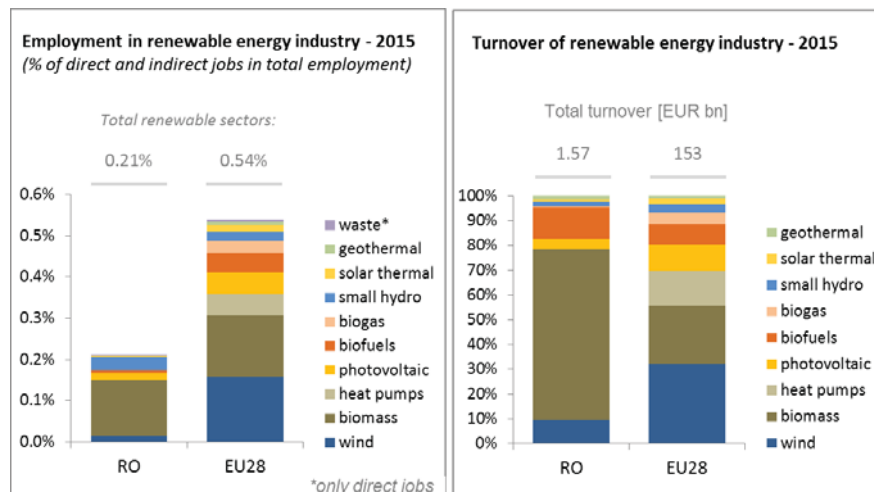
The decarbonisation of the energy and transport sectors will require significant investments and economic activity beyond the remit of these sectors themselves. The energy transition implies a structural shift in economic activity. Energy-related investment and jobs will in part migrate from traditional fossil fuel based activities towards construction, equipment manufacturing and other services related to the deployment of low carbon and clean energy technologies. At the moment, the efforts related to the low-carbon and clean energy transition in sectors beyond energy can only be partially quantified and are therefore not included in this analysis.

¹ The indicators used in this country factsheet largely build on indicators developed for the Commission Staff Working Document "Monitoring progress towards the Energy Union objectives – key indicators" (SWD(2017) 32 final) https://ec.europa.eu/commission/sites/beta-political/files/swd-energy-union-key-indicators_en.pdf

² Gross value added and employment in NACE sectors D-Electricity, gas, steam and air conditioning supply and H-Transportation and storage

³ National accounts, Eurostat

In the case of renewable energy sector, both the direct as well as the indirect effects on employment are being estimated. According to EurObserv'ER, in 2015, the share of renewable energy related employment in total employment of the economy in Romania was at about 0.21%. Employment was particularly high in biomass, small hydro, wind and photovoltaic industries. The turnover of the renewable energy industry in 2015 in Romania was estimated at around EUR 1.57 billion, about 70% being attributed to the biomass related industry, 12.4% to biofuels industry and almost 10% to the wind industry.

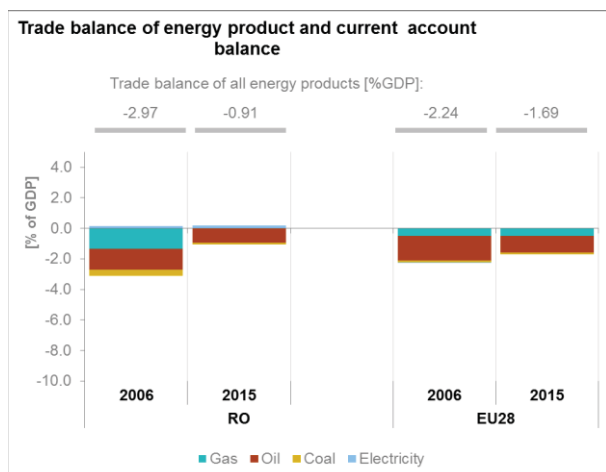


(source: EC based on Eurobserv'Er and Eurostat)

The overall investment, as measured by the Gross fixed capital formation (GFCF)⁴, is usually taken as an indication of the level of efforts and challenges in the energy sector. However, data is not available for Romania for this indicator.

In terms of trade, Romania is a net importer of gas, oil and coal, but it has reduced its deficit between 2006 and 2015, while it continues being a net exporter of electricity. The trade deficit in energy products has fallen from about 3% of GDP in 2005 to around 1% in 2015, influenced by a decrease in the import of gas, which accounted for 1.3% of the GDP to almost nothing in 2015, and the decrease in the oil trade balance from 1.4% of the GDP to 0.9%. The trade surplus in electricity remained at around the same level in 2006 and in 2015.

⁴ Gross fixed capital formation consists of resident producers' acquisitions, less disposals, of fixed tangible or intangible assets. This covers, in particular, machinery and equipment, vehicles, dwellings and other buildings. It also includes foreign direct investment (FDI).



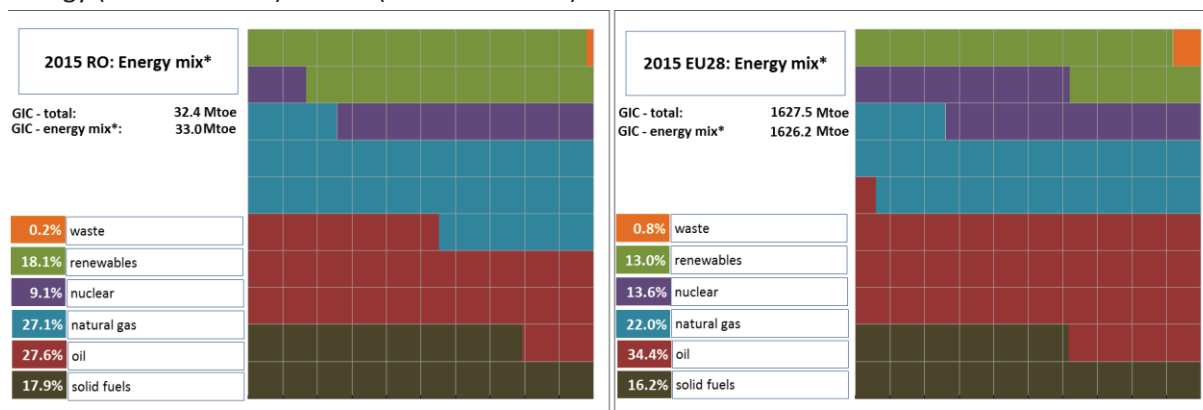
(source: Eurostat)

2. Energy security, solidarity and trust

2.1. Energy Mix

In 2015, Romania's gross inland consumption was of 32.4 Mtoe. The highest shares of primary products in the energy mix were taken by petroleum products (27.6%) and gas (27.1%), followed by renewables (18.1%), solid fuels (17.9%) and nuclear (9.1%).

In comparison to the average energy mix in the EU, Romania's energy mix has a higher share of renewable energy (18.1% vs 13%) and natural gas (27.1% vs 22%) and a lower share of nuclear energy (9.1% vs 13.6%) and oil (27.6% vs 34.4%).



*energy mix as share share in GIC-excluding electricity and derived heat exchanges, GIC=gross inland consumption

(source: Eurostat)

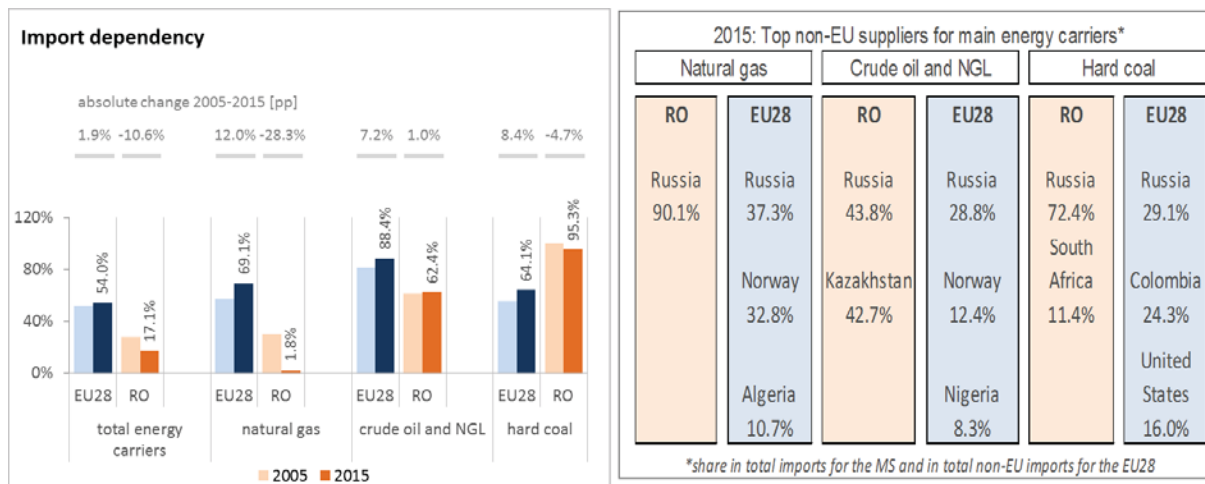
2.2. Import dependency and security of supply

The overall energy import dependency of Romania is low, reaching 17,1% in 2015, well below the EU average. The overall import dependency of Romania recorded a decrease of about 10.6 p.p. between 2005 and 2015, whilst at the EU level, import dependency increased by 1.9 p.p. over the same period.

Gas import dependency has considerably decreased since 2005. In 2015, it is of 1.8%, a level particularly low compared to most other EU Member States, reflecting the importance of domestic

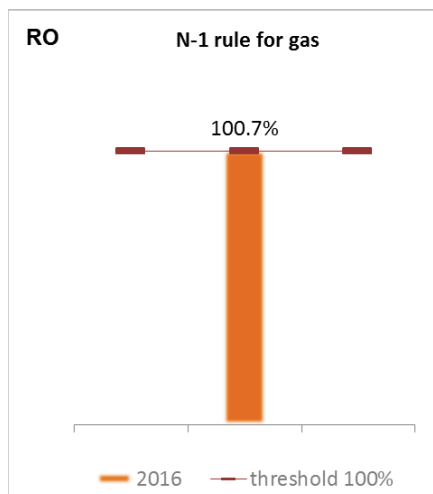
gas production and the decreased level of demand. Despite a low level of import dependency, the imported gas volumes are sourced predominantly (90.1%) from one main supplier, Russia.

Romania imported 62.4% of its oil needs in 2015 from two sources: Russia (43.8%) and Kazakhstan (42.7%). Russia is also the dominant supplier of hard coal (72.4%).



(source: Eurostat)

The Regulation concerning measures to safeguard security of gas supply requires that, if the single largest gas infrastructure fails in one Member State, the capacity of the remaining infrastructure is able to satisfy total gas demand during a day of exceptionally high gas demand. In accordance with the Regulation, Romania complies with this rule, reaching a N-1 value of 100.7%.

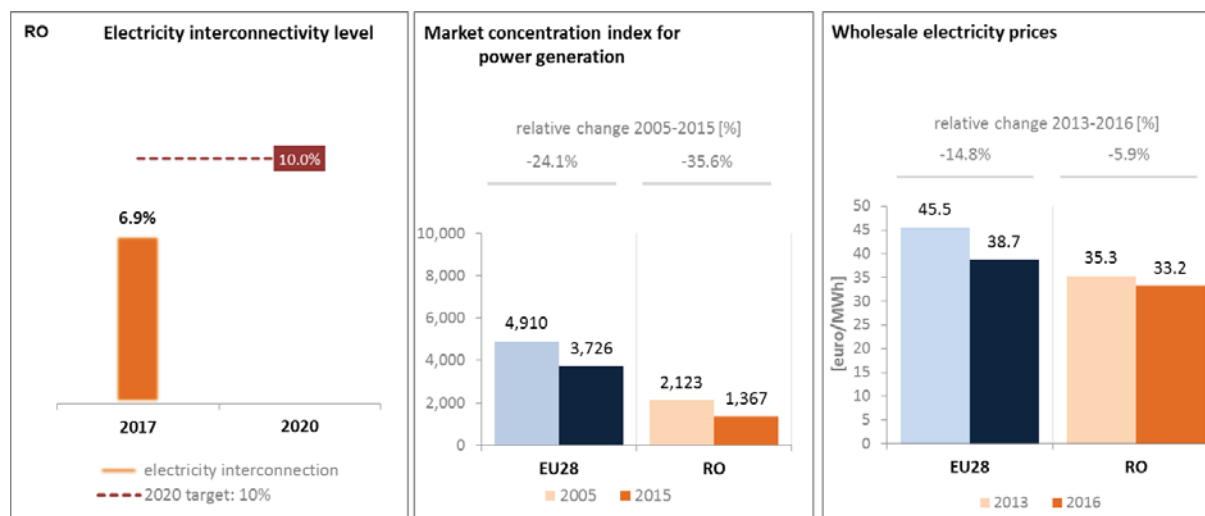


(source: gas coordination group)

3. Internal market

3.1. Interconnections and wholesale market functioning

3.1.1. Electricity



(source: EC based on ENTSO-E scenario outlook and adequacy forecast 2014) (sources: EC services based on Eurostat for the left graph and based on Platts and European power exchanges for the right graph)

In 2016, the electricity interconnectivity level⁵ of Romania was 7%, below the 2020 target of 10% set by the European Council. To reach the 10% target by 2020 several Projects of Common Interest should be implemented, notably an interconnection with Serbia and five internal lines for upgrading the existing national electricity system. Romania will have to further enhance its interconnection capacity with neighbouring countries (PCIs with Bulgaria and PECIs with the Republic of Moldova) to fully exploit its high generation capacity.

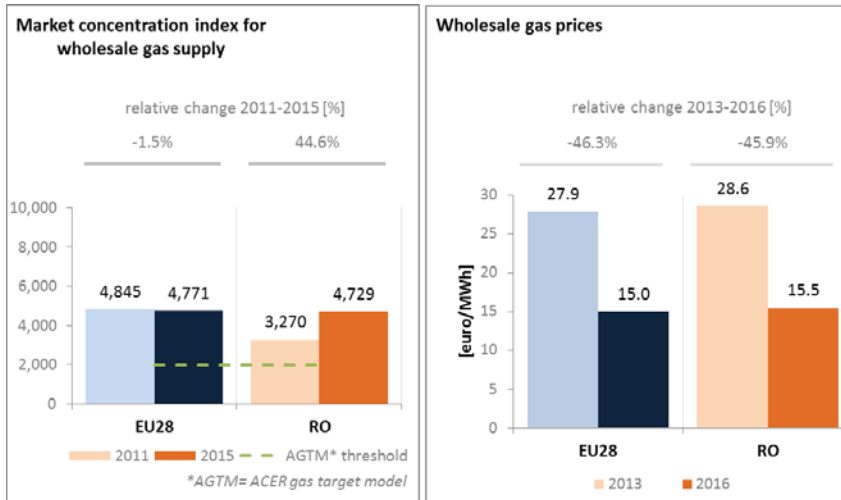
Concentration on the Romanian power generation market is low. Due to changes in legislation, transactions performed on the centralised competitive electricity wholesale markets significantly increased. Wholesale electricity prices are below the EU average, however between 2013 and 2016 recorded a decrease of 5.9 % compared with a decrease of 14.8% at EU level.

Gas

The Romanian gas market concentration is at the same level with the EU average. Despite this, wholesale gas prices in 2016 were slightly higher than average EU gas prices, decreasing since 2013 by 45.9% (i.e. EU average decrease by 46.3%). Gas market competition could further improve with the completion in 2019 of the Bulgaria- Romania- Hungary- Austria (BRUA) CEF co-financed pipeline which will enable cross-border trade in gas at regional level and will stimulate gas market liquidity on the Romanian market.

Legislative and regulatory measures have been taken to liberalize the wholesale gas market as of 1st of April 2017, through the Emergency Law 64/2016.

⁵ The interconnectivity level is calculated as a ratio between import interconnection and net generation capacities of the country (i.e. the 2017 value is the ratio between simultaneous import interconnection capacity [GW] and net generating capacity [GW] in the country at 11 January 2017, 19:00 pm as resulted from ENTSO-E Winter Outlook 2016/2017)



(source: ACER for the left graph and EC services based on on Platts, gas hubs, Eurostat for the right graph)

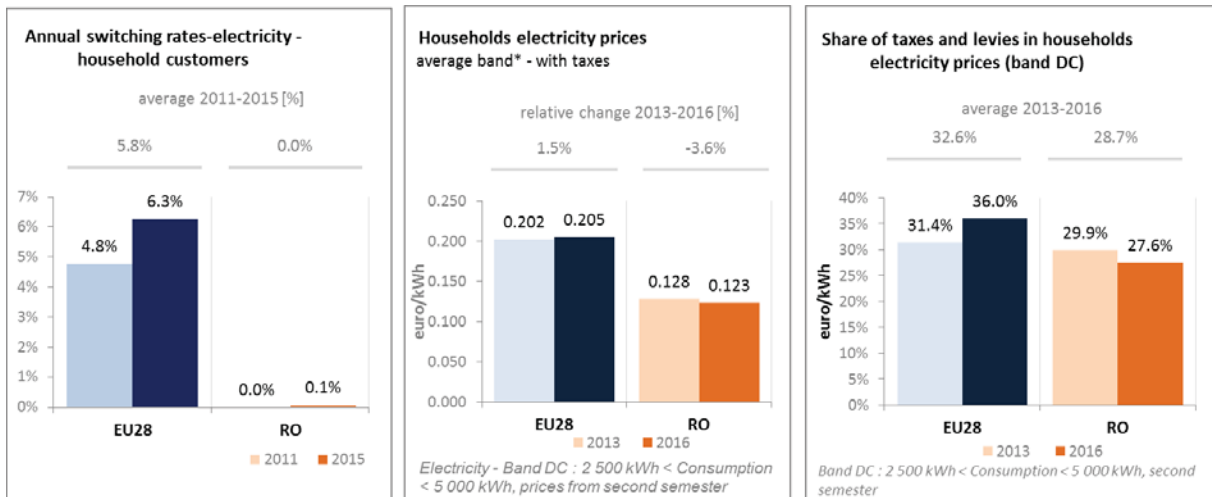
3.2. Retail electricity and gas markets

3.2.1. Electricity

In 2016, households' electricity prices in Romania were below the EU average. The share of taxes and levies in households electricity prices were in 2016 at around 8 p.p. below the EU average.

The annual switching rate by consumers from one electricity supplier to another is close to zero.

The liberalisation of electricity prices for households is planned for end 2017 whilst electricity prices for non-households are fully liberalised since 2014.



(source: ACER)

(source: Eurostat)

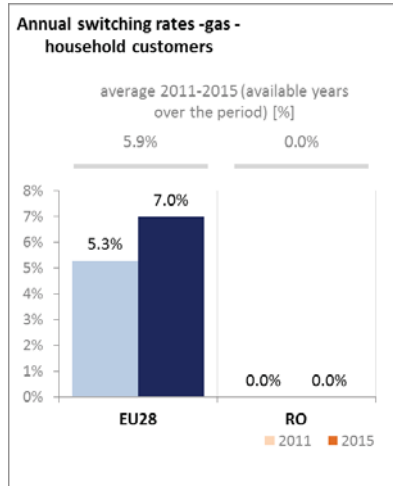
(source: Eurostat)

3.2.2. Gas

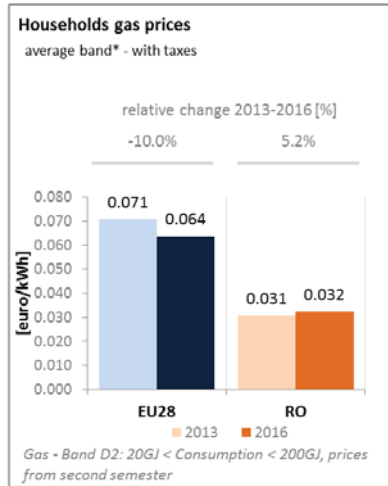
In 2016, households' gas prices in Romania were much below the EU average. Nevertheless, between 2013 and 2016, average band retail gas prices for households increased by 5.2%, while at the wholesale level they decreased. This increase at retail level can be partially explained by a 49% increase in taxes and levies.

Gas prices for non-households are fully liberalised since the beginning of 2015. The liberalisation of gas prices for households is planned for 2021.

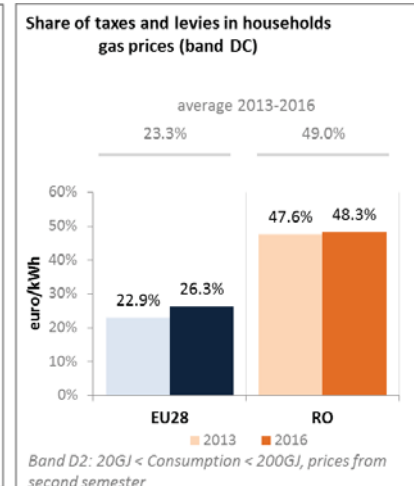
Due to the negative or slim margins allowed by price regulation, suppliers are discouraged to making offers outside their supply areas, therefore consumer choice is in reality often very limited, and this translates into very low switching rates (i.e. around 0% in 2015).



(source: ACER)



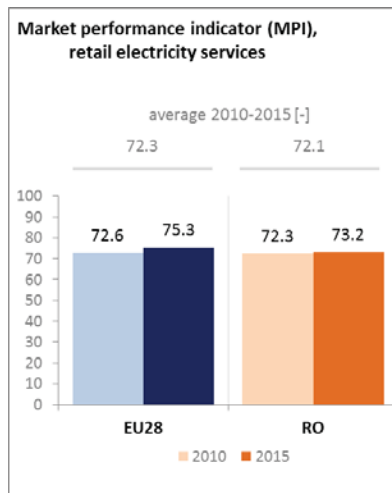
(source: Eurostat)



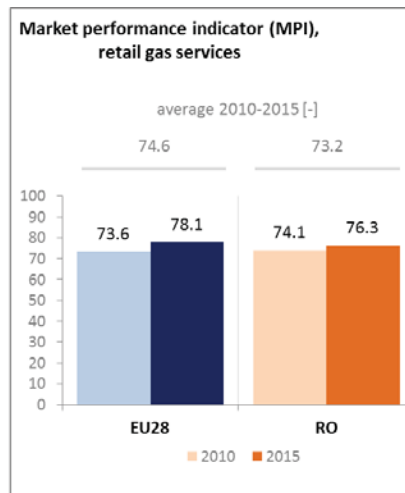
(source: Eurostat)

3.2.3. Market performance indicators

According to the periodical survey of DG JUST, the Romanian consumers are less satisfied than the EU average about the services received on energy retail markets.

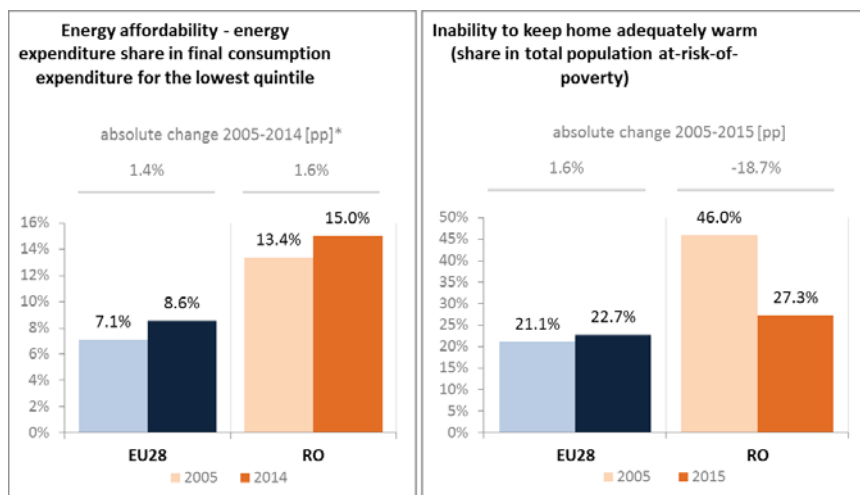


(source: DG JUST survey)



3.3. Energy affordability

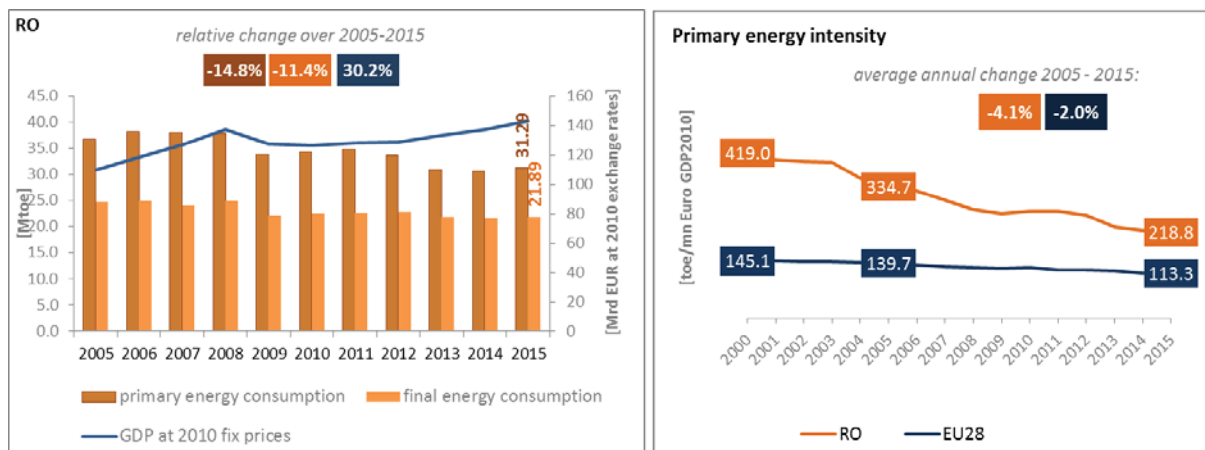
In Romania, the share of energy in total household expenditure of the lowest quintile of population is among the highest in the EU, i.e. at around 15% as comparing to 8.6% at the EU average. The part of population unable to keep home adequately warm decreased significantly (-18.7%) during the period 2005-2015 reaching 27.3% (above the EU average of 22.7%). This can be explained by low purchasing power but also by low energy efficiency standards of residential buildings.



(source: ad-hoc data collection of DG ENER based on HBS with the support of Eurostat and national statistics)

4. Energy efficiency and moderation of demand

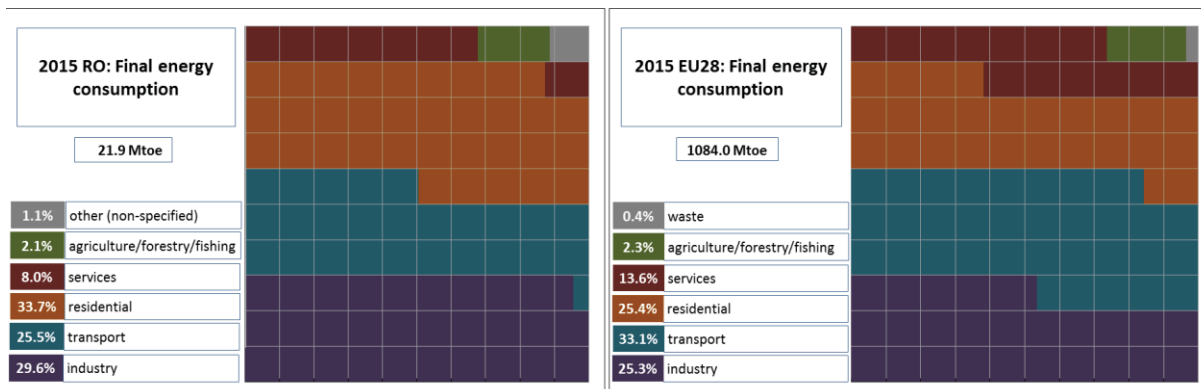
Romania reduced its primary energy consumption from 36.7 Mtoe in 2005 to 31.3 Mtoe in 2015. Final energy consumption decreased from 24.7 Mtoe in 2005 to 21.9 Mtoe in 2015. Primary energy intensity in Romania remains above the EU average, but has improved more than most other Member States since 2005. Final energy consumption per capita in households is below the EU average. In terms of implementation of the Energy Efficiency Directive, Romania started with some delay but made progress both in 2015 and 2016.



(source: Eurostat)

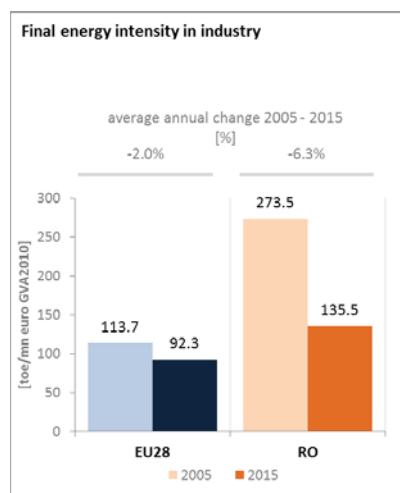
In 2015 in Romania, the residential sector was the biggest energy consuming sector representing a 33.7% share in the total final energy consumption, which is well above the EU average (i.e. 25.4%). The residential sector is followed by industry, representing 29.6% of the total final energy consumption (slightly above the EU average of 25.3%). The transport sector comes on the third place with 25.5% of the total final energy consumption (well below the EU average of 33.1%). The energy consumption of the services sectors in Romania are below the EU average, with a share in total final energy consumption of 8%.

For the period 2014-2020 Romania allocated significant amounts of EU Cohesion policy funds for energy efficiency, in particular for the residential sector. This is expected to improve the energy performance of buildings, and reduce their energy consumption.

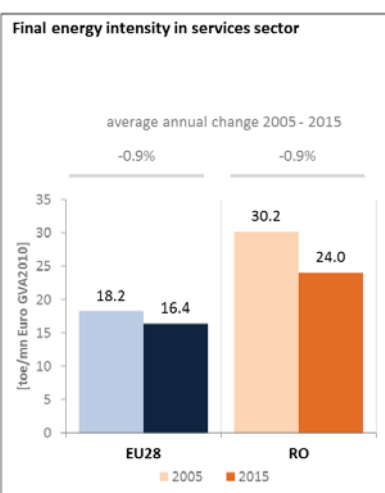


(source: Eurostat)

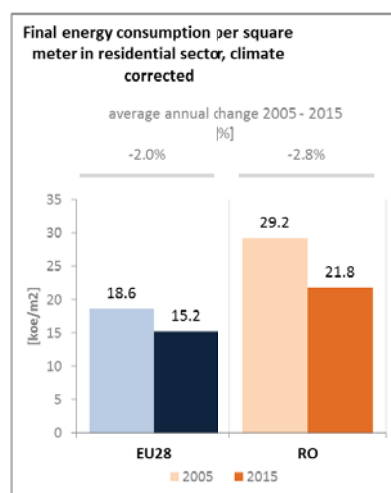
Between 2005 and 2015 the energy intensity in industry decreased significantly, with an average annual change of 6.3%, more than triple than the EU average of 2%. In the service sector there was a slight decrease of energy intensity (by 0.9% annual average change, similar to the EU-28). Over the same period of time, the energy consumption per square meter and climate corrected of Romanian households decreased by 2.8%, more than the EU average of -2%), but it remains higher than the EU average.



(source: Eurostat)

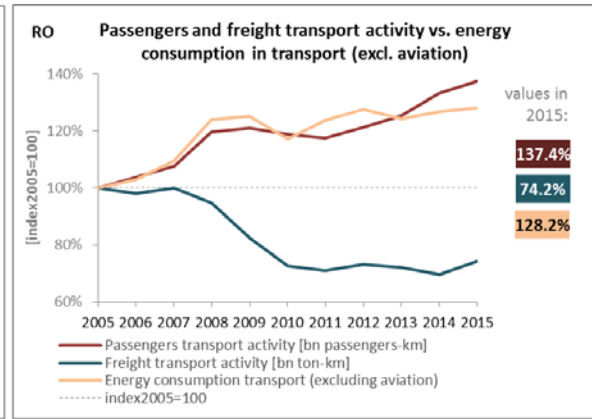
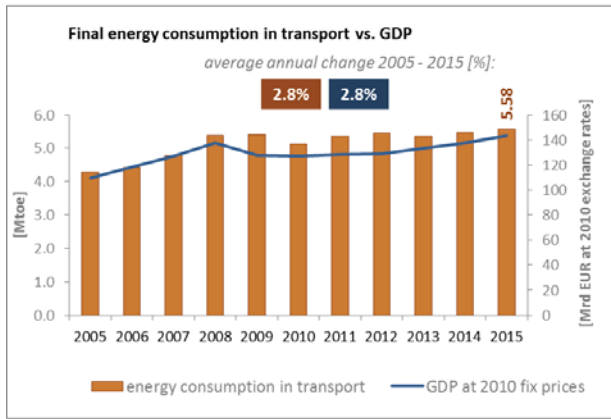


(source: Eurostat)



(source: Odyssee database)

Between 2005 and 2015, the final energy consumption in transport recorded an average annual increase of 2.8%, just as GDP over the same period. Behind the increase by 28.2% in energy consumption in transport, divergent trends could be observed over this period: while passenger transport activity increased by 37.4%, freight transport activity decreased by 25.8%.

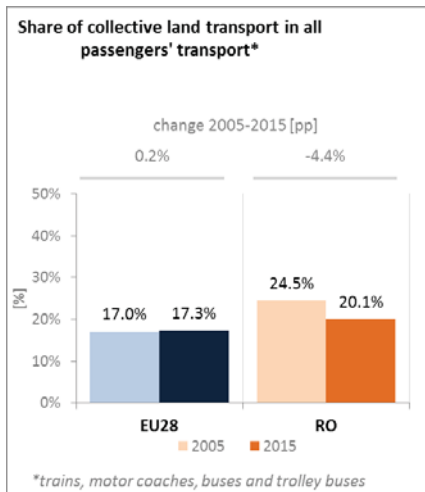


passengers transport activity=Private cars + bus + rail + tram & metro
freight transport activity=road+rail+inland waterways+pipeline

(source: Eurostat)

(source: Eurostat and DG MOVE pocketbook)

The share of collective land transport in total transport is still higher than the EU average, but it decreased over the last decade (-4.4 p.p. in 2015, as compared to 2005), indicating an increase in private transportation use.



(source: Eurostat)

With the adoption of the General Transport Master Plan in October 2016, the efforts of the Romanian authorities are now focused on its implementation, including increasing the absorption of the European funds, by rendering the investments in infrastructure more efficient. The Ministry of Transport will benefit from the expertise of the EIB through technical assistance projects in order to improve the management capacity of European funds and the preparation and implementation of major transport infrastructure projects. Among the most significant transport projects currently under way is the motorway project Sibiu-Pitesti.

An important element of the reform of the transport sector is the on-going restructuring of the road and rail agencies. The newly created Authority for Railway Reform will focus on restructuring the national rail network and the recovery of the rail transport by increasing its competitiveness.

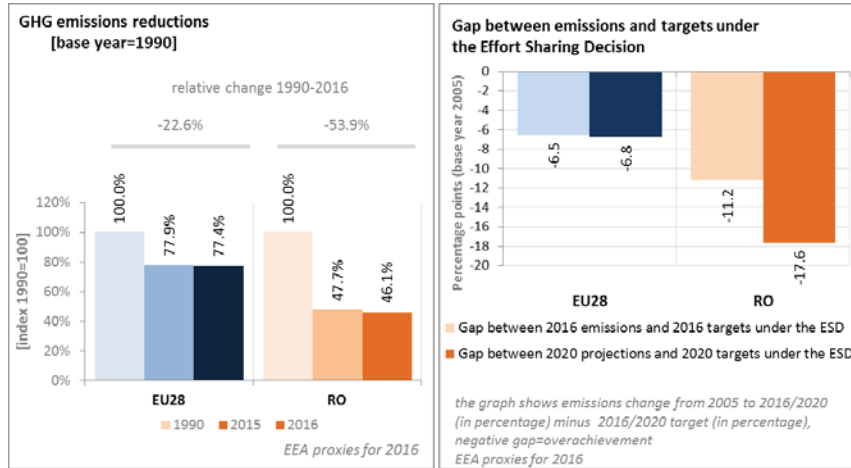
In the field of rail passenger transport a positive development can be noticed, as regards application of EU railway law. Romania notified its new railway law transposing the Single European Railway Area Directive in 2016.

5. Decarbonisation of economy

5.1. GHG emissions

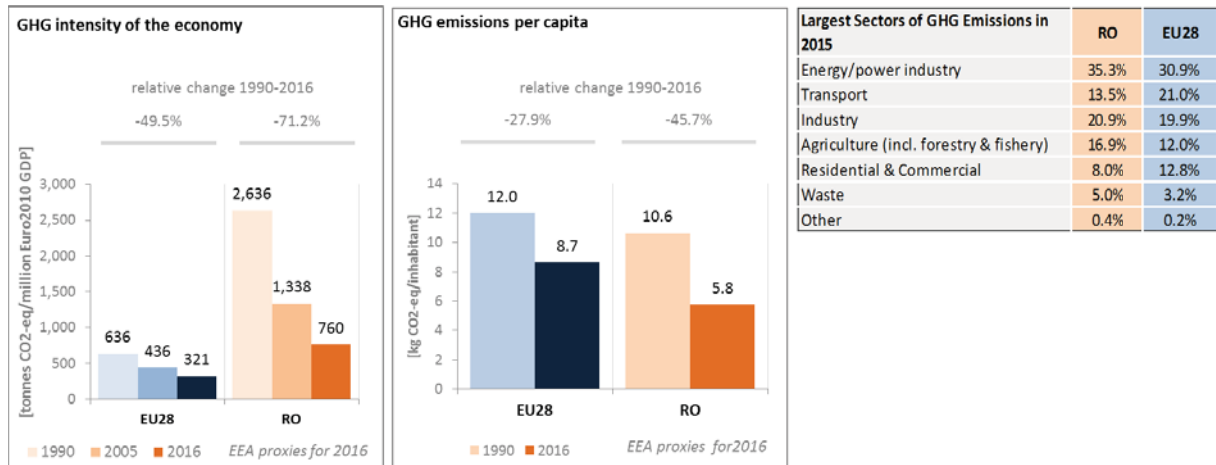
The GHG emissions have been reduced by 53.9% since 1990, more than twice the EU28 average reduction over the same period.

Romania has decreased its non-ETS emissions by 4% between 2005 and 2016. According to the latest national projections and taking into account existing measures, Romania is expected to reach its 2020 target with about 18 p.p. margin.



(source: EC and EEA)

In 2015, the GHG emissions per capita in Romania were well below the EU average. The energy/power industry sector was the largest emitting sector in 2015 (35.3% of total emissions) followed by industry including manufacturing industries and construction category (20.9%) and agriculture including agriculture / forestry / fishing category (16.9%).

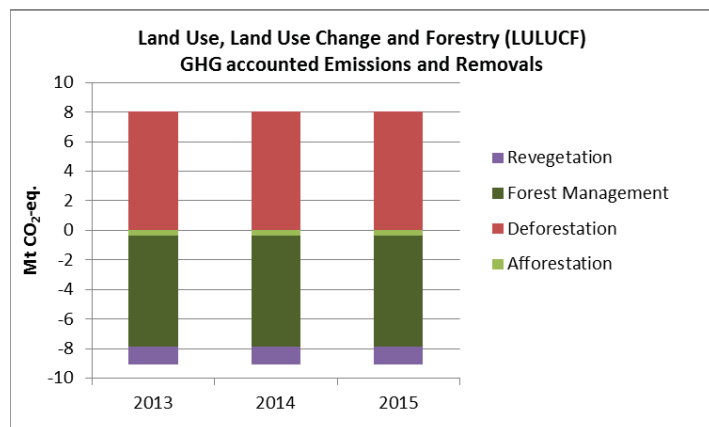


(source: EC and EEA)

Preliminary accounts under the Kyoto Protocol for Romania show overall removals of -1.0 Mt CO₂-eq. as an annual average in the period 2013-2015. For comparison, the annual average of the EU-28 accounted for removals of -119.0 Mt CO₂-eq. It should be noted that in this preliminary simulated

accounting exercise, removals from Forest Management did not exceed the accounting cap. Romania is the only EU Member State with accounted removals by Revegetation.

Emissions by Deforestation are notably higher than very limited removals by Afforestation. Removals by Forest Management, of nearly the same quantity as emissions by Deforestation, make up the highest share among all removals, followed by removals by Revegetation. Overall, there is no trend in removals; in fact all activities show no particular trend over the course of the three-year period.

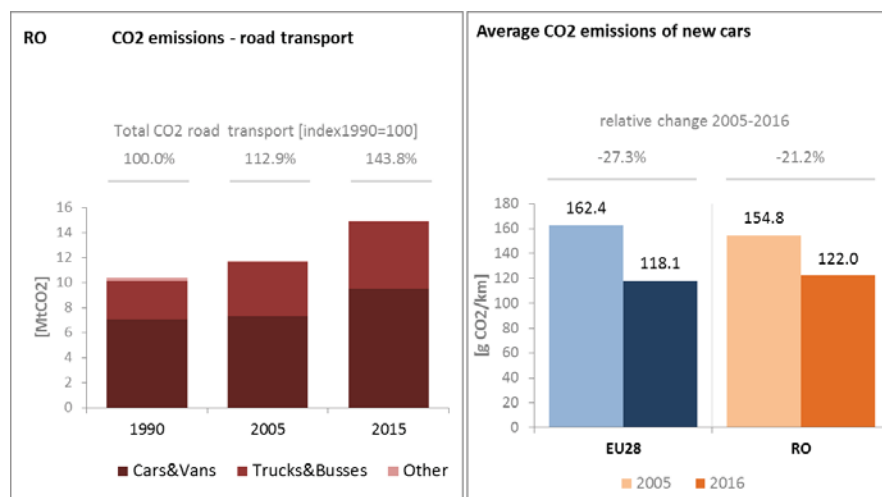


Note: Forest Management credits are capped and presented as yearly averages when the total Forest Management credits of the considered period exceed the simulated cap over the same period.
 (source: EC and EEA)

CO₂ emissions in transport and alternative vehicles

In Romania, the CO₂ emissions from road transport were in 2015 almost 44 % higher than in 1990, reflecting the consistent increase of passengers and freight traffic when moving towards a market economy. Nevertheless, between 2005 and 2016 the average CO₂ emissions for new cars decreased over the last years, but at a slower pace than at the EU average (-21.2% vs. -27.3%).

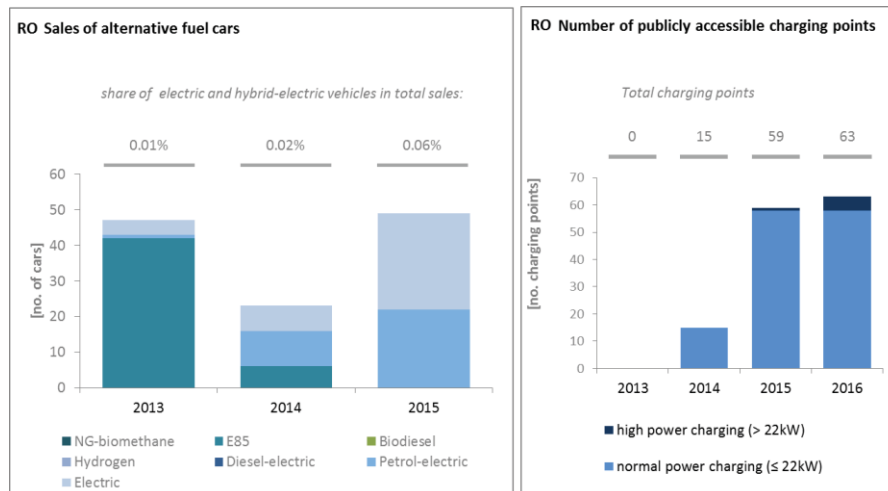
The emission reduction may be partly due to the a Programme for Renewing the National Car Fleet (“Rabla”) that Romania has been implementing for 12 years now. In 2016 a new component was added to the programme providing support for the purchase of hybrid or electric cars even without the replacement of an older one. Moreover, Romania launched a complementary project to further develop the infrastructure for the usage of such cars.



(source: European Environment Agency)

The share of electric cars in total sales on the Romanian market is very small, around 0.06% of total cars sales in 2015 (i.e. 22 petrol-electric cars and 27 electric cars).

Over the last three years the number of electric charging points in Romania has increased from 15 units in 2014 to 63 units in 2016.



(European Environment Agency)

(European Alternative Fuels Observatory)

Directive [2014/94/EU](#) on the deployment of alternative fuels infrastructure calls upon Member States to "adopt a national policy framework for the development of the market as regards alternative fuels in the transport sector and the deployment of the relevant infrastructure". The Directive sets out the obligation for Member States to "notify their national policy frameworks to the Commission by 18 November 2016".

The national policy framework is crucial to the creation of the conditions for the uptake of alternative energies in transport and to enabling Member States to reach the objectives they set themselves through the 2030 Energy and Climate framework and the EU's commitments at COP21.

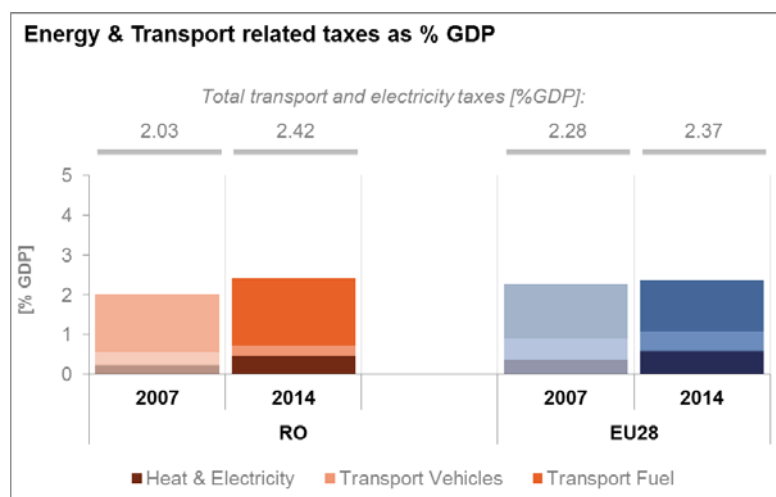
The Romanian authorities are going to adopt the national policy framework and to promote it through a legal act around mid-November 2017. Nevertheless, Romania still has to notify the Commission that it fulfilled its obligations under Article 3(7) of Directive [2014/94/EU](#) on the deployment of alternative fuel infrastructure.

5.2. Adaptation to climate change

In 2016, Romania adopted its 2016-2030 National climate change and low carbon growth strategy and an associated 2016-2020 national action plan on climate change – each of them with distinct adaptation components. The sectors covered are: agriculture and rural development, water resources, infrastructure and urban planning, transportation, industry, energy, tourism, forestry, biodiversity, education, insurance, public health and emergency response services. Reports on the implementation of the NAS/NAP have so far not been published. Actually, apart from the regular implementation progress report on the action plan, which is to be provided according to the strategic environmental assessment permit, no specific monitoring framework has been provisioned.

5.3. Taxes on energy and transport and fossil fuel subsidies

Romania is close to the EU average in terms of energy and transport taxation as a proportion of the GDP (both around 2.4% in 2014). This also represents an increase compared to 2007 by 0.4 p.p. Energy taxes are the main component of this revenue (2.2%), whilst only 0.3 % comes from taxation on transport (excluding fuel). In 2014, transport fuel taxation accounted for a higher share of tax revenue in Romania than in the EU average, whereas the opposite applies for transport vehicle taxes. Heat and electricity taxes in Romania represent 0.5% of GDP, which reflect an increase since 2007 but remains below the EU average. The car taxes are not dependent on CO₂ emissions. The registration tax is dependent on engine size (engine displacement in cc).



(source: Eurostat)

State aid decisions were adopted under Council Decision 2010/787/EU to support the closure of uncompetitive coal mines in order to alleviate the social and environmental impact and several schemes and plans have been put in place⁶.

5.4. Renewable energy

With 24.8% renewable energy share in gross final consumption, Romania is well on track and even above in attaining its renewable energy target for 2020. Romania met the 2013/2014 indicative trajectory on RES share in gross final energy consumption; it is well above its 2015/2016 indicative trajectory as well as its 2020 target as set under the Renewable Energy Directive.

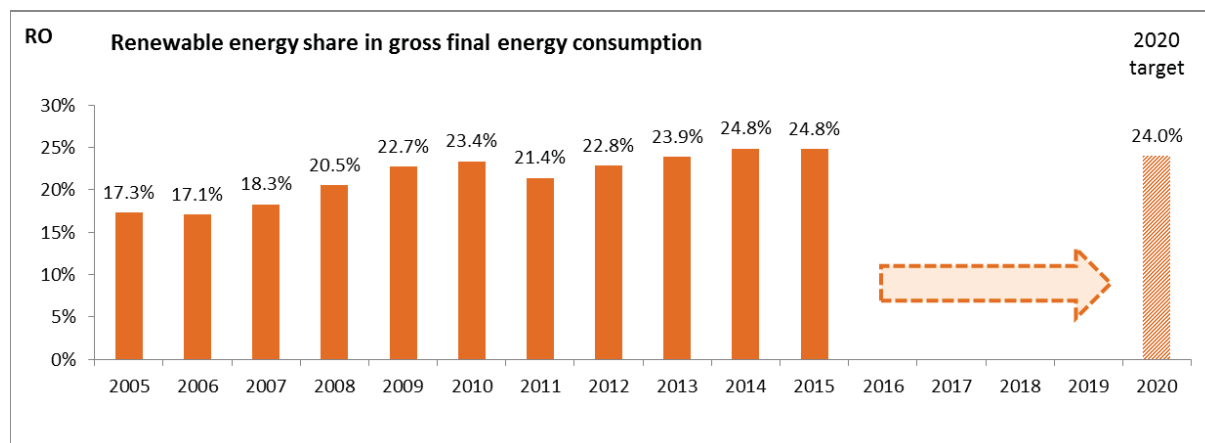
Looking at sectors, in 2015, Romania reached a renewable energy share in transport of 5.5% and a renewable energy share in heating & cooling of 25.9%.

In 2015, 43.2% of the electricity was generated from renewable energy sources out of which 27.8% from hydro, 11.1% from wind and 3.35% from solar energy. This confirms the already significant

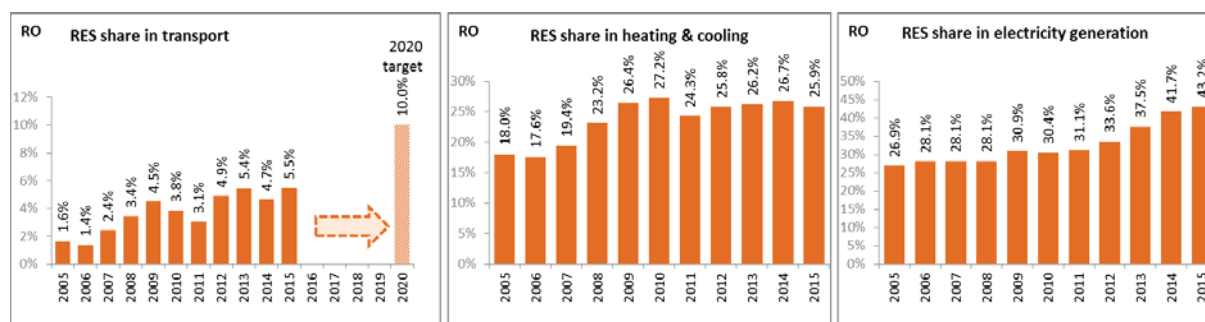
⁶ For instance, in 2012, three coal units received state aids for closure plan (http://ec.europa.eu/competition/state_aid/cases/241737/241737_1352982_64_2.pdf), and likewise for two additional coal mines in 2016 (http://ec.europa.eu/competition/state_aid/cases/266815/266815_1884825_88_2.pdf)

contribution of hydro to electricity generation in Romania but also reveals the consistent development of wind and solar electricity generation from 2010 onwards.

The deployment of wind and solar energy technologies was facilitated due to a generous Green certificates scheme in place from 2008 onwards. The support scheme was adjusted in 2013/2014 and basically halved the number of certificates attributed to wind and solar PV. On 30 March 2017 the Emergency Ordinance 24/2017 has been adopted, approving the amendments to the renewable energy support scheme, providing a balanced approach to promoting renewable energy in a sustainable manner while ensuring a reasonable consumer impact. This approach brings the much needed stability and predictability to the Romanian renewable energy sector.



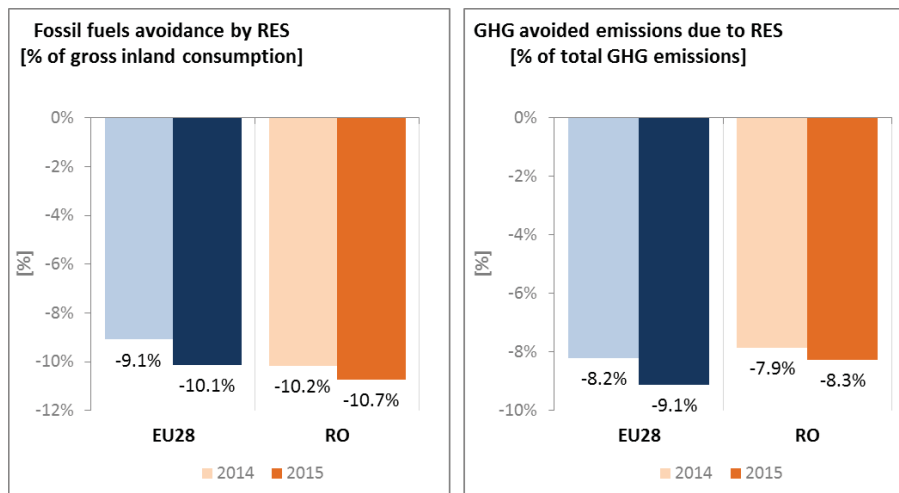
(source: Eurostat-SHARES)



(source: Eurostat-SHARES)

Due to a consistent deployment of renewables since 2005, it is estimated that Romania avoided in 2015 about 10.7% of the fossil fuel use in gross inland consumption and about 8.3% of GHG emissions at national level⁷.

⁷ Avoided GHG emissions mentioned here have a theoretical character as these contributions do not necessarily represent 'net GHG savings per se' nor are they based on life-cycle assessment or full carbon accounting.

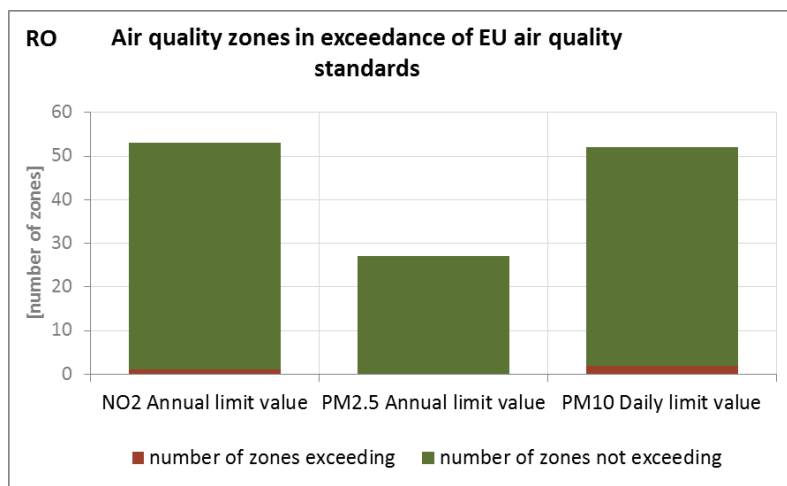


(source: EEA)

5.5. Contribution of the Energy Union to better air quality

Air quality in Romania continues to cause concern. For 2013, the European Environment Agency estimated that about 25,330 premature deaths were attributable to concentrations of fine particulate matter (PM_{2.5}) concentrations and 1,900 to nitrogen dioxide (NO₂) concentrations⁸.

For both pollutants Romania reported exceedances of the binding EU air quality standards⁹. For the year 2015, Romania reported exceedances of the limit value for PM₁₀ in 2 out of the 52 air quality zones in Romania, while exceedances of the limit value for NO₂ were reported in 1 of 53 zones as shown in the figure below¹⁰.



(source: EEA)

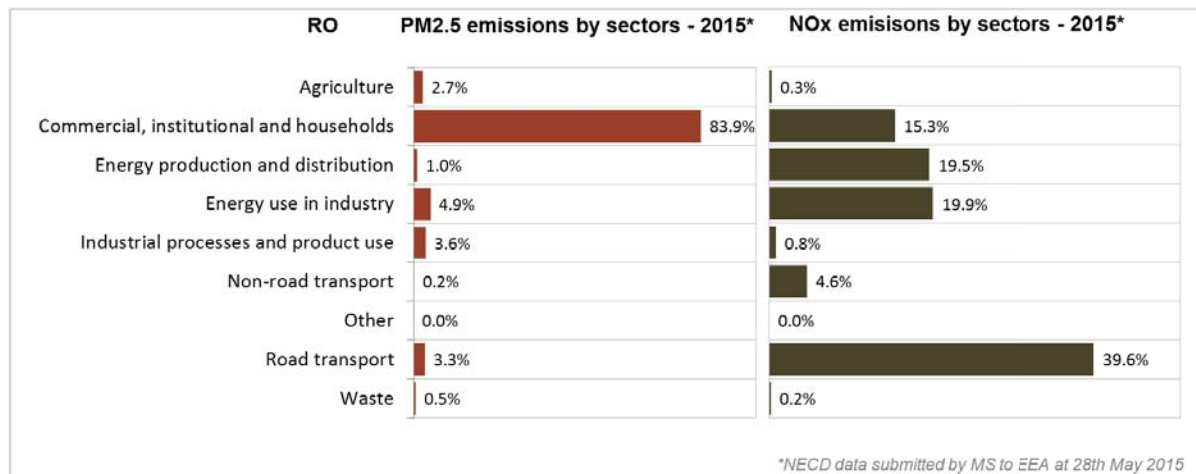
⁸ European Environment Agency, 2016, *Air Quality in Europe – 2016 Report*, table 10.2. The report also includes details as regards the underpinning methodology for calculating premature deaths.

⁹ Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe, OJ L 152, 11.6.2008, p.1-44

¹⁰ Compliance data as reported by the Member States as part of their official annual air quality report for the calendar year 2015 (available on the European Environment Agency's (EEA) Eionet/Central Data Repository), <http://cdr.eionet.europa.eu/ro/eu/aqd>

The health-related external costs from air pollution in Romania have been estimated to be more than EUR 10 billion/year (income adjusted, 2010), which includes the intrinsic value of living a healthy life without premature death as well as the direct costs to the economy such as healthcare costs and lost working days due to sickness caused by air pollution¹¹.

The Energy Union can substantially contribute to addressing these air quality problems through measures reducing emissions of both GHG and air pollutants such as PM and nitrogen oxides (NO_x) from major contributing sectors such as (road) transport, energy production, industry and residential heating (e.g. stoves and boilers) as shown in the figure below¹².



(Source: EEA. This table reflects only sources of primary PM_{2.5} emissions.)

6. Research, innovation and competitiveness

6.1. Research and innovation policy

The Romanian National Research, Development and Innovation Plan is the main instrument by which the National Authority for Scientific Research implements its Strategy for Research and Development. Two main programmes provide funds for energy research: the Innovation Programme and the Partnerships Prioritising Science and Technology Programme. These programmes' beneficiaries are SMEs, larger companies, research institutes, universities and public entities such as cities and municipalities.

Energy research in Romania is based on institutional funding through government agencies. The Ministry of Economy also supports energy research through the Increasing Economic Competitiveness Sectoral Operational Programme and Axis II of the Competitiveness through Research and Technology Development and Innovation Programme.

¹¹ See also the EU Environmental Implementation Review Country Report for Romania, SWD(2017)55 final of 3.2.2017

¹² National emission data as reported by the Member States to the EEA (available on the EEA's Eionet/Central Data Repository), http://cdr.eionet.europa.eu/ro/eu/nec_revised

Romania is not a very active contributor to the ongoing work of the Strategic Energy Technology (SET) Plan. It only participates in one (out of fifteen) temporary working groups for the implementation of the integrated SET Plan, the one dedicated to nuclear safety.

Regarding the Horizon 2020 programme, Romania has received so far 0.6% of the EU contribution devoted to the 'secure, clean and efficient energy' part of the programme. As of September 2017, 69 participations from Romanian organisations have been awarded EUR 10.6 million in Horizon 2020 energy projects. This includes a grant of over EUR 0.7 million to Centrul Roman al Energiei for its participation in project WiseGRID (smart grids). Romania's participation in several energy ERA-NETs is also worthy of mention.

Romania does not participate in Mission Innovation, apart from the indirect participation by means of EU budget increase for clean energy innovation¹³.

6.2. Investments and patents in the Energy Union R&I priorities

In 2014, public (national) investments in the Energy Union R&I priorities reached EUR 10 million, having increased by 39% compared to 2013. This was the maximum annual public investment in the period 2010-2014. The largest share of these investments (30%) was attracted by the Renewables R&I priority of the Energy Union, followed by the Sustainable Transport and the Smart Systems priorities (24% and 22%, respectively). In 2014, the most recent year for which data for most Member States are available, public investment per GDP in Romania was lower than the EU average.

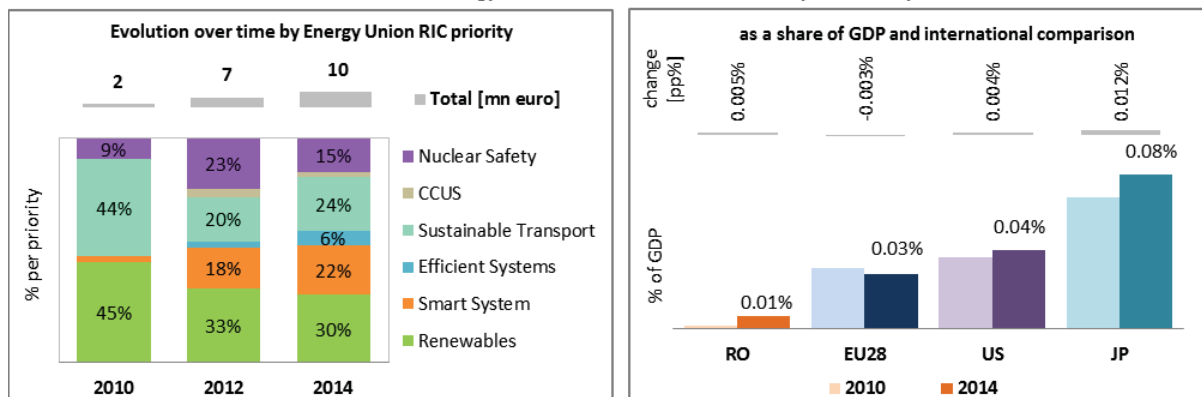
Private investment in the Energy Union R&I priorities in 2013 was estimated at EUR 26 million (0.2% of the private R&I investment in Energy Union R&I priorities in the EU). The focus was on Renewables, which received 43% of these investments, followed by Efficient Systems with a share of 28%.

In 2013, the most recent year for which complete patent¹⁴ statistics are available, 26 companies and research organisations based in Romania filed 30 patents in low-carbon energy technologies (0.5% of the EU total). The focus was on Renewables (38%), followed by Efficient Systems (23%) and Sustainable Transport (22%).

In 2013, private R&I investments and patents in Energy Union R&I priorities were lower than the EU average when normalised by GDP and by population respectively. In the period 2007-2013, both private R&I investments and the number of patents in Energy Union R&I priorities increased on average by 16% and 23% respectively, displaying higher rates of increase than the same indicators at EU level (6% and 15% respectively).

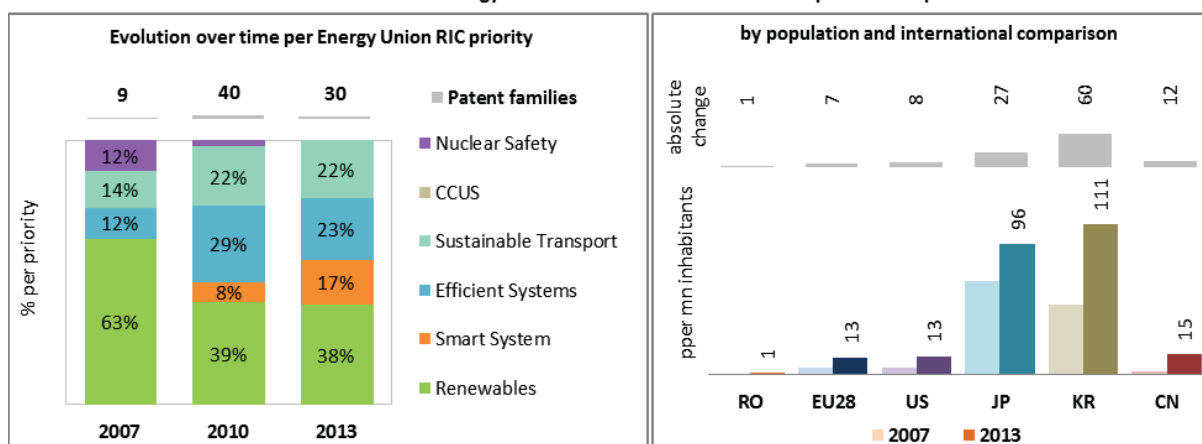
¹⁴ In the context of this document, the term 'patent' refers to patent families, rather than applications, as a measure of innovative activity. Patent families include all documents relevant to a distinct invention (e.g. applications to multiple authorities), thus preventing multiple counting. A fraction of the family is allocated to each applicant and relevant technology.

Public R&I investment in Energy Union Research Innovation and Competitiveness priorities



Note: Public investment data only available for the period 2010 – 2014, as collected by JRC SETIS.

Patent families in Energy Union Research Innovation and Competitiveness priorities



(Data sources: Public investment data collected by JRC SETIS. Patent data based on the European Patent Office PATSTAT database¹⁵. Private investment as estimated by JRC SETIS. The detailed methodology is described in a JRC study¹⁶.)

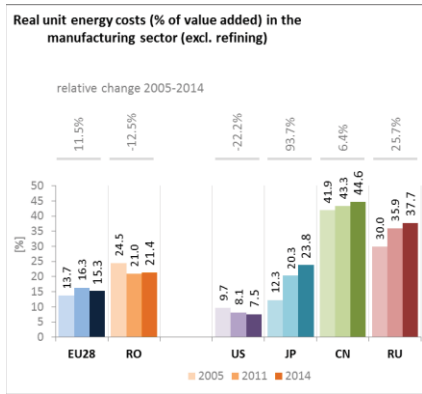
6.3. Competitiveness

In 2014, the share of real unit energy costs (RUEC)¹⁷ in the value added of the manufacturing sector in Romania (21.4) was above those at the EU average (15.3), almost three times more than those in the US but below those in Japan and China. The electricity and gas prices paid by industrial customers in Romania are below the EU average but well above US levels.

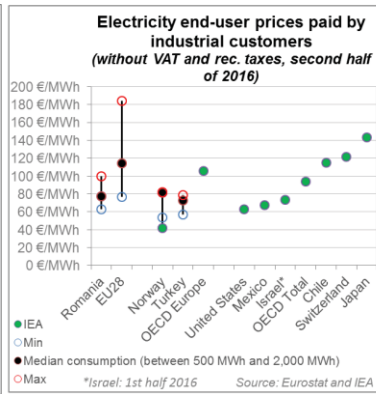
¹⁵ <https://www.epo.org/searching-for-patents/business/patstat.html#tab1>

¹⁶ <https://setis.ec.europa.eu/related-jrc-activities/jrc-setis-reports/monitoring-ri-low-carbon-energy-technologies>

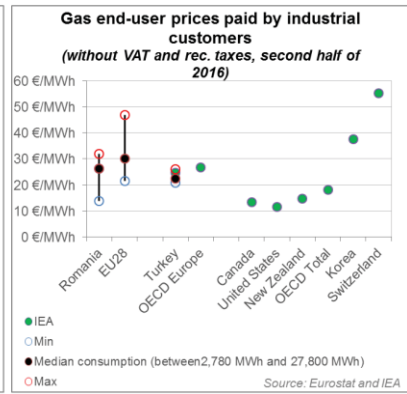
¹⁷ This indicator measures the amount of money spent on energy sources needed to obtain one unit of value added.



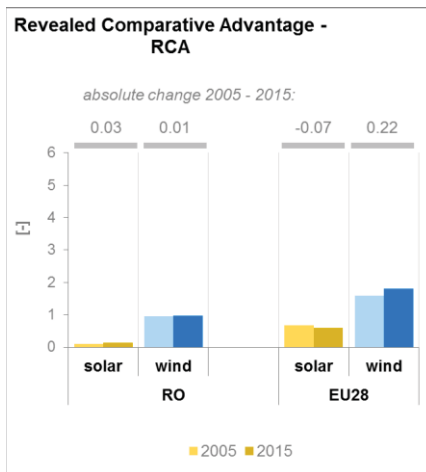
(source: ECFIN)



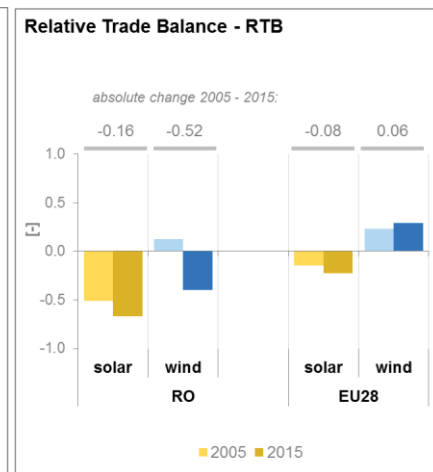
(source: Eurostat and IEA)



Romania is not specialised in solar PV technology, as it is shows by the revealed comparative advantage indicator¹⁸ below 1. In the wind sector the country performs better, even though the indicator, closer to 1, does not show any particular specialisation. The relative trade balance¹⁹ confirms that Romania is overall a net importer of solar and wind components, whereas for the latter the EU is a net exporter. It nonetheless recorded a trade surplus in wind turbine power electronics in 2015.



(source: UN comtrade)



¹⁸ The RCA index for product "i" is defined as follows: $RCA_i = \frac{\frac{X_{j,i}}{\sum_i X_{j,i}}}{\frac{X_{w,i}}{\sum_i X_{w,i}}}$ where X is the value of exports, and j is the country and w is the reference group, the World economy. 2005 refers in the text to the indicator average over the 2000-2009 period, while 2015 represents the average over the 2010-2016 period. The same applies for the RTB indicator - see below.

¹⁹ The RTB indicator for product "i" is defined as follows: $RTB_i = \frac{X_i - M_i}{X_i + M_i}$ where X_i is the value of product's "i" exports and M_i imports.

7. Regional and local cooperation

Romania is a member of three Regional Groups which have been established under the TEN-E Regulation:

- North-South electricity interconnections in Central Eastern and South Eastern Europe
- North-South gas interconnections in Central Eastern and South Eastern Europe
- Southern Gas Corridor

Romania is a member of the High Level Group on Central East South Europe Connectivity (CESEC). The main aim of the group is to coordinate efforts to facilitate cross-border and trans-European projects that diversify gas supplies to the region, as well as to implement harmonised rules. Austria, as a regional gas hub, has an important role there. More specifically, Romania is cooperating with Bulgaria and Greece to connect the North-South Corridor in Eastern Europe with the Southern Gas Corridor, through access to storage, to existing and planned LNG terminals in Greece, as well as through continuous bi-directional flows between Greece, Bulgaria and Romania.

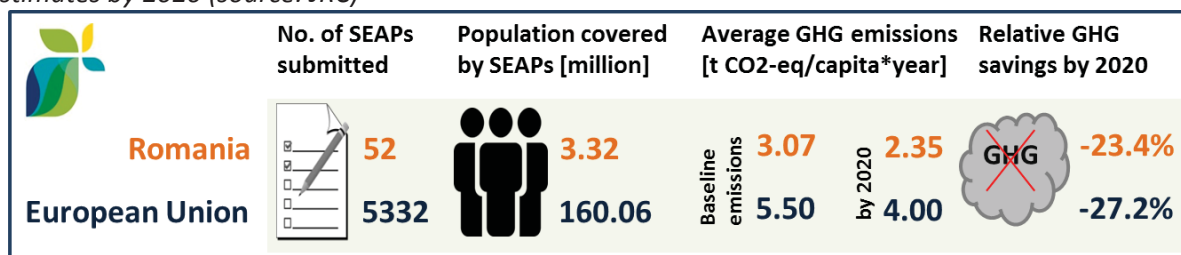
Romania has successfully introduced market coupling for its electricity markets with Hungary, Slovakia and Czech Republic. As a next step, Romania also seeks participation in the North-Western Europe and Central Eastern Europe flow-based market coupling project (NWE-CEE FB MC).

The EU macro-regional strategy for the Danube Region in which Romania takes part can be used as a basis for regional cooperation on energy. European Territorial Cooperation – 'Interreg' – under EU cohesion policy also provides further opportunities for cross-border, transnational and interregional cooperation, including in the Energy Union areas.

Cities and urban areas have a key role in the energy and climate challenge. The Urban Agenda for the EU, established by the Pact of Amsterdam in May 2016, better involves cities in the design and implementation of policies, including those related to the Energy Union. It is implemented through Partnerships, in which the Commission, Member States, cities and stakeholders work together on a number of important areas, including on Energy Transition, Urban Mobility, Air Quality, Climate Adaptation and Housing. Romania is participating in the partnerships on Urban Mobility, as member, Air Quality, with the city of Constanta as member, and Climate Adaptation, with the city of Sfantu' Gheorghe as member.

Up to 2016, 52 sustainable energy action plans were submitted by Romanian municipalities and assessed in the framework of the Covenant of Mayors initiative. The 52 municipalities cumulate about 3.3 million inhabitants and committed to a 23.4% average reduction of the GHG emissions per capita by 2020.

Average GHG emission per capita in Covenant Baseline Emission Inventories and corresponding estimates by 2020 (source: JRC)

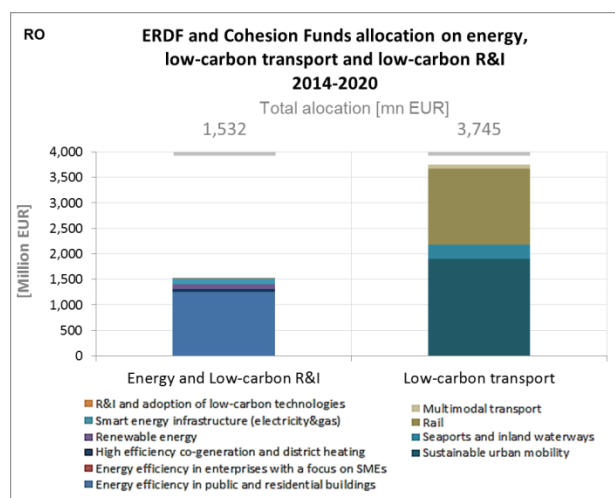


In Romania, by September 2016, 6 cities (covering 0.25 million inhabitants) have committed to conduct vulnerability and risk assessment and develop and implement adaptation plans in the framework of the Covenant of Mayors for Climate and Energy.

8. Cohesion policy and EU clean energy investments

EU cohesion policy makes a key contribution to delivering the Energy Union objectives on the ground, including important investment possibilities to implement energy policy objectives in Romania, which are complemented by national public and private co-financing, aiming at optimal leverage. It also ensures integrated territorial solutions to energy and climate challenges, supports capacity building and provides technical assistance.

Over 2014-2020, cohesion policy is investing some EUR 1,517 million in energy efficiency improvements in public and residential buildings, as well as in high-efficiency cogeneration and district heating, renewable energy and smart energy infrastructure in Romania. Cohesion policy is also investing significantly in R&I and in SME competitiveness in Romania, based on the national strategy for smart specialisation. For Romania, the RDI strategy 2014-2020 includes a focus on renewable and clean energy sources. At this stage, at least EUR 15 million is foreseen for investments in R&I and adoption of low-carbon technologies in Romania, but this might increase further in line with the evolving content of the smart specialisation strategy. A further estimated EUR 3 745 million is invested in supporting the move towards an energy-efficient, decarbonised transport sector.



(source: DG REGIO)

These investments are expected to contribute to around 129,000 households with improved energy consumption classification, a decrease of around 31,365,000 kWh per year of primary energy consumption of public buildings, around 60 MW of additional capacity of renewable energy production and 80,000 additional users connected to smart grids, as well as to around 640 km of reconstructed or upgraded railway lines and 70 km of new or improved tram and metro lines and 30 km of new or improved inland waterways. Overall, the EU cohesion policy investments in Romania over 2014-2020 are expected to contribute to an estimated annual decrease of GHG emissions of around 343,000 tonnes of CO₂eq.

For example, the European Regional Development Fund (ERDF) has co-financed 111 projects to improve energy efficiency in blocks of flats throughout the country. Their total cost amounts to EUR 75.3 million, including an ERDF contribution of EUR 37.1 million. More than 41 000 apartments have been retrofitted whereby total energy savings reach 346 GW/year. Responding to huge needs, about EUR 1 billion has been allocated to continue investments in both residential and public buildings up to 2023.

As another example, in the area of clean urban transport, the European Regional Development Fund (ERDF) has co-financed the modernisation of 25.5 km of tram lines in Cluj-Napoca, Romania's second most populated city. With this investment public transport use would increase with 10% and energy costs decrease with 38%. The ERDF invested EUR 22 million, out of a total investment cost of EUR 36.3 million.

As a further example, the Cohesion Fund invested EUR 27 million, out of a total investment cost of EUR 58 million, to rehabilitate the district heating system in Timisoara. The project included retrofit of boilers for natural gas, installation of a desulphurisation plant and modernisation of pumping stations. Energy efficiency was increased and the plant made compliant with the large combustion plant directive. The number of direct beneficiaries connected to the district heating system is about 220 000.

Through its support to sustainable transport systems, the Connecting Europe Facility (CEF) also contributes to the goals of the Energy Union. Following Romanian participation in the CEF – Transport 2014-2015 Calls, the Romanian action portfolio comprises 20 signed grant agreements, allocating EUR 1,218 million of actual CEF Transport Funding to Romanian beneficiaries (state-of-play February 2017)²⁰. The transport mode which receives the highest share of funding is rail (92.5% of actual funding). The Romanian rail actions target conventional rail and aim at eliminating important bottlenecks along the two core network corridors crossing the country, i.e. the Rhine Danube and the Orient East-Med corridors. Another large share of the Romanian action portfolio is in the inland waterway (IWW) sector. All IWW actions are located along the Romanian-Bulgarian common section of the Danube and aim to remove existing bottlenecks, thereby reinstating a good navigation status. The Romanian road actions mainly focus on intelligent transport systems (ITS) as well as the deployment of alternative fuels.²¹

²⁰ Note that European Economic Interest Groups and International Organisations are excluded from the analysis.

²¹ Source: INEA