

ROMANIAN ENERGY STRATEGY 2016-2030, WITH AN OUTLOOK TO 2050

EXECUTIVE SUMMARY

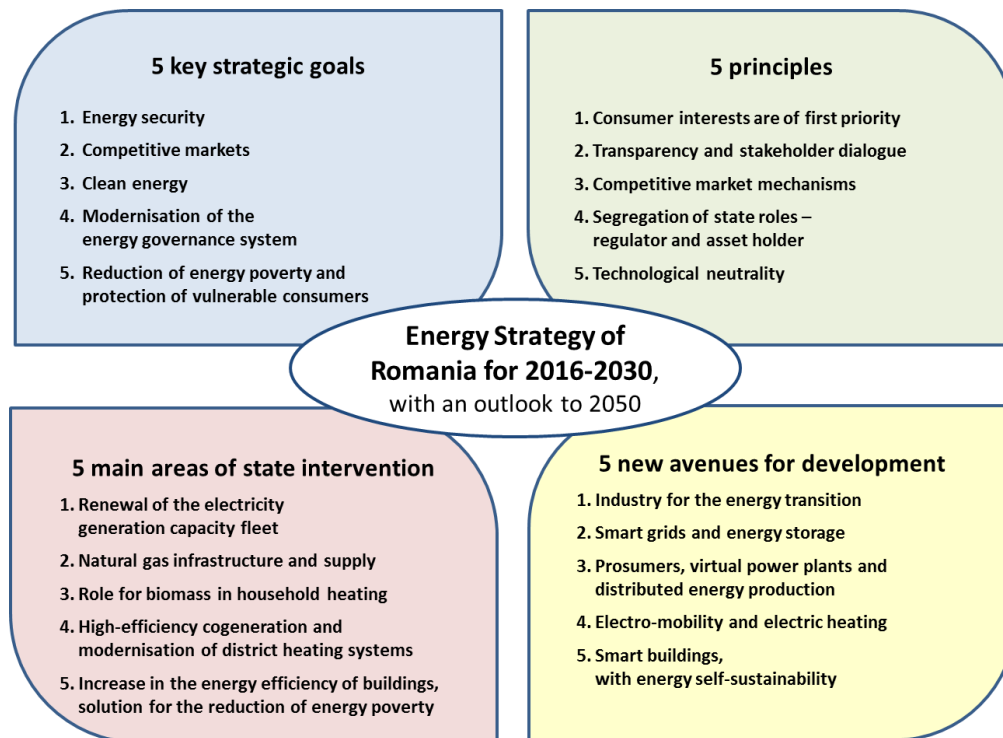
The energy sector has an essential contribution to Romania’s development, with strong influence on economic competitiveness, life quality and the environment. To meet consumers’ expectations in the long run, the Romanian energy sector must become cleaner, more economically robust and technologically advanced.

The focus of the Energy Strategy is the year 2030, for which detailed analysis and strategic planning are provided. The Strategy advances a vision and a proposal for energy sector development by 2030, and relies on a set of main principles and key strategic goals. The vision is presented in section I.1. To achieve the key strategic goals, prioritised actions and measures must be defined following a thorough

analysis of the Romanian energy sector, against the background of international economic, geopolitical and technological trends.

For proper delineation of the strategic options, an extensive macroeconomic modelling study was conducted, with simulation and benchmarking of multiple scenarios, presented in the appendix on methodology. Forecasts for 2030 rely on high resolution quantitative modelling. The outlook for 2050 places Romania in a context of long-term technological, economic and energy policy trends. Inevitably, forecasts for 2050 have a higher level of uncertainty and are reliable only in terms of general tendencies, providing a long-term perspective for the 2030 strategic options.

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

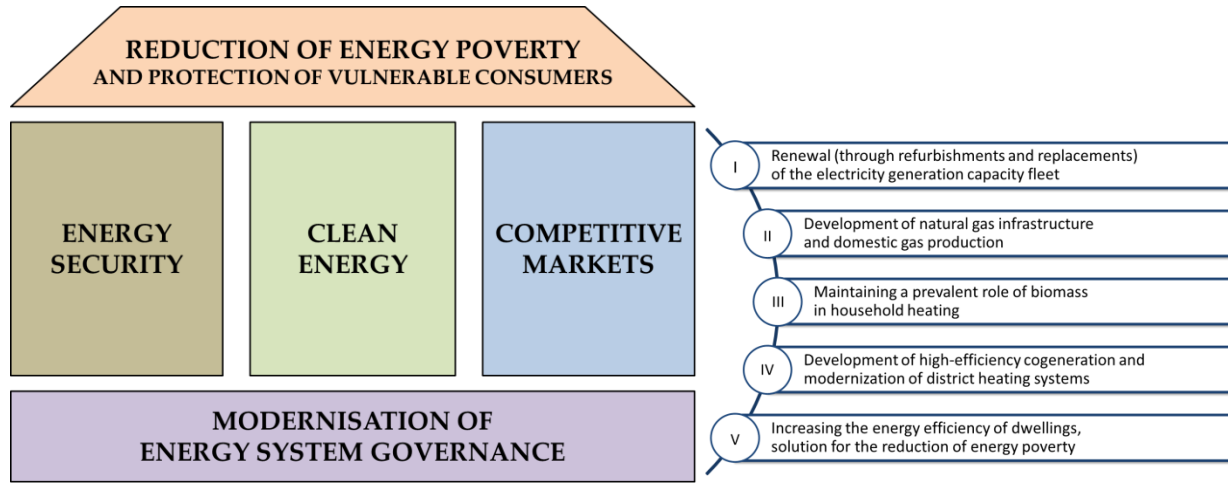


Key strategic goals

The Strategy has **five key strategic goals** (briefly presented in section I.2 and detailed in chapter II): **energy security, competitive energy markets, and clean energy**, along with **good governance** in the

energy sector and affordable energy supplies, which entails the **reduction of energy poverty and better protection of vulnerable consumers**.

Figure 2 – Five key strategic goals and five key areas of strategic intervention



The key strategic goals are implemented by means of 25 **objectives**, for which **priority actions** are defined for the short, medium and long term. The objectives address challenging aspects of the Romanian energy sector, which constitute main areas of strategic

intervention. The strategy also promotes new avenues of development for the energy sector, which can take Romania forward in the global energy transition and bring substantial economic benefits.

Energy strategy principles

As a first principle, the Strategy is **mainly focused on the needs and interests of energy consumers** – domestic, commercial and institutional. Such needs and interests are diverse and in continuous evolution. Relating to this, the second principle includes **transparency and meaningful dialogue** with stakeholders during the overall policy-making process.

Modernisation of the energy governance system must follow three principles: **better delimitation of the state’s roles** as policy-maker and regulator from the roles as asset holder and investor; **preferential use of competitive market mechanisms** in pursuing

strategic objectives, to foster a dynamic, yet stable business environment; and **technology neutral** market interventions. Technological neutrality minimises the cost of the energy transition. In pursuit of energy security and emission reductions, one should avoid the tendency to prescribe specific technological solutions, which are not necessarily the most economic. Technological neutrality assumes the competitive market’s capacity to select the most efficient technological option in terms of performance-cost ratio. The quantitative modelling exercise indicates the relative competitiveness of technologies and how their mix can make an efficient contribution to the achievement of strategic goals.

Key areas of strategic intervention

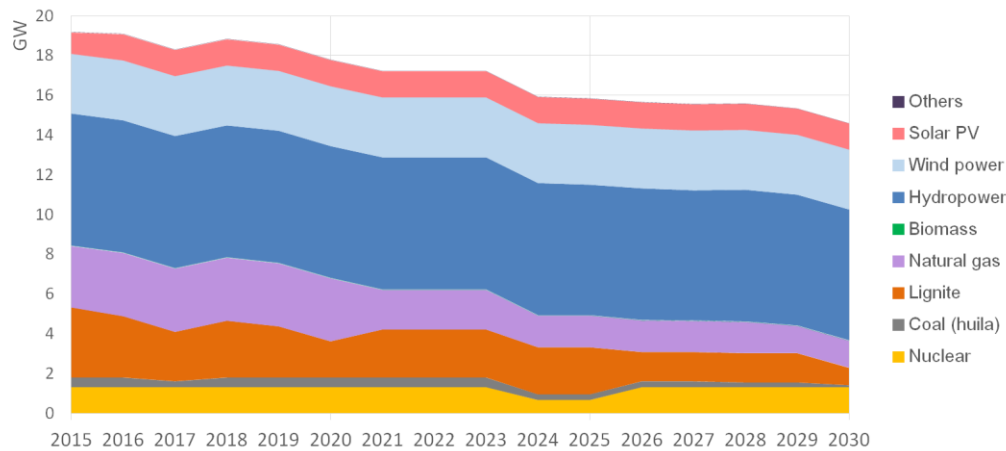
The strategy confirms an important role for conventional fuels - oil, natural gas, coal and nuclear energy - in the energy mix, for decades to come. Hydropower remains the backbone of the national grid. Despite an increased role for nuclear energy, the energy mix has room also for more renewable energy. Natural gas produced *onshore* and in fields recently discovered in the Black Sea, can cover domestic demand, while coal, on a medium and long term, will

be under increasing pressure due to rising greenhouse gas emission costs. Biomass will remain prevalent in household heating in rural areas, but in more efficient and less polluting forms. High-efficiency cogeneration will play an important role, but requires integrated investment planning, in parallel with the modernisation and resizing of district heating systems and the progress of energy efficiency programmes for dwellings.

The structure of the energy sector and its expected evolution during the period until 2030 indicates that achievement of the five strategic goals depends on

successful action within five key areas of strategic intervention.

Figure 3 –Evolution of the existing electricity generation capacities, without investment in new capacities



Source: Ministry of Energy, based on data from Transelectrica, ANRE and company reporting

RENEWAL OF THE POWER GENERATION FLEET

The first key area of strategic intervention is the renewal (by refurbishment or replacement) **of the ageing electricity generation capacity fleet**. In this process, Romania's electricity mix must remain diverse and balanced. A considerable share of the baseload power generation capacities are nearing their end of life, and some are already economically inefficient and too polluting (Figure 3). The replacement of power generation capacities requires investments of €7 bn to €14 bn by 2030, depending on the development scenario. The new generation capacities will use efficient, flexible and less polluting advanced technologies, and will be able to contribute to grid stability by providing ancillary services.

Nuclear energy is a strategic option for Romania. The extension of nuclear capacity can enhance energy security and lower GHG emissions. The nuclear project is the largest potential investment in the Romanian energy sector over the next decades. To be sustainable, the project requires income guarantees and must comply with technical and environmental conditionalities for new nuclear projects, as agreed at European level.

The process of replacing ageing natural gas plants is in progress, as Romania has more than 1500 MW installed in efficient plants, following investments made over the last decade. The process of replacing the remaining old gas power plants will continue

during the next decade. Romania has the strategic option to rely on natural gas in the electricity mix, given the flexibility of new gas units (CCGTs and gas engines), which can balance unpredictable RES generation, and the relatively low cost of initial investment. Gas power is also recommended by low maintenance costs and relatively low emissions.

The competitiveness of coal in the electricity mix depends on the efficiency of each individual group (rather low for existing capacities), on the cost of delivered coal and on ETS prices. Coal-fired capacities play an important role in ensuring system stability. The replacement of ageing coal-fired capacities will take place especially after 2025. Any new lignite-fired capacities must have supra-critical parameters, high efficiency and low specific GHG emissions.

The Strategy envisages, by 2030, a slight increase in hydropower capacity, following completion of the projects already under construction. The essential role played by hydropower on the ancillary services market will be strengthened through the execution, in due time, of maintenance and refurbishment works. A pre-feasibility study of potential locations for small-sized pumped storage capacities may also be useful. However, investment in a large reverse pumping plant is unlikely before 2030. Hydropower capacities already have a substantial contribution to the

ancillary services market, with load variations of up to 4500 MW within 24 hours.

Romania aims to remain an attractive destination for new RES investments over the long run, and capitalise on its high natural resource potential. It also aims to build a new industrial sector, supplying the energy transition with tools, equipment and materials. Nevertheless, access to the current RES support scheme, i.e. green certificates, ends on December 31, 2016. New capacities based on intermittent RES will continue to develop in the medium and long term, but

without any support schemes. A key factor for the development of new RES projects will be access to low cost capital.

Through adequate support mechanisms, the use of biogas and waste for energy purposes will increase, mainly in cogeneration capacities, in compliance with environmental standards.

Romania has committed to the European target of increasing the interconnection capacity of its power transmission grid to 10% of the total installed power generation capacity and is on track to meet it.

NATURAL GAS INFRASTRUCTURE AND SUPPLY

The second key area of strategic intervention relates to **natural gas infrastructure and supply**. The Romanian energy system will be resilient to energy supply shocks, by continuing to develop its domestic

energy resources in a sustainable manner and through modernisation of energy transmission infrastructure, including the construction of new bidirectional interconnectors for natural gas.

Figure 4 – Development of natural gas transmission network, including interconnection projects



Source: Gas Infrastructure Europe, 2016

Continuous development of *onshore* and *offshore* natural gas production is of utmost importance, as it will reduce import dependency during the next decades (Figure 4). However, maintaining domestic gas production requires investments in geological exploration and further increases in the rate of recovery from existing fields. The development of fields recently discovered in the Black Sea requires the building of connecting infrastructure to the national gas transmission system (NTS).

For integration into the natural gas regional market, the most significant project is the Bulgaria-Romania-Hungary-Austria (BRUA) interconnector, included in the EU list of Projects of Common Interest (PCIs). Another priority is to ensure transmission capacity to the Republic of Moldova. In parallel, the Strategy sets as priority the modernisation of the national infrastructure for natural gas transmission, storage and distribution, to enable operation at high pressure, reduce grid losses and increase operational flexibility.

An important objective of the Strategy is the creation of a competitive gas market: transparent, liquid, with a moderate level of concentration and competitive prices. Coordination with the electricity market

requires that the two markets reach similar levels of maturity, through gradual harmonisation of provisions in their secondary legislation.

MAINTAINING A PREVALENT ROLE FOR BIOMASS IN HOUSEHOLD HEATING

The third key area of strategic intervention addresses the **prevalent role of biomass in household heating in rural areas**. Almost 90% of dwellings in rural areas and 45% at national level are mainly using firewood for heating. These dwellings are often only partially heated, by burning wood in traditional stoves with incomplete combustion. The comfort level is low and the cost high. For Romania, improving the quality of life for the inhabitants of rural areas is a priority, which includes universal access to quality energy services.

Biomass will preserve a key role in heating rural dwellings. The Government will support, through dedicated policies, the use of efficient and less polluting equipment, as well as biomass and biogas-

based cogeneration systems in semi-urban areas which are suitable for the development of small district heating networks.

In 2030, most rural households will probably have access to alternative heating sources, and dwellings will have higher energy efficiency. The extension of natural gas distribution networks will lead to an increase in the use of gas for cooking and heating. Growth in distributed electricity generation systems (solar photovoltaic and wind), backed up by small scale storage capacities, will be common in semi-urban areas and facilitate heating with ground heat pumps. Thermal solar panels will become a popular solution for water heating.

DEVELOPMENT OF HIGH EFFICIENCY COGENERATION AND MODERNISATION OF DISTRICT HEATING

The fourth key area of strategic intervention is the **development of high efficiency cogeneration**, in parallel with the **modernisation of district heating supply systems (SACET)**. The relatively low operating efficiency of thermoelectric power plants justifies large scale development of cogeneration which, in Romania, has high potential. The Strategy promotes the integrated local planning of new high efficiency cogeneration capacities, of modernising the heat distribution networks, and of thermal insulation programmes.

The replacement of ageing cogeneration plants by new ones is in progress and will continue during the

next decade, especially in municipalities with a high share of apartments connected to the SACET. Most cogeneration capacities are based on natural gas, but the new capacities will use to a higher extent biomass, biogas and geothermal energy.

In parallel, it is necessary to improve and develop local heat markets, by modernising, increasing the efficiency and resizing the ageing heat distribution networks, as well as by increasing the quality of services provided to domestic consumers. The Strategy set as target to have at least 1.25 mil apartments connected to SACET in 2030.

INCREASING THE ENERGY EFFICIENCY OF DWELLINGS AND MITIGATION OF ENERGY POVERTY

The fifth key area of strategic intervention emphasizes the programmes for **increasing the energy efficiency of dwellings**. In Romania, energy poverty is a result of low income, rather than of high energy prices, but high specific energy use for heating compounds the problem.

The investments will be channelled mainly for the thermal insulation of blocks of flats, with maximum impact in terms of energy savings and number of inhabitants, as well as to energy efficiency measures in households entitled to heating subsidies, with

maximum social and public budget impact. Financing may be both private, supported by appropriate regulations (including to facilitate the development of ESCO services), and public, such as local budgets, the regional and central budgets, as well as structural funds. Thermal insulation works has to comply with minimum quality standards.

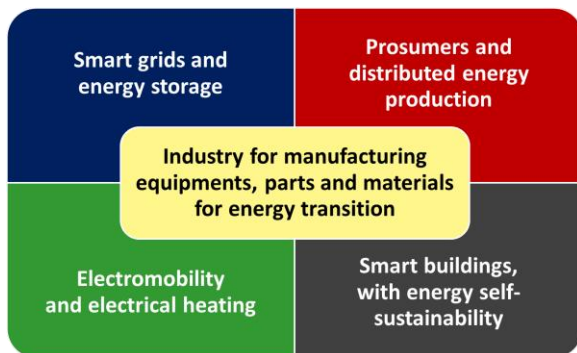
To reach the annual target of thermal rehabilitation of at least 3% of the overall number of public buildings, schools, hospitals, administrative buildings etc. will also be prioritised.

New avenues for development in the Romanian energy sector

To benefit from the global energy transition, Romania should take advantage of the opportunities that build on its strengths, and pursue new avenues for energy sector development. Investment in these areas is encouraged by the Romanian state.

One such opportunity is the development of the manufacturing industry for equipment, tools, parts and materials for the energy transition. By strengthening its attractiveness for investment in these industries, Romania can create new jobs and increase its competitiveness.

Figure 5 – New avenues for development



(I) **Turning Romania into a manufacturing centre for the energy transition;** e.g., electric vehicle and household-size batteries, heat pumps, materials for increasing energy efficiency in buildings, smart grid technologies etc. Research and innovation in Romania can reinforce this path of technological evolution.

There is a fierce competition between countries to attract investments in manufacturing equipment, parts and materials for the energy transition. To become an attractive destination for investment and to create jobs in this field, Romania should progressively become a regionally important user of such technologies, in line with its strategic priorities.

(II) **Smart grid development.** Smart grids enable real-time communication with consumers, with better control and instant optimisation of energy generation and consumption. The interaction between electricity grids, the Internet and communication networks will be enhanced, leading to efficiency and flexibility gains. New technologies should be adopted gradually,

at minimum cost, while protecting the privacy of personal data and a high level of security against cyber-attacks.

(III) **Smart grids facilitate the transition from consumers to prosumers,** who deliver to the grid their own electricity production. Distributed electricity generation (i.e. power generated in different types of low-capacity systems) and virtual power plants can reduce grid losses, and increase flexibility and security of supply. In the long run, prosumers will influence grid architecture, especially when equipped with an electricity storage capacity, to limit interactions with the grid. There will be fewer households without access to power in Romania, not least following the adoption of *off-grid* solutions, which are increasingly affordable.

(IV) **Promotion of electric and hybrid vehicles,** including cars, buses and light duty vehicles (LDVs), especially those mainly used in urban areas. By 2030, hybrid and electric vehicles will be a common occurrence, contributing to a reduction in pollution from exhaust gases. The main role of the state in this transition is to support the development of charging infrastructure and to kick-start the market in its early stages of development. Romania is well placed to manufacture electric vehicles, including batteries and other parts; an active policy for attracting such type of investment will be put in place.

(V) **Smart buildings,** in terms of construction, architecture, operation, inter-changeability and storage of all forms of energy, with prosumer features. The construction of such buildings will be promoted on the long term at national level, including by setting ambitious standards for energy efficiency for new buildings. Achieving the decarbonisation targets for 2050 will require large investments in reducing energy demand in buildings. The countries which succeed to attract investments in the energy efficiency industry will stand to gain, compared to the mere importers of such technologies. Romania may be among the winners in this field: sustainable construction materials and equipment may be manufactured in Romania, both for the domestic and for international markets.

Romania's fair participation to the achievement of EU decarbonisation targets

Romania will meet its 2020 targets for RES, GHG emissions and energy efficiency at national level. Additional effort is only required to reach the 10% RES share in transportation.

The reduction of GHG emissions will continue, but at a slower pace than in the last 25 years, given that the profound restructuring of the industrial sector can be regarded as completed. Further reductions will be the result of smaller improvements in all sectors, with focus on increasing energy efficiency and the share of clean energy sources in the energy mix.

Energy efficiency is a strategic priority for Romania, for reasons of energy security (maintaining a low level of import dependency), economic competitiveness, price affordability and limitation of negative environmental impacts associated with energy use. The increase in energy efficiency could maintain primary energy demand in 2030 at current levels, an outstanding performance considering the sustained pace of economic growth envisaged for this period.

Romania has already met its European commitment for 2020 to increase the **RES share** to 24% of gross final energy consumption. It reached 26.3% in 2015, but at considerable cost for the consumers.

Three main factors will determine the RES ratio in Romania in 2030: the capital cost for RES financing; the evolution of biomass demand in heating; and reaching the 2020 target for RES in transportation, followed by the development of electro-mobility and electric heating.

Between 2017 and 2030, improving the quality of life in rural areas and better forestry management will be national priorities. The effect will be a slower increase in the RES ratio, due to lower biomass demand in rural heating, including as result of a more efficient use of

biomass. Consequently, Romania will analyse thoroughly its level of ambition for the 2030 RES targets.

Undoubtedly, Romania will participate fairly in the achievement of the common EU targets for 2030, of 27% RES in gross final energy consumption, an increase of 27% in energy efficiency, and a reduction of GHG emissions by 40% as compared to 1990.

An important source of financing for the investments that contribute to the achievement of strategic goals will be the auctions for emission allowances withing the EU ETS system. Depending on the evolution of ETS prices, the amount available for investment can be considerable, i.e. several billion euros.

The EU28 long-term decarbonisation target is to reduce overall GHG emissions by at least 80% in 2050, as compared to 1990. Committing to such a target at national level would involve major investment efforts, in the transformation of most dwellings into zero-energy buildings, as well as in speeding up, in a costly manner, the electrification of transport. Romania should avoid large scale subsidising of first-generation technologies, which are not competitive enough. The Strategy envisages a reduction of GHG emissions by 75% in 2050, an overachievement of this target depending on the reduction of technology costs beyond current projections.

Romania plans to become an essential partner in the achievement of European and global decarbonisation targets, through the participation of Romanian research institutes in international research programmes in the field of clean energies, as well as through the development in Romania of industrial manufacturing of parts, components and equipment for the energy transition, taking advantage of a pool of productive and skilled human resources.